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Modelling resource supply and demand: Expanding the utility of ABC

Chris Salafatinos

University of Edinburgh, Department of Accounting and Business Method, George Sq., Edinburgh, EH8-9JY, UK

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Abstract

Users of cost management systems should be able to predict the economic consequences of their actions. Activity-based costing (ABC) systems have proven useful to management for making operational changes based on resource usage, but have failed to inform management about spending changes, and consequently about profitability. This is because ABC was designed to measure the rate of resource *demand*, not the rate of resource *supply* (spending). One of the most important established guides for performance measurement used by management, investors, and creditors, is profit. Management uses profitability to evaluate proposed courses of action, creditors use it to assess credit worthiness, and investors use it to determine potential return. Traditionally, costing systems have been designed to translate management decisions into pro-forma balance sheets and income statements. Indeed, the standard by which costing systems have been judged depends largely upon the accurate translation of management's actions into quantified statements of condition and performance. A cost system which does not meet this standard is deficient.

This paper suggests that ABC systems can be adapted to provide profitability information. A method for modelling the relationship between resource supply and resource demand, which permits activity-based decisions to be evaluated in terms of their expected economic consequences, is presented.

Keywords: ABC; Resource supply and demand

1. Introduction

ABC systems and traditional ledger systems provide two distinct views of cost. ABC systems provide a resource demand view, and traditional ledger systems provide a resource supply view. The resource demand view focuses on the resources consumed by performing activities, and the resource supply view focuses on the amount of organizational expenses incurred to make resources available for productive use [1].

Management must balance continuously the demand for resources with the availability of supply for those resources. It is necessary to understand how changes in demand from activities have an impact on the supply of resources in order to assess the potential profitability associated with proposed operational changes. Traditional approaches, such as contribution margin analysis and cost-volume–profit analysis, are used to inform management of the future economic effects of proposed decisions. At present, ABC systems fail to do this.

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This is because there is no established method for reconciling the resource supply view with the resource demand view. Both ledger systems and ABC systems provide important and unique perspectives on cost behaviour, and this author believes that integrating them would provide a more complete view. The aim of this paper is to bring the two views of cost behaviour together by suggesting a method for linking changes in resources demanded by activities to changes in spending.

The model suggested in this paper permits incremental analysis to activity information. Activities provide information about the causes of spending changes, and how they are influenced by operational changes. Introducing activities to the incremental equation adds visibility to spending changes that allows management to make operational changes prospectively.

The paper begins by using a simple linear equation to explain the early conceptions of the relationship between supply and demand. The equation is expanded by introducing the role of excess capacity, and its effect on spending changes. The equation is then evaluated for its faithfulness in representing spending changes when considering different degrees of supply flexibility and under the condition that no excess capacity remains. The key variables for estimating the incremental investment necessary to create new layers of capacity are then introduced. Finally, an integer function equation is used to explain the behaviour of resource supply and demand, when considering both supply flexibility and the role of capacity. This equation is used to model how changes in demand influence spending behaviour and predict profitability from proposed courses of action.

2. Notations used in the paper

In order to analyze the behaviour of resource supply and demand, a number of important variables need to be defined. Each variable plays a role in the developing argument. I have therefore given a specific notation to each in order to improve the legibility of the logical framework of this paper. The variables, their assigned notation, and a brief definition are given below:

- s_0 current resource supply, expressed in monetary units
- s_1 expected future supply (spending), expressed in monetary units
- d_0 current demand, expressed in cost driver units[1]
- d_1 expected future demand, expressed in cost driver units
- dc_0 current demand capacity available, expressed in cost driver units
- ISI incremental supply interval (ISI), the expected incremental investment necessary to accommodate a change in demand, expressed in monetary units
- IDI Incremental demand interval (IDI), the expected incremental change in capacity from a change in supply, expressed in cost driver units

Each variable, and its contribution to the argument, is explained more fully as they are introduced in the discussion.

