

**MODELING THE PROFITABILITY
OF CUSTOMER RELATIONSHIPS:
DEVELOPMENT AND IMPACT OF
BARCLAYS DE ZOETE WEDD'S BEATRICE**

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August 1992

Center for Research on Information Systems
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Working Paper Series

STERN IS-92-23

Modeling the Profitability of Customer Relationships: Development and Impact of Barclays de Zoete Wedd's BEATRICE¹

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2 June 1992

Abstract

Traditional management accounting systems are limited in their ability to provide profitability information relevant to management decisions. The problems of inadequate profitability measurement are intensified in today's business environments, where changing margins due to deregulation and new entrants, new products with unknown costs, and customer sophistication in locating low-cost providers often combine to leave unprepared firms with growing numbers of loss-making client relationships. In response, firms in a number of service and manufacturing industries are experimenting with new methods for measuring performance, and are implementing these techniques using information systems. The collection and analysis of information on the profitability of customer relationships enables managers to identify and defend their most attractive market segments, and to turn loss-making accounts into profitable ones. The London-based securities house, BZW, developed BEATRICE, an innovative information system that combines activity-based accounting principles and a model of customer profitability to make an income assignment to each of the 6,000 trades the firm makes in a day. The system's value is considerable, and can be evaluated by using industry performance benchmarks, and by comparing management decision-making with the currently available information to what was possible with previous data.

1. Introduction

Consensus is emerging on the conditions under which information systems (IS) can provide strategic benefits [5][13][15]. New systems to provide profit-

¹ To appear *Journal of Management Information Systems*, Fall 1992. An earlier version of this paper with the same title appeared in *Proceedings*, Vol. IV, pp. 687-696, 25th Hawaii International Conference on Systems Sciences, January, 1992.

ability information and performance measurement data are increasingly visible in a number of industries. Studies by Lucas (1975), McLeod and Rogers (1985), Beath and Ives (1986), and Clemons and Row (1988) have described information systems that improve organizational performance by providing valuable marketing, cost, and profitability information. Separate from firms' internal accounting systems, these systems are better suited to senior managers' decision needs than traditional accounting reports, and represent considerable enhancements to the firms' existing data collection and dissemination procedures. Furthermore, the new information supports improvements in management processes and decision-making. With profitability measures by customer, by line of business, or by product line, managers can increase accountability for portions of the firm's total earnings, better allocate the firm's resources, support bids for new business, and make well-justified decisions to expand or to exit certain businesses.

Management accounting is the set of procedures required for collecting and reporting cost and performance information for the management of a firm. Leading researchers in the management accounting field have identified distortions and misleading signals arising from traditional accounting systems. These flaws preclude accurate performance measurement, and are described in Section 2. As information processing costs fall, the development of specialized management information systems for profitability analysis becomes realistic. Robert Kaplan, in particular, calls for "*a more effective set of integrated management information systems*" and new methods that raise the "*visibility of indirect costs by linking them to the activities that cause them*" as steps toward correcting the problems [17]. Kaplan's propositions in concert with more powerful office computers have made practical the development of sophisticated *customer profitability systems*. These systems are focused on senior managers' more specialized planning needs, and provide information systems managers an opportunity to develop important, strategic systems for management accounting. Notably, such performance measurement systems are being developed outside of firms' traditional accounting groups, and often lead to radically different values for product costs and relationship profitability than the traditional methods embedded in existing accounting systems. These customer profitability systems support more intelligent customer marketing and management decision-making as we will illustrate with a detailed case example from the securities industry.

Profitability Information. Recently, the securities industry in the U.S. and the U.K. has encountered business conditions sufficiently adverse that firms with

superior information to support management decisions may find this is the difference between survival and failure. The industry-wide losses posted recently indicate that some services are being provided at prices that do not cover their associated costs. The return on capital employed by member firms of the London Stock Exchange (LSE) was negative 2 percent between 1987 and 1990. For New York Stock Exchange (NYSE) member firms, return on capital was just 6 percent in the same period. Commenting on weakness of returns in the U.K. securities industry, the London Stock Exchange's *Quarterly Review* pointed out that firms' managers are often constrained because "*it is difficult to identify the profitable from the unprofitable lines of business.*" ([26], p. 21) Companies in other industries have been visibly damaged by the lack of appropriate management information to support profitability analysis. Aggressive pricing policies by Delta Airlines in 1982 and 1983 led to just 8 percent of passengers paying full-fare and the first annual losses for the airline. By matching all competitors' low fares on its 5,000 routes, Delta neglected the market conditions in which it could charge a premium according to the differential convenience and value of its service, and hence failed to cover its costs [2]. Firms that know the true costs of their products and services are in an advantageous position. Clemons and Row (1988) reported the experience of PNC Financial in offering third-party check processing as part of their retail account management service for brokerage firms. By accurately knowing their costs, PNC was able to bid successfully and profitably for the processing of asset management accounts offered several major Wall Street securities firms. Without knowledge of the resources consumed by the firm's activities or the value of those activities to customers, managers have only intuition and casual analyses to identify where to invest, or what non-contributing lines of business activities to abandon.

Research Approach. Management accounting has received criticism for adhering to outdated techniques that fail to put relevant cost and revenue information into the hands of managers. Carefully constructed profitability models and well-designed information systems can address this problem. This paper explores one firm's experience, and finds that BEATRICE — an innovative information system that utilizes recently developed principles of activity-based costing — has filled the gap that had opened between its rapidly changing business environments and traditional, but obsolete, accounting systems. BEATRICE was developed by a major British securities house, Barclays de Zoete Wedd (BZW). The initial prototype was written in late 1988 by the authors working as client and consultant. BEATRICE comprises a detailed model of customer profitability, which is now implemented in a SQL database management system running on a minicomputer.

The system's impact is illustrative of the value of profitability information systems in general. However, the activity-based accounting approach used in BEATRICE is innovative and new within the management accounting literature, and as a result an adequately large field study sample of similar systems is not yet available. This reflects a general problem in IS research, where rapid technological change creates "moving targets" that often frustrate traditional data collection and analysis [3][20]. Yet an in-depth analysis of a single system does not preclude arriving at valid explanations and relevant conclusions. Tsoukas notes that "idiographic research explanations are valid for identifying the contingent conditions that lead to the success of particular systems" [29]. The case study method then enables us to detail the implementation steps, and to assess the benefits and impact of BEATRICE.