3. The role of excess capacity

Until recently, it was implicit in ABC methodology that changes in resource demand would result in proportional changes in resource supply [2]. It was assumed that expected supply (future spending) would be changed by the relative proportion of current supply (s_0) to current demand (d_0). This is expressed as follows:

$$s_1 = d_1(s_0/d_0).$$

For example, consider the activity of processing purchase orders. Assume that the current amount of total resources (expenses) traced to this activity is £5000 (s_0) and the current number of purchase orders is 100 (d_0). If the number of purchase orders

[1] Cost driver units refer to the occurrence of a particular event or transaction which is intended to measure the demand of resources. Cost driver units include the number of invoices, set-sups, batches, and purchase orders. The demand for an activity could be expressed by the number of cost drivers units that have occurred as a result of the performance of the activity.

processed (resource demand) increases from 100 to 200, then management would expect spending to double. This is computed as follows:

£ 10 000 = 200 (£ 5000/100).

After many attempts at applying ABC in this way, it was revealed that changes in cost driver demand greatly overstated the impact on spending [3]. Kaplan [4] explains that these early problems were a result of confusion between resource supply and demand. He points out that when managers asked how much costs would change with respect to a particular decision (e.g. add or drop, change a process, or impose minimum order sizes), they were inquiring about spending changes in the short term. However, Cooper and Kaplan [3] argue that ABC was never intended to be used in this way. Rather, ABC systems were designed to measure the cost of *using* resources, not the cost of *supplying* them. The difference between resources supplied and resources consumed or demanded through activities represents unused capacity for the period. This is expressed in the following logic-statements:

Unused capacity $= s_0 - [d_0(s_0/\mathrm{dc}_0)]$;

Used capacity $= d_0(s_0/\mathrm{dc}_0)$.

Consequently,

Current resource supply

= *used* capacity + *unused* capacity.

This is expressed as,

$$s_0 = d_0(s_0/\mathrm{dc}_0) + s_0 - [d_0(s_0/\mathrm{dc}_0)].$$

Therefore, as long as current capacity $(\mathrm{dc}_0) \geqslant$ expected demand (d_1),

Expected supply = expected demand + expected unused capacity.

This is expressed as,

$$s_1 = d_1(s_0/\mathrm{dc}_0) + (\mathrm{dc}_0 - d_1)(s_0/\mathrm{dc}_0).$$

For example, recall that the total current resources supply to the activity of processing purchase orders is £ 5000 (s_0). If the capacity for the activity of processing purchase order is 400 purchase orders (dc_0) and the current demand is only 100(d_0), then there is excess capacity of 300 (400 − 100). Therefore, increases in demand should not increase resource supply requirements until excess capacity has been reduced to zero. In this case, since excess capacity is greater than zero (300) then expected resource supply (s_1) is equal to current resource supply (s_0). This is expressed using the above equation as follows:

$$s_1 = 100\ (£ 5000/400) + £ 5000 - [100(£ 5000/400)]$$
$$= £ 1250 + £ 3750,$$

and therefore,

$$s_1 = £ 5000$$

According to this example, £ 1250 represents the cost of resources *used* and £ 3750 represents the cost of *unused* capacity. Therefore, only 25% (£ 1250/£ 5000) of the resource is consumed by the activity. As long as excess capacity exists, no increase in resource supply is expected. To illustrate this point further, assume that the number of purchase orders increases dramatically from 100 to 350. Using the equation above, the expected resource supply (s_1) is computed as follows:

$$s_1 = 350(£ 5000/400) + (400 - 350)\ (£ 5000/400)$$
$$= £ 4375 + £ 625 = £ 5000,$$

and therefore

expected supply (s_1) remains equal to current supply (s_0).

Even as resource demand increases from 100 to 350 purchase orders, the level of recourse supply remains the same at £ 5000. In this example, there has been an increase in the level of resources consumed by the activity, which has resulted in a reduction in the cost of unused capacity from £ 3750 to £ 625, but no change in spending has occurred.

3.1. Spending reductions

The same phenomenon holds true when management redesigns activities and processes to reduce the number of cost driver units. For example, assume that management finds a way to reduce the number of purchase orders from 350 to just 75. This is computed as follows:

$$s_1 = 75(£\,5000/400) + (400 - 75)(£\,5000/400)$$

$$= £\,937 + £\,4063 = £\,5000,$$

and therefore

expected supply (s_1) remains equal to current supply (s_0)

Note that even when demand is reduced significantly, the expected supply requirement remains at £ 5000. This is because the reduction has only resulted in an increase in excess capacity without affecting spending. Spending reductions can only be obtained by management taking action to limit the level of supply to the activity through budgetary adjustments, not by simply reducing demand [5].

4. Consumption patterns

The above illustrations deal with changes in demand while excess capacity exists. We saw that, as long as excess capacity remains, significant increases or decreases in demand will not result in changes in spending. However, not all resources supplied to activities result in excess capacity. Cooper and Kaplan [3] describe two ways in which resource supply is adjusted to meet activity demand. The first way is by supplying resources in advance of demand which exhibits a *pushed* consumption pattern. The second way is by the activity initiating supply as it is needed which exhibits a *pulled* consumption pattern.

4.1. Pushed resources

A resource is *pushed* when resources are supplied in advance of demand to accommodate unknown future usage. For example, a building is purchased in advance of expected floor space needs. How much actual floor space is required is an unknown future variable. Management may attempt to supply resource capacity which approximates the expected resource demand, or it may deliberately invest in excess capacity in anticipation of future increases in demand [6]. Acquiring excess capacity may prove to be the most economical method of anticipating future demand. When resources are pushed, inevitably supply and demand will be unequal, and either excess capacity or deficit capacity will result. Excess capacity occurs when management supplies resources to an activity in excess of the rate at which the activity is able to consume them. Managerial judgment for pushed resources is required at two stages. First, at the budget stage to decide how much initial resource is to be supplied, and second at the adjustment stage when management attempts to balance supply and demand by cutting expenses or providing additional support [7].

4.2. Pulled resources

A resource exhibits a *pulled* consumption pattern when demand initiates supply. A pulled resource is therefore supplied as a function of usage. For example, utility related resources, such as telephone and energy expense, are supplied as they are used. There is no separation between supply and demand, and thus no excess capacity or deficit-capacity exists. Generally, when an organization supplies resources through external suppliers without long-term commitments, a pull phenomenon exists to some degree. This is because the supply of resources can be increased or decreased rather quickly, limiting the potential gap between supply and demand. Consequently, limited additional managerial judgment, either at the budget stage or at the adjustment stage, is required to address supply and demand equilibrium. Additional resources are supplied almost automatically as the demand requirements change. Examples of pulled resources include flexible labour costs, energy costs, telephone costs, and even fees paid to an outside supplier of a short-term service contract.

Clearly, the extent to which a resource is *pushed* or *pulled* depends on the degree of supply flexibility. The more ability management has to control resource supply levels and adapt them to demand fluctuations, the more the resource exhibits a pulled resource consumption pattern. Fig. 1 shows the

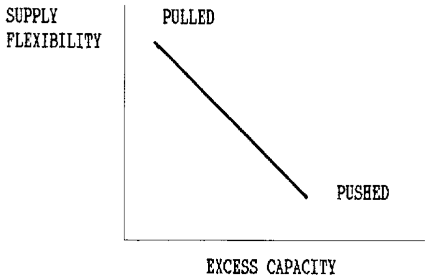

Fig. 1. Resource supply flexibility.

basic relationship between consumption patterns, excess capacity, and flexibility:

If a resource exhibits a highly pulled consumption pattern, then excess capacity is expected to be small. On the other hand, a highly pushed resource is very inflexible with respect to demand fluctuations, and is likely to result in significant levels of excess capacity. Therefore, highly pulled resources are likely to behave in a way initially conceived by early users of activity information, that is, changes in demand will result in proportional changes in supply, which is represented by the equation $s_1 = d_1(s_0/d_0)$.