The paper is organized into seven sections. The second section is a description of the deficiencies in management accounting and information systems for performance measurement. Section 3 is a summary of the high-level design objectives for BEATRICE. The fourth section explains how BEATRICE was developed to meet these objectives. Section 5 provides application examples and details how BEATRICE output is used by management. The business value and performance impact is explored in Section 6. Published data on profitability in the U.K. securities industry now provides profitability benchmarks for BZW managers, and we describe several examples of the system being used to improve management decisions and the firm's use of resources. Section 7 is a conclusion.

2. How Accounting Systems Distort Performance Signals

Accounting Deficiencies. As the shortcomings of traditional management accounting become evident, information systems research will be increasingly concerned with the design and development of systems to deliver crucial performance measurement information that is often unavailable in firm's reports. Researchers including Johnson and Kaplan (1987), Kaplan (1988), Cooper and Kaplan (1988), and Dixon, Nanni, and Vollmann (1990) demonstrate that management accounting methods developed as long as 60 years ago at a time of labor-based manufacturing are no longer able to meet the information needs of management decision-making. At that time, the diversity of firm's product and services was low, costs were largely accounted for by materials and direct labor, and information processing was expensive. Cost accounting methods were simple, and suited to the environment. Since that time, these authors point out, most new

cost accounting systems have not been developed to improve management decision-making, but to satisfy statutory financial reporting requirements, such as quarterly profit and loss statements (P&L) and inventory valuations. The resulting data generally do not give management a true picture of the profitability of their products or their customer relationships. Because management decision needs were not considered in the design of these systems, relevant data are often not available in any form to support planning and strategic analysis.

Distortions appear in management accounting systems because they have traditionally allocated overhead and indirect costs according to easily acquired data on a product’s required direct labor or machine hours, or its proportion of total output volume. This introduces a number of biases in the current environment, in which automation, reduced labor content, greater design complexity, and growth in distribution channels and customer service provision have led to increases in overheads and indirect costs. Despite the growing importance today of indirect cost activities — such as product design, service, marketing, distribution, information resources, and R&D — evidence indicates few companies correctly identify these costs with their causal factors, or have adequate control systems for measuring costs in a way that is relevant to management. Table 1 summarizes the characteristics of the two environments.

Table 1

Traditional Environment for Management Accounting	Current Environment
<ul style="list-style-type: none"> ● Labor-intensive manufacturing ● Labor and materials costs dominant, and easily traced to individual products ● Few indirect expenses ● Simple, single channel distribution ● Static cost structures 	<ul style="list-style-type: none"> ● Low direct labor content ● High proportion of indirect costs due to services and support activities ● Extensive support operations and overheads that are burdened in diverse ways by a firm’s products ● Multiple delivery channels ● Changing cost structures due to new production processes and technology

Murphy and Braund (1990) report that 54 percent of the 389 company accountants surveyed use labor-based mechanisms to recover overheads. As a result, relevant information for profitability analysis and strategic control is obscured, and poor decisions are a consequence. When companies’ cost

accounting systems spread overhead costs on the basis of headcounts, sales revenue, or materials used, managers often step up those apparently profitable products that, in fact, generate large indirect cost burdens in administration, purchasing, special production processing, and customer service. Profit is often overstated on custom and specialty products that often require particular handling, and place large burdens on support and service resources. Neglected are value-adding products or services that create few indirect costs. Poor signals from a management accounting system can easily lead to poor decisions and the underperformance of the firm.

Information system shortcomings. Unfortunately, most companies' management information systems (MIS) collect and disseminate those cost accounting data that researchers have found to be deficient. These MIS are centrally-controlled systems most relevant to middle management facing well-structured control decisions. A survey by McLeod and Rogers (1985) found that 60 percent of managers using marketing information systems in Fortune 1000 companies regarded their firms' internal accounting system as the primary source of data. Because the principal MIS outputs are accountability, control, and exceptions reports [11], the database designs to provide these often neglect the types of data necessary for addressing strategic management concerns that arise.

No Integrated MIS. Lacking profitability data and a supporting MIS, managers are constrained in their ability to understand the profit contribution of customer relationships and their lines of business. In addition, decision support for strategic planning is not possible without relevant and accurate data. Difficulty measuring profitability is not unique to the securities industry. Airlines for instance may want to know the profit from operating a certain route and selling seats at a particular price taking into account the demand for feeder routes or onward connecting flights. The problem is understanding the complex buying patterns of customers for some products — especially those where multiple services are provided as a bundled package. Effective management decision-making requires meaningful profitability measures that include all relevant costs in the final realized profit of a firm's delivered goods. In many cases, deregulation and change in many industries has allowed new market entrants to "*skim the cream*" by chasing only the most attractive and profitable customer segments, leaving unprofitable customers and lines of business for the established firms to service. Threatened with the loss of high margin business, cross-subsidization of loss-making activities by profitable ones is increasingly unviable. However, many firms lack an

accounting system to help them realize this until their most profitable customers have been wooed away. In addition, eroding customer loyalties and a growing transaction orientation — i.e., unbundling and selecting the low-cost provider for needed services only — has placed even long-standing client relationships in jeopardy, and left unprepared firms with increasing proportions of loss-making accounts.

Activity-based accounting. Activity-based costing (ABC) has been advanced as a solution to the problem of accounting information that is unsuitable or biased for management purposes. The assumption in ABC is that virtually all of a firm's activities exist to support the production and distribution of goods and services. The basic activity-based model is:

$$\begin{array}{ccc} \text{require} & & \text{cause} \\ \text{Products} & \text{===>} & \text{Production and} \\ & & \text{Support Activities} \\ & & \text{(including overheads} \\ & & \text{and indirect costs)} \\ & & \text{Costs} \end{array}$$

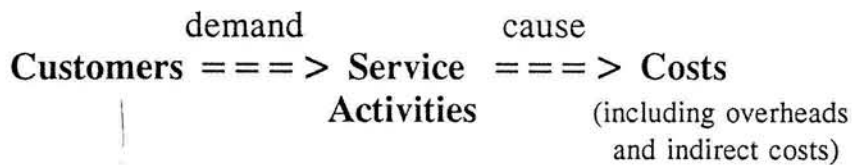
The activity-based approach models the economics of producing a good or a service as a set of activities that consume resources. Indirect and support costs are assigned on the basis of "drivers": that is, the model recognizes that a cost may be incurred for each batch that is scheduled, or for each order handled, or for each custom product design undertaken. By allocating indirect expenses according to the burden placed on them by activities and products, ABC provides a predictive model of a firm's resource consumption. The consequences of management actions — e.g., introducing a new product, or performing an activity less frequently — can be identified and the indicated changes in resource consumption can be measured against the changes in revenues.