For example, consider a highly pulled resource such as telephone expense. If the current level of call units used increases from 50 to 75 (an increase of 50%), then the current resource supply is likely to increase from £2000 to £3000 (an increase of 50%). This is computed as follows:

$$S_1 = 75(£2000/50) = S_1 = £3000.$$

On the other hand, highly pushed resources are more likely to behave in a manner consistent with the more refined equation which includes the excess capacity component which is represented by the equation $s_1 = d_1(s_0/\mathrm{dc}_0) + (\mathrm{dc}_0 - d_1)(s_0/\mathrm{dc}_0)$.

For example, consider a highly pushed resource such as an executive salary. Assume the current annual salary of the executive is £40000 with a working capacity of 2000 h per year. Although the current hours worked may increase from 1600 to 1900 the expected supply requirement is expected to remain the same. This is computed as follows:

$$s_1 = 1900(£40\,000/2000) + (2000 - 1900)(£40\,000/2000) = £40\,000.$$

As long as excess capacity exists, there remains a buffer forestalling spending changes and permitting demand from activities to increase or decrease without affecting resource supply. However, when current capacity reaches zero, the prediction of spending changes requires the modification of the simple linear equations described above.

5. When excess capacity reaches zero

As explained above, the economic consequences of expected changes in demand on highly pulled resources can be reasonably predicted using the liner equation $s_1 = d_1(s_0/d_0)$, which makes the issue of excess capacity less relevant. In addition, changes in expected demand on pushed resources when excess capacity exists can be predicted using the equation $s_1 = d_1(s_0/\mathrm{dc}_0) + (\mathrm{dc}_0 - d_1)(s_0/\mathrm{dc}_0)$, which includes the excess capacity component and permits changes in demand without affecting spending. The question now becomes how do pushed resource supply levels behave in response to expected increases in demand when that demand is expected to exceed current capacity limits. In other words, how much additional spending should be expected to accommodate projected increases in demand beyond current capacity? Or perhaps more importantly, what spending reductions are possible with respect to proposed reductions in resource demand? These are the initial question that early users of activity information were most interested to have answered.

In order to answer these questions, the equations above need some modification. Two additional variables are needed to express the incremental changes in investment necessary to create new levels of resource capacity to accommodate projected increases or decreases in demand. The first variable is called the incremental supply interval (ISI), which represents the estimated incremental change in spending (expressed in monetary units) necessary to accommodate the expected level of capacity from d_0 to d_1. The second variable is called the incremental demand interval (IDI), which represents the incremental change in capacity (expressed in cost driver units) made available from a change in spending.

5.1. Estimating the ISI and the IDI

A new layer of capacity could be expressed both in monetary terms and in cost driver terms. The ISI represents the incremental monetary investment necessary to increase capacity to accommodate projected increases in demand from activities beyond the current level of capacity. It could also represent the opportunity for incremental cost savings in response to decreases in demand below capacity. The IDI could be thought of as the ISI expressed in cost driver units.

The ISI is formulated by analysing the market acquisition characteristics of a particular resource. The market acquisition characteristics are the limitations and peculiarities of the market place which are confronted when acquiring new capacity. It is these characteristics which determine the degree of supply flexibility [8]. For example, consider the prospects of adding new personnel resources (salary expense) to the activity of processing purchase orders. The market place for acquiring human resources does not permit people to be hired in excessively small increments. At best, some markets allow for part-time or temporary employment. Therefore, the ISI for this resource/activity relationship could be the cost of hiring a part-time or temporary purchase order clerk. Since the market place does not permit hiring workers to process only a few purchase orders it is likely that excess capacity will have to be acquired. For example, assume the current supply of resources is one clerk at £ 10 000 per year who has a capacity of processing 100 purchase orders. Further assume that management expects the demand of this activity to increase from 100 to 115 purchase orders. Since the market characteristics for acquiring human resources does not permit employing a worker just to process only a 15 purchase orders a year, management would have to invest in excess capacity by employing a part-time worker who may have the capacity to process 50 purchase orders (the IDI) for a cost of £ 5000 (the ISI) a year. In this case, management is forced to purchase excess capacity of 35 purchase orders (50 − 15).

The more a resource exhibits a pushed consumption pattern, the less responsive supply adjustments are to changes in demand, and the larger the ISI value. The ISI for acquiring a purchase order clerk is small in comparison to ISI for acquiring a facility related resource such as office space.

6. Modelling resource/activity relationships

In order to model changes in highly pushed resources, the ISI and the IDI variables must be integrated in the equation. The equation must express the changes in supply and demand in relation to the level of capacity. Expected supply (s_1) could be predicted by modelling the changes in demand using the following step function equation:

$$s_1 = \mathrm{ISI}\{d_1/\mathrm{IDI}\} + \mathrm{ISI}$$

where the brackets { } denote an integer function (e.g. $\{3.1\} = 3$ and $\{3.9\} = 3$).

For example, consider again the activity of processing purchase orders. In the interest of simplicity, assume that only two resources have been traced to this activity: A highly pushed resource, office rent in the amount of £ 10 000 per year; and a highly pulled recourse, telephone expense in the amount of £ 6000 per year. Further assume that these resources allow for a maximum (current capacity) of 400 (dc_0) purchase orders to be processed per year. Processing purchase orders beyond this point without additional resources would result in some form of organizational pain, such as delays and other forms of quality erosion, indicating to management that the practical capacity threshold has been exceeded [1, 6]. The question is, if management expects to be processing 600 purchase orders next year because of new business, how much new spending would be required to accommodate the increase in demand from this activity?

To analyze the impact on spending, each resource must be considered separately as it relates to the demand from the activity, thus forming a unique resource/activity relationship. Because telephone expense is a highly pulled resource, excess capacity is likely to be zero (or close to zero) and thus would exhibit a different cost behaviour pattern than office rent. Therefore, expected spending with regard to telephone expense could be reasonably predicted using the linear equation; $s_1 = d_1 (s_0/d_0)$ described earlier. This is computed as follows:

$s_1 = 600(£\,6000/400) = s_1 = £\,9000.$

The supply and demand relationship is expressed as a smooth upward slope and is presented in Fig. 2

Spending changes for office rent will most likely result in excess capacity because physical facilities can not be supplied in small increments. In order to add more floor space to accommodate increases in demand, management must invest in new facilities by either buying or renting office space. Assume that management estimates that a future incremental layer of capacity would require an investment of £ 8000 (the ISI) which would permit an estimated increment of 350 (the IDI) additional purchase orders to be processed. By using the step function $S_1 = \mathrm{ISI}\{d_1/\mathrm{IDI}\} + \mathrm{ISI}$, a model of supply and demand could be constructed. Any value for estimated demand could be plugged into the equation to get a value for supply along the step function slope. This is the resource/activity relationship presented in Fig. 3.

The vertical jumps in the slope steps represent the ISI and the horizontal movements represent the IDI. The step function in Fig. 3 indicates that changes in demand will not have an impact on supply until current capacity reaches zero. Once capacity is reached, the change in supply would be equal to the value of the ISI. Highly pulled resources in which supply is very flexible with demand would have very small vertical jumps in the line, indicating a small ISI value. In fact, a purely pulled resource would be depicted as a smooth upward sloping line without steps, and with an ISI equal to zero. In contrast, highly pushed resources would exhibit larger vertical jumps in the slope, depicting the inflexibility of supply to changes in demand from activities.