Several criticisms of ABC have been widely discussed in the management accounting profession [12][16][18]. Some critics have commented that reducing unprofitable activities that the firm undertakes may simply create excess capacity, and will not necessarily result in a change in the firm's costs. Proponents argue that a good ABC system will signal that a product or service is unprofitable, and distinguish costs that are volume-sensitive and controllable from those that are fixed. Users of ABC methods accept that there are lags in achieving bottom-line effects depending on the how management responds to the signals, and whether the costs are controllable in the short-run or not.

A second criticism is that activities alone do not determine all costs. In fact, many concomitant events influence costs including time, business volumes, and earlier decisions that may have led to excess resources or inefficiencies. ABC advocates realize that the consumption of resources is not always caused by the production activities for a good or a service. For example, processing errors or machine breakdowns cause costs, but cannot be attributed to a particular product or to a customer. A related problem occurs when there is excess capacity to perform an activity. In that situation, the ABC literature recommends that the full cost of this capacity should not bear on a product's costs or the profitability of a customer relationship. If a machine has a total daily cost of \$1,000 and is used at half capacity to produce just 100 units per day, its full capacity cost of \$5 per unit should be applied to its output. If the full cost is applied, a manager might wrongly feel justified in raising prices, which would reduce demand and create even more idle capacity leading to still higher unit costs. A separate expense item is suggested that treats excess capacity as a cost of the quarter or the period, and not a product or activity cost. A good ABC system will provide an accurate signal; however, it is left to the manager to assess the causality — activities or otherwise — that lead to resource consumption. In cases where costs are not caused by activities, those costs should be treated separately and should not be allocated to a firm's products or services.

ABC in service businesses. Activity-based costing was developed principally for production and manufacturing operations. Like other large securities firms, BZW is a complex service business comprising a well-equipped trading room, sales and investment advisors, a securities research group, and trade settlement and clearing operations. There are a number of different revenue sources and expense categories. Customers are fund managers and other investors looking to achieve attractive rates of return on their invested assets. Historically, financial services firms maintained account-based information systems, which made it difficult to look at the totality of a customer relationship. A bank, for instance, knew its trust account-holders, its checking account-holders, and its mortgage account-holders. However, they were known only as separate accounts *even* when several were held by the same person. Bringing together the entire customer relationship was not possible with the previous technology, but in the past 5-10 years has become a major goal for many banks, insurance companies, and brokerage houses.

A small modification to the activity-based model is needed for measuring customer profitability in a service industry:



The premise is that service activities cause costs, and that customer demands require activities to be undertaken. BZW exhibits the conditions most suited to an activity-based approach: (1) they have a diverse range of services, business processes, and customers, (2) there are significant overheads that are not easily assigned, and (3) the demands on resources by BZW customers are not proportional to the volume of business they generate [25].

3. Conceptual Design and Objectives

There were several objectives for BEATRICE. First, BZW needed to respond to the weakening business conditions in its industry. Second, the firm recognized there was overcapacity in its operations, but was handicapped by its inability to distinguish between those costs that contributed commensurate revenue, and those which were ineffective in producing adequate revenue. This meant that cutbacks to improve profitability were haphazard and potentially threatening to viable lines of business. Third, the firm wanted an integrated MIS to provide relevant output for senior managers. The BEATRICE design addresses these objectives.

Response to industry conditions. In the early and mid-1980s, the securities industry was characterized by rapid growth and substantial margins. Economic expansion and the rise in investible assets led to buoyant conditions for securities brokers and dealers on both sides of the Atlantic. During this time aggregate revenues were sufficient to cover the cost for most lines of business. In recent years, deregulation and new entrants have led to narrower margins and more difficult conditions, especially in the U.K. equities market, which underwent deregulation in 1986 and experienced a dramatic influx of new competitors.

The London market's *Big Bang* deregulation and the drop in business volumes after the October 1987 stockmarket plunge created a fiercely competitive environment in the U.K. securities industry. Big Bang occurred on October 27, 1986, and abolished the fixed commission rate schedule that had existed, removed a 30 percent limit on corporate ownership of member firms, and opened Exchange

membership to overseas firms [9]. SEAQ, a screen-based market mechanism, was introduced to support the new Exchange operations. The halt to the steady increase in securities trading volumes came with the worldwide price drop in October 1987. Firms have since reported record losses, and revenues and margins have fallen. In London, member firms of the London Stock Exchange lost £350 million in 1990, and about 10,000 net job losses are estimated to have occurred since 1987. Capital employed by member firms fell from its 1989 peak of £3.5 billion to £3.1 billion in late 1990. ([26], p.12) An initial rush to set up U.K. equities operations led to a jump from 13 market making firms in 1985 to a peak of 36 in 1987. There has since been a decline to 24 in mid-1991.

After 1987, the U.K. securities industry faced the unfamiliar challenge of scaling back and managing resources more tightly. Without data necessary to measure performance and the profitability of customer relationships, BZW managers chose to develop BEATRICE to compare revenues with their associated service costs. During the years of growth, most IT investments in the securities industry went toward "front-office" systems to supply brokers and dealers with trading information and analytical capabilities. BEATRICE represents a critical new phase of IT investment in leaner times for the securities business: systems to monitor risks, and to measure and control the profitability of customer relationships and business activities.

Support intelligent planning. Howard Coates, Chief Executive of the equities division at the time, saw that a more tightly controlled operation was needed to deal with profit pressures and the evident excess capacity caused by the rush of new entrants into the market. Yet any management steps taken to control expenses and focus on the most attractive segments would rely on judgment, rather than hard data on the firm's profit sources. In 1988, BZW lacked systematic awareness of which costs generated which revenues, and hence did not know its profitability across customers or across its lines of business. The firm's existing management accounting system detailed major expense items, but maintained nearly half of all costs as unallocated overhead expenses. Further, it provided no integrated information on revenues, which were available only from a number of sources that were tracked in other systems. At a time of contraction in its industry, BZW management saw the need to gauge its profits and success by client.

A major design objective for BEATRICE was to support BZW's strategic planning. It wanted to identify those activities that are non-value adding and to be

able to reduce excess capacity intelligently. In response, some firms are cutting back in all operations, laying off staff, or closing down altogether. BZW implemented BEATRICE to clarify and make explicit the profitability of their multi-faceted customer relationships. Aided by BEATRICE information, BZW can make plans to strengthening the profitability of its promising customer relationships, and to emphasize its value-adding activities, while scaling back on those activities that do not cover their costs. The firm's strategic planning can "cut back without cutting muscle".

Integrate MIS with improved accounting techniques. Management accounting specifies the procedures and systems for providing information for management decisions. Anthony (1988) noted that "designing a management control system is a complicated, time-consuming process" and pointed out the importance of having "the management control function supported by an information system." ([1], p. 17). Historically, securities firm's revenues and costs have been tracked in separate systems. A typical MIS report might appear as below:

Table 2
Earlier Mainstream Cost Accounting MIS
Periodic Management Report

<u>Revenue Sources</u>			<u>Costs Items</u>	
1) Commissions	...		1) Staff	...
2) Bid-ask & position trading combined	...		2) Equipment	...
3) Fees	...		3) Technology	...
4) Other (interest income and miscellaneous)	...		4) Premises	...
			5) Administration	...
			6) Trade settlement	...
			7) Other (interest expense, misc.)	...
	Total Revenue			Total Costs
	= Profit			

Because the necessary data is not captured and available in the MIS, reports cannot communicate a comparison of costs to various customer revenue streams. The accounting reports it can produce are too aggregated to aid managers in reducing costs or improving productivity. For instance, the cost going into

generating a unit of commission is impossible to estimate with the data available in a typical securities firm's MIS, although it can vary substantially by customer.

Develop robust revenue and cost models. The securities industry exhibits the four characteristics of a service business: (1) heterogenous outputs, (2) intangible goods, (3) consumption and production are inseparable, and (4) its product is not storable. In a service business, "delivery" of service to the customer is generally part of a "event" that causes the provider to undertake some resource-consuming activities. Amorphous events, rather than identifiable "products" make allocation of a securities firm's costs difficult. Thus, performance measurement in service businesses needs to identify the cost of activities that support service "events". Competing in an increasingly global business with a diverse and changing customer base means that securities firms must be quick to adapt their service offerings to new needs, new financial instruments, and new investment strategies. Yet in the U.K., BZW appears to be among the first to recognize that meeting these needs must be on the basis of an economic understanding of the resources used, and the revenues derived from its services to customers. Revenues are particularly hard to attribute since BZW may trade with a customer, and not know until some time after whether they made a profit.

Reflecting on BEATRICE, Howard Coates noted that "at the outset we didn't have a clear idea of the ways in which revenues were derived and felt that acquiring this information would be enormously valuable in managing the business." The first step for BZW was to develop a model of how customer demand for its services contribute revenues and generate costs.

Revenue sources. Revenues in a securities firm come from customer commissions and the firm's trading profits. Customers generally pay a *commission* when a securities house executes a trade on their behalf. In 1991, the standard institutional commission rate in the London equities market was 0.20%, meaning that a £50,000 trade would generate a £100 commission for the securities firm. In addition, securities houses act as market makers, offering to trade as principals with — rather than just trading as an agent for — their customers. This leads to two ways of earning trading revenue. The first comes from the market maker quoting a *bid* price at which he is willing to buy and quoting a somewhat higher *ask* price at which he will sell stock. The market maker derives his *turn*, or "bid-ask" trading revenue from buying at the lower bid price and selling soon after at the higher ask price. The second source is more risky speculation or

positioning revenues (or losses) that result from a trader taking a *long* or *short* position to gain from changes in the price over a greater period of time. Trading income in either form varies upwards or down according to the price movements after a trade. Because of the uncertainty about future prices at the time of a trade, however, the full revenues from a customer transaction are not known until the trader's resulting position is unwound at a later stage. To measure trading gains accurately, BEATRICE calculates the profit from a trade sometime after the transaction in light of subsequent trades and price changes.

Costs. Expenses are difficult to identify with particular activities and particular customers in the securities industry. Firms are principally involved in securities research, advice, settlement, execution, and the commitment of capital to facilitate customer trades. The unallocated overheads and indirect costs to provide these services often account for over half of all costs in many firms. Securities firms traditionally have provided their customers with services as a bundle, and have charged overall on the (easily measured) volume of trading channelled to the firm, e.g., applying a 0.20% commission to £5,000,000 in trading volume generates £10,000 revenue for BZW. The problem arises because there is not a standard set of services that is provided to customers; they draw resources from the firm in diverse ways. Consequently, costs are not easily assigned to the customers that caused them, and customers pay according to a volume measure that can be highly inconsistent with their demands on resources. To measure resource demands, BEATRICE traces costs to customers based on the activities undertaken on their behalf, and the transactions they generate. This is a considerable improvement on a volume-based measure to estimate costs, and better reflects the economics of serving investors. The revenue and cost equations form the basis of an aggregate profit model that reflects the performance of the firm's business units and the attractiveness of its customer relationships.

4. Implementing the Profitability Model

BZW provides securities research on over 600 companies, and is a market maker in the shares of nearly 2,000 U.K. companies. The firm serves 400 sizable clients in U.K. equities from its network of offices worldwide. BEATRICE assigns a profit to each of the firm's 6,000 transactions a day according to algorithms that are discussed in this section. BEATRICE is based on a relational database design. In the main relation, each record represents a trade, and fields include the customer name, the security traded, price, time, and the various

revenues and service costs subsequently allocated to the trade. Hence, 6,000 records are added each day. The database runs on a Stratus XA2000 with SQL 2000 (Structured Query Language) as the data manipulation language.

After a period of system development, BZW is beginning to realize benefits from BEATRICE. We next describe the development of a customer profitability model, and discuss its implementation in an MIS. In Sections 5 and 6, we document some of its early applications and results, and assess the potential for BEATRICE to improve the firm's performance.