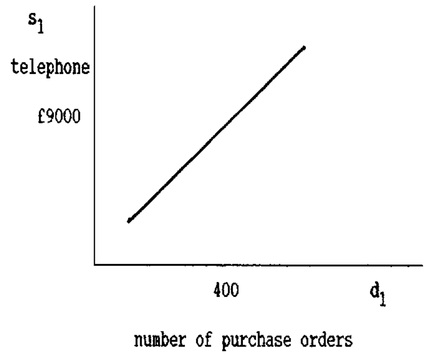

Fig. 2. Supply and demand function for a pulled resource. For any value of d_1, a proportional change in s_1 occurs. For example in Fig. 2, the slope is expressed as $s_1 = 15(d_1)$. Therefore, if d_1 is equal to 100 then s_1 is equal to 1500, and if d_1 is equal to 101 then s_1 is equal to 1515.

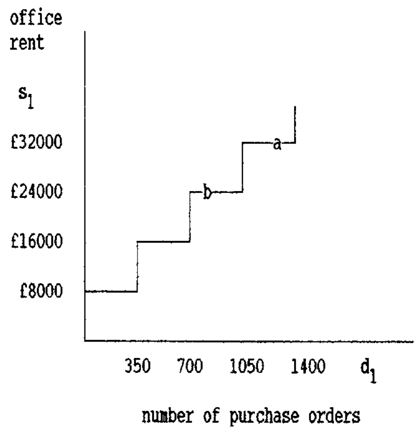

Fig. 3. Supply and demand step function for pushed resource. The level of spending will depend on whether the current layer of capacity is greater than or equal to zero. If no excess capacity exists, a change in demand will result in a change in supply by the value of the ISI. In contrast, if excess capacity is greater than zero then s_1 will be equal to s_0 and no new spending is required. For example, when d_1 is equal to zero then s_1 is equal to 8,000, and when d_1 increases to 349 then s_1 is still equal to 8,000. However, once demand reaches 350 (dc_0), then excess capacity has been reduced to zero ($d_1 = \mathrm{dc}_0$), and spending jumps up to 16,000 creating a new capacity layer.

Using the model in Fig. 3, spending requirements can be estimated for both increases and decreases in projected demand. For example, if the number of purchase orders grew significantly to 1300 (at point 'a' in Fig. 3), the level of spending required to accommodate this demand would be estimated at £32 000. This is computed as follows:

$s_1 = £\,8000\{1300/350\} + £\,8000 = £\,32\,000.$

On the other hand, if management discovered a way to reduce the number of purchase orders through process redesign efforts to 800 (at point 'b' in Fig. 3), the necessary supply level would be reduced to £24 000, resulting in the opportunity for saving of £8000 (£32 000 − £24 000). This is computed as follows:

$s_1 = £\,8000\{800/350\} + £\,8000 = s_1 = £\,24\,000$

where potential savings is equal to: $s_0 - s_1$.

Note that changes in demand for pushed resources are not proportional to changes in supply. Rather, changes in spending depend upon the degree of supply flexibility. Market characteristics determine the extent of flexibility, and therefore the size of the ISI and the IDI. Using these variables in a step function equation provides a model for predicting the economic consequences of proposed operational decisions which involve changes in demand from activities.

7. Interdependent resources and activities

So far the model has assumed a one-to-one relationship between a resource and an activity. Clearly, the organizational environment is more complex, involving many interrelated connections between resource supply and demand. Organizational resources are consumed by many activities in the company and, consequently, an activity cost may be composed of a combination of varying degrees of pushed and pulled resources. In addition, each activity is likely to have a different cost driver representing the consumption of resources assigned to the activity. The model essentially attempts to express the change from d_0 to d_1 by quantifying the change from s_0 to s_1, using the ISI and the IDI inside a step function equation. However, since there is likely to be more than one resource traced to a specific activity, the