The need for profitability analysis. As in many securities firms, BZW managers have difficulty identifying the sources of its profits. A Director at BZW likened securities firms to a supermarket in which "customers roam about filling their baskets with the goods they desire (i.e., research, advice, trading services etc.), but pay at the check-out *not* on the basis of the costs of the items, but on the basis of an unrelated quantity such as the weight of basket (i.e., the volume of their trading)." Hence, a customer purchasing a pound of filet mignon is often charged the same as the customer buying a 16 oz. tin of baked beans. BEATRICE remedies this disparity by applying the principles of activity-based costing. The unit level of activity in a securities firm is a trade, and all revenues and costs eventually apply to individual trades.

Cost allocation. Cost allocation in BEATRICE operates in two stages. The first stage determines the cost of activities. The principal cost elements are:

Table 3

Cost Category/ Business Activity	Description
<ul style="list-style-type: none"> ● Research ● Sales ● Execution 	<ul style="list-style-type: none"> ● Investment analysis ● Advice to fund managers and investors on securities and the timing of trades ● Handling customer orders, negotiating trade terms, and completing transactions
<ul style="list-style-type: none"> ● External fees ● Settlement 	<ul style="list-style-type: none"> ● Fees payable to the London Stock Exchange ● Physical delivery of stock and transfer of money

All costs within the equities division are assigned to one of these categories, and indirect costs and overheads including premises, administration, and computer

equipment are associated with individual business functions. The next stage allocates these activity costs to customers who require activities to be undertaken. The basis for allocating costs is the activity that is felt to have the strongest causal link with the expense. Two types of activity costs were identified. Unit-volume related costs are those that are a function of the number of transactions. Process sustaining costs are those that are insensitive to volume and result from the consumption of service and support-level resources. The activities and the basis for their allocation are reported in Table 4.

Table 4

Securities Industry: Allocating costs to customer transactions		
Activity	Basis	Assignment
Sales Support	Staff hours (from survey) applied to client	(Client's sales demand in hours \times staff per hour cost) \div No. Trades by client
Research*	Staff hours (from survey) applied to client	(Time discussing research with client in hours \times staff per hour cost) \div No. Trades by client
Trader/Execution	Cost per trade by trader group or industry sector	Per trade cost for particular trader group involved
Settlement and Clearing	Cost per trade	Per trade cost for category of trade
Stock Exchange Fees	External tariff per trade	Per trade cost

* Only forty percent of BZW's research costs are directly attributed to clients. The remainder is background analysis and interacting with traders and sales staff, i.e., treated as a fixed overhead item whose cost is not affected by volume.

In the system's processing, nearly all of the costs of running the U.K. equities business are allocated to individual trades according to the staff time they require and the fees and costs that they give rise to. Each category of service has its costs assigned to individual transactions in the most explicit and realistic way. As Alastair Yexley, Assistant Director at BZW, noted, "it took a long time to determine where costs arose and where they should be allocated, and this was the most complex element of specifying the system." For example, settlement costs may be allocated at one of two levels. First, BZW settling with a Stock Exchange member firm requires only intra-market settlement, which uses electronic book entry and is relatively inexpensive. On the other hand, client settlement with non-member firms requires settling twice, once within the Exchange market and once physically exchange cash and share certificates with the client. Accordingly, the

higher costs of client settlement are borne only by client trades, and the lower costs of market settlement are borne by trades with member firms.

Trader/Execution activities provide another illustration of the cost allocation process. BZW employs four market makers and trading staff to cover oil stocks. Each trade in oil stocks requires roughly equivalent time and effort on the market makers' part, and is allocated an equal share of cost of oil market makers. If market makers cut their costs — by shedding staff or using fewer terminals or data services — each trade will have a smaller cost allocation, and thus will be more likely to be profitable.

Revenue allocation. Measuring profitability also requires data on revenues. BEATRICE tabulates two different types of revenues for each trade: *commission* and *trading revenue*. Commissions are paid as a percentage of customer trade size for BZW's research, advice, and client settlement services. Trading revenue is the income BZW expects to receive for committing its capital to facilitate clients' desire to trade. In general, market makers seek to have a zero position, and to close out long or short positions, which represent risk and require the commitment of the firm's capital. BEATRICE allocates trading revenue to individual trades according to an algorithm that splits trading gains into two categories depending on whether a trade's contribution can be allocated to a customer or to a BZW trader. Trading profits are usually *client facilitation trading profits*, which are attributed to client trades. These profits are the result of short holding period trades for BZW; for instance buying from a customer at 10:00 am and selling to another (at a higher price to be profitable) at 10:05 am. Longer holding periods for a BZW market maker often indicate an attempt to realize *speculative position revenues*, which are not assigned to clients. Consider the following example in which a BZW market maker transacts three times in a half-hour period and closes out his or her position:

Figure 1
Simplified Transaction and Profit Record for a BZW Market Maker

<u>Market making activity</u>	<u>Customer</u>	<u>Time</u>	<u>Position</u>	<u>Profit</u>
			0	
1) buy 100,000 shares at £2.00	A	10:00 am	100,000 long	£2,000 – £1,500
2) sell 40,000 shares at £2.10	B	10:10 am	60,000 long	£2,000
3) sell 60,000 shares at £1.95	C	10:30 am	0	–£1,500
				£1,000

Assuming the market maker's position in these shares just before 10:00 am was zero, the aggregate profit of these trades is simply sales revenue less buying cost, or $£201,000 - £200,000 = £1,000$. Yet a difficulty arises in determining how this profit should be allocated across the three transactions. The second trade and part of the first trade appear to be profitable, but the third trade is not profitable. One possible approach is to let the first and second trade split evenly the £4,000 profit realized at the time of the second trade, but have the first and the third trade split the £3,000 loss realized at the time of the third trade.

Many other sensible ways of allocating the £4,000 gain and the £3,000 loss exist, but as a BZW Director observed, "the key issue is to ensure that the method chosen is capable of consistent application and apportions the income from successful trading to the trades most responsible for the success." If the profitability patterns for the three customers were persistent, managers at BZW might conclude that customer C was better informed about short-term price movements, and potentially a more risky trading counter-party. BZW could then adjust its trading tactics to trade in smaller quantities or to be less willing to negotiate tighter prices with customer C.

Trade profitability algorithm. The full algorithm for assessing the profitability of a trade is applied consistently to all transactions. Each trade, however, will have a different set of background conditions or parameters that influence how the profit model is applied. The profit of a particular trade is a function of the inventory held at the time of the trade, the cost of acquiring that inventory, the elapsed time between trades, the stock's level of trading activity, and the trade price paid or received. If the third trade did not occur until 4:00 pm, for instance, the algorithm might dictate its associated loss not be allocated to a customer at all if it appeared that the BZW trader made a conscious decision to maintain the

position of 60,000 shares long rather than trade out of it. In this case, the £3,000 loss would be deducted from the market maker's position revenues. This simple example suggests the complexity in assigning trading profits and losses to clients' trades. Other complicating factors include accounting for stock splits, dividends, and transactions in the options and futures markets. Options and futures are traded in a different market, and different trading strategies are utilized for different reasons. Sometimes trades in these derivatives markets are used to hedge positions taken in transactions with customers, and sometimes they are used to speculate on anticipated price movements.

As a result of the computations in BEATRICE, each transaction will have a number of cost elements as well as commission and trading revenues or losses associated with it. A fully costed profit is calculated for each trade. This profit data can then be used to work out the contribution of any subset of trades; for instance, trades by particular clients, those within a particular size range, or all trades handled by an individual salesman. In aggregate, the model's revenues and costs reconcile to the figures in the mainstream financial accounts, but with the benefit that key relationship profitability information is made available in BEATRICE.

5. How the model is used

BEATRICE is intended to inform BZW's decision-makers with relevant data on relationship profitability. With the system in full use in 1990, Howard Coates reflected, "we are now in a position to assess accurately the strengths and weakness of our operation and to evaluate our commitments to various customers and customer segments — in some cases this means strengthening our ties and increasing our exposure, and in other cases, cutting back on ill-placed efforts." Although BEATRICE uses objective inputs and is based on a formal model of cost and revenue allocation, the interpretation of the model's outputs nevertheless requires judgment

Role of judgment. Management accounting information, including that produced by BEATRICE, is a by-product of the firm's records of customer transactions and internal production activities. As Jordan (1989) demonstrates, however, these data, even in an idealized form, are not adequate for solving the firm's microeconomic production problem [16]. To set efficient production levels, a firms offering a number of goods, each of which is produced with a number of

different activities must determine the marginal net revenue of its products and the shadow prices of its activities. These are not available from the records of transactions and production activities. Thus, management accounting data, including that from an ABC system, does not map directly into management production decisions, but is subject to interpretation. Raiffa (1968) refers to the inevitable "judgment gap" that exists between any formal model used by a decision maker and the real world. The objective of the systems developer is to reduce the judgment gap and bring the model closer to the demands of the real-world problem. We next describe how BZW senior managers interpret and use BEATRICE output.

BEATRICE analyses. The profitability calculations are applied in a batch program that is run quarterly on each of the 400,000 transactions arising in a quarterly period. BEATRICE is not a real-time system since a fairly large number of trades from one customer is needed to reach a statistically significant conclusion about the activities involved in a particular client relationship. Based on the observed statistical variance in the profit of individual transactions, a minimum of 50 trades in a quarter is sufficient for arriving at reliable conclusions about individual clients. BZW's larger institutional clients transact with the firm about 800 times in a quarter.

Once the model is run for a quarter, as many as 100 reports are generated detailing the performance of many different types of cross-sectional groupings. Information is calculated and can be presented in the format and level of detail appropriate for a range of management decisions. An ABC system does not make decisions. Rather, it focuses attention on unprofitable relationships and lines of business, and allows managers to identify the causal factors and to consider corrective responses. Decisions result from knowledge of market opportunities, and the costs of pursuing an opportunity or a customer. For example, offering an existing client a new instrument that would result in less trading risk to BZW could be compared to the additional cost of monitoring and managing a position in the security.

Value in decision-making. Since BEATRICE supports short-term tactical and strategic planning, it separates fixed and variable costs in the output. In the short-run, management decisions will not affect fixed costs. Capital expenditures — for instance, dealing room equipment and computer hardware — are sunk costs that are not related to volume and are only controllable in the long-run. This suggests

that some activities may be loss-making relative to *total* allocated costs, but as Alastair Yexley pointed out, "may still be profitable when compared to the smaller amount which would be saved by shutting down that line of business or not servicing an individual client." For example, dropping unprofitable customers will not lower the current period costs of equipment, facilities, and administration. However, it is possible to identify relationships that will only cover the current level of costs with additional revenue. In the case of an unprofitable customer relationship, BZW has several alternative. The firm can try to attract additional business volumes from the client, or commissions and fees can be raised, or BZW can try to limit the resources it expends on the relationship. BZW managers recognize there are different interpretations and uses of BEATRICE information depending on the particular planning decision at hand. Expending fewer resources will be likely to have a lagged effect on performance because the newly available capacity will need to be redeployed in more advantageous areas, or the capacity will be cut back over a period of time. Alternatively, BZW can seek to make an activity more efficient with changes in its processes, or by introducing new technology. A result may be a return to profitability for some relationships. The three most important purposes that BEATRICE is used for are depicted below.

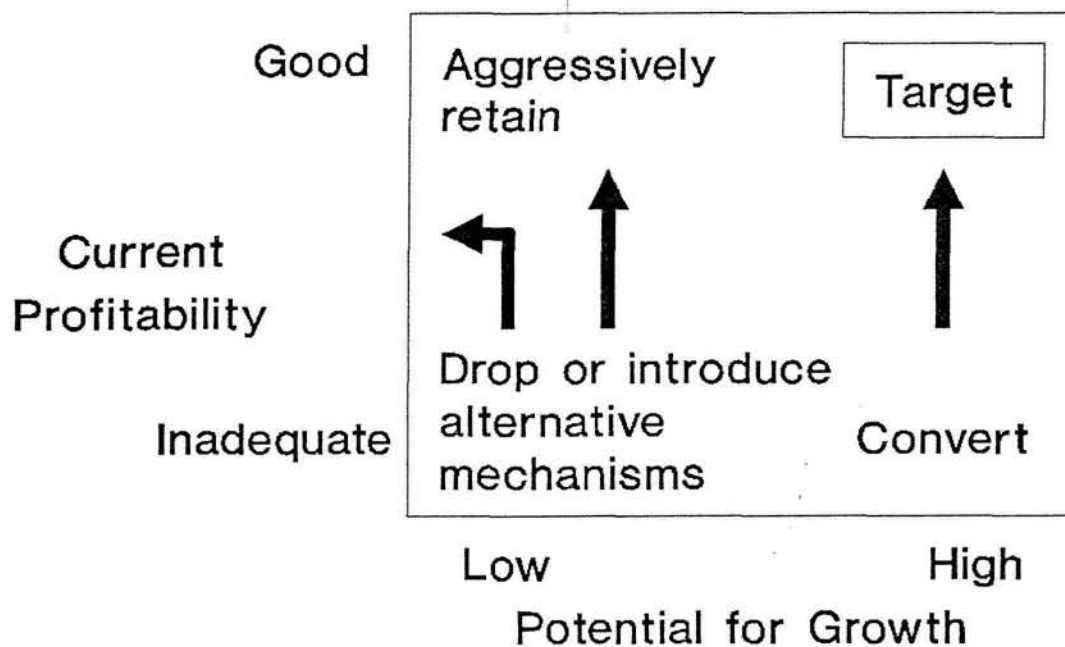
Figure 2
Types of Management Decisions Supported by BEATRICE

<u>Purpose</u>	<u>Costs</u>	<u>Question</u>	<u>Horizon</u>
Tactical, attention-directing	Controllable incremental costs	What problems do we have?	Immediate action, Corrective loss-preventing steps
Problem-solving	Relevant costs	What is the best way to operate?	Medium-term, Resource reallocation
Strategic planning	Full costs	Are we performing adequately? — Do we belong in the business?	Long-term decisions, Capital allocation

Tactical decisions require incremental costing, which are only those costs that can be immediately reduced by a fall in transactions volumes, or curtailing an activity. Such volume-sensitive costs are often a small proportion of the full costs. For instance, the cost of clearance and settlement for a customer that is not a member firm of the London Stock Exchange is about £40 fully costed. However, in the short-term £32 of the £40 expense is fixed, leaving £8 as the settlement cost that management actions could potentially save in the short-term. Problem-solving situations consider a particular decision that the firm faces. For instance, the firm may study whether to provide an unprofitable customer with a terminal for using TRADE, BZW's on-line order entry system for their small trades [8]. The relevant costs would be a one-time cost for the terminal and training, and the reduced costs from less time spent by BZW traders on the phone with that client. Other costs, such as the hardware and TRADE software maintenance would not be affected by the marginal user. Strategic planning involves identifying where the firm has a comparative advantage, and looking for ways to offer services and to attract customer segments with the most leverage for increasing profits. For BZW, the customer segments and lines of business in which the firm covers its fully allocated costs are those that the firm is willing to invest in to attract growth and to defend the segment in the future.

Customer segmentation. Expectations for growth and future profitability of certain client relationships are also taken into account when evaluating current, possibly inadequate, profitability. A loss-making client relationship today may become profitable in the future, and accounts such as these are monitored for improvement. BEATRICE information and prospecting reports from sales managers are used to classify clients into several categories. The classification is based on a client's current profitability and potential for increased revenue. Figure 3 depicts four customer categories.

Figure 3
Marketing Responses based on Customer Relationship



In the first category are clients with adequate profit levels, who are likely to respond with additional business volumes to upgraded services from BZW. These clients are actively targeted, and would have additional contacts from BZW’s senior research analysts and portfolio strategists. The second category is profitable clients that are unlikely to respond to additional services with an increase in volume and revenue. Because the client is not a loss-making account, the level and mix of services are maintained. Category 3 customers may include those whose revenues do not cover all costs, but that cover marginal costs and contribute to overheads at BZW. There is a good possibility that the client’s business volumes directed to BZW could improve. In these cases, the financial implications of the relationship are discussed with the client in hopes of converting the relationship to profitability. This often involves repricing the services BZW provides to cover the client’s usage pattern and the known costs. Recognizing their mutual reliance, some of these clients have shown a willingness to increase the commission rate paid to BZW, or to reduce their demand for services that they value less to enable BZW to reduce its costs, and apply the resources elsewhere. In the fourth category are clients whose associated revenues may not even cover

Table 5

Sample Customer Relationship: Period 1990				
	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Trades	82	80	56	102
Volume	£23,412,460	£7,900,980	£25,274,480	£24,730,760
<u>Revenues</u>				
Commissions	£40,802	£15,255	£49,774	£46,171
Trading P&L	-£680	-£3,049	£9,811	£6,208
Total Revenue	£40,122	£12,206	£59,585	£52,379
<u>Costs</u>				
Sales	£18,682	£7,938	£19,064	£16,800
Research	£14,020	£13,004	£18,926	£11,490
Trader/ Execution	£1,694	£1,564	£1,254	£1,945
Settlement	£4,555	£3,995	£2,986	£5,557
SE/Talisman	£2,178	£708	£1,232	£2,148
Total Cost	£41,129	£27,209	£43,462	£37,940
Profit	-£1,007	-£15,003	£16,123	£14,439
Profit per trade	-£12	-£188	£288	£142
Margin (profit/volume)	-0.004%	-0.190%	0.064%	0.058%

It is unusual for decisions to be made on data from a single quarter. The analysis of trends is therefore important to avoid making judgments based on statistical anomalies. In the sample relationship shown, two unprofitable quarters placed the client account in the third, loss-making category. BZW increased the service provided, and the client directed an increased volume of business to BZW. This led to profits for the relationship in the subsequent quarters, and for the year as a whole.

Some of the factors taken into consideration in interpreting the output are external to BZW. For instance, customers' activity levels are influenced by the overall level of activity in the market and by the customer service charges set by

the London Stock Exchange. Similarly, the profitability of BZW's trading is in part a function of the spread between the bid price and the ask price in the market as a whole, which will affect all clients, and over which no one firm has control. These exogenous factors are published by the London Stock Exchange, or are directly measured by BZW, and can be taken into account. In addition, comparisons can be made to the aggregate performance of firms in the industry. For instance, the net margin (i.e., (revenues-expenses) ÷ trading volume) in U.K. equities was -0.018% for member firms of the LSE in 1990 (it was 0.031% in 1989, and was 0.023% in 1991).² For the sample customer, the net margin for the relationship was 0.018% indicating relatively good performance for the year, and an attractive relationship for BZW.

Beyond relationship profitability. By looking at information on the profitability of large subsets of total trades, BEATRICE enables particular types of clients or lines of business to be analyzed. One decision in particular was whether to undertake a costly hardware upgrade to allow additional users to access TRADE, BZW's automated small trade execution system [8]. Prior to BEATRICE, it would have been guesswork to determine whether the client activity through TRADE generated profits for BZW. By analyzing the costs and revenues of the subset of trades made with the TRADE system, BEATRICE showed that this line of business was sufficiently profitable to justify the investment. An analysis of the client activity through TRADE in the quarter subsequent to the upgrade showed that with the extra throughput to TRADE the upgrade investment was fully recouped in three months.

² Correspondence with Stephen Wells, Chief Economist, London Stock Exchange, 1992.

6. Results and Performance Impact

A profitability information system does not clearly exhibit one of the identified sources of strategic advantage — switching costs [23], preemption [5], or unique assets [7]. However, such systems can provide benefits and improve decision-making and strategic planning. BEATRICE greatly improves decision information available to BZW managers, and provides accurate measures of the economics of customer relationships. BEATRICE supports closer management of the firm's resources, and enables the firm to correctly position itself for profitable operations in a highly competitive industry. There are several ways in which the system could enhance the competitiveness and profitability of BZW.

Enhanced information for management. Prior to the development of BEATRICE, management information in BZW was limited. Total profit and loss could only be calculated on an aggregated basis for trading activities, and by market maker in individual stocks. Commissions could only be tabulated for each client. No information was available on the services each client was receiving, and no analysis or breakdown of profits by client was possible. BZW's management did not know how effectively its expenditures and service efforts were contributing to the bottom line. It had a team of professionals generating a revenue stream, but no way to track the costs incurred in servicing individual clients. Without an understanding of the profitability sources, management was admittedly "flying blind."

BEATRICE has remedied these shortfalls. It enables management to determine which customers and customer segments are profitable and for what reasons. For example, a client may pay below average commissions but engage in a high volume of low risk trades which create profits for BZW dealers. The relationship is profitable, but without BEATRICE the client could have appeared to be loss-making. Initially the system's output was "greeted with some skepticism" according to a BZW Director. Several of the profit allocation mechanisms needed to be adapted to handle several special situations that arose in the markets. With the treatment of these situations, and the added experience using BEATRICE output, the system has become well-accepted.

As the diversity of BZW's client base increases due to globalization and new investment management styles, the firm will need to continue to developing appropriate metrics for evaluating their profit performance across clients and

market segments. BZW will also continue to develop its ability to interpret the BEATRICE data, and to perfect its responses to unprofitable relationships. The firm's new intelligence about trade-by-trade performance can support the discovery and evaluation of new trading, and position-taking tactics. These abilities should improve over time.

Benchmarking and BEATRICE business value. Published data on commissions, trading revenue, expenses, and turnover in the U.K. equities markets provide benchmarks for BZW managers to compare the firm's performance and profitability of relationships. Since BEATRICE is based on activity-based accounting principles, the outputs have forceful economic implications for management decision-making. When revenues are inadequate to cover the cost of maintaining a product or a customer relationship, some management action is appropriate. The alternatives include raising price, increasing volume, and abandoning the activities and redeploying the resources elsewhere or cutting capacity outright through layoffs and equipment disposals.

BEATRICE enables BZW to compare the profitability performance of each customer relationship to industry benchmarks. If the management actions taken reduce the number of underperforming relationships, the business value of the system may eventually be reflected in superior financial performance relative to consolidated industry figures published by the London Stock Exchange on a quarterly basis. Benchmarking and the ability to manage profitability at the level of individual relationships could result in improved performance of the firm overall, and a clear business value impact [19]. However, such an analysis requires a larger set of data than is currently available, and is outside the scope of this paper.

7. Conclusion

Traditional management accounting data is limited in its ability to provide profitability information relevant to strategic management decisions. Without such information, senior managers cannot systematically identify sources of profits accurately and systematically, and thus cannot deploy resources to the firm's best advantage. The problem is intensified in many business environments today where deregulation and new entrants often combine to leave unprepared firms with the risk of growing numbers of loss-making client relationships. Activity-based accounting methods offers a solution, and several firms are developing information

systems to gather and process cost and revenue data using these techniques. The evidence is accumulating that such systems provide information that is more relevant and accurate than what was previously available, and that improves the quality of management decision-making.

BZW's response to poor accounting information and adverse conditions in its industry was to develop BEATRICE, an innovative MIS, that combines ABC principles and a model of customer profitability for the securities industry that is based on a per trade assignment of costs and revenues. The impact of customer profitability analysis on BZW's management processes and decision making was shown to be considerable. Unless competitor firms carry out similar types of analysis, BEATRICE is likely to provide a competitive advantage.

While a single site case study limits the ability to generalize, there is support for the result that a well-executed information system based on ABC principles can improve management decision making and organizational performance. This finding is particularly applicable in securities firms, which have encountered recent deregulation and rising competition, and until recently lacked effective management accounting systems. Extensions of this research will examine how to use the data from customer profitability systems intelligently in marketing and distribution decisions, what other industries and economic conditions support the use of activity-based profitability systems, and finally what challenges and benefits arise when performance measurement systems are integrated with firm's other information technologies including processing and control systems, inventory systems, supplier-vendor networks, and customer order entry systems.

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Acknowledgements

Many of the key insights for assessing securities trading profitability were gained while Weber was a 1988 summer intern with Oliver, Wyman & Co., and international financial services consulting firm. This research was carried out while Weber was a Post-Doctoral Fellow at the London Business School. This research benefitted from discussions with Professors Frank F. Land of the London Business School and Eric K. Clemons of the Wharton School. Chuck Bralver, a founding partner of Oliver, Wyman & Co., a financial services consulting firm, introduced us to methods for analyzing trading profitability, and encouraged us to pursue the research.

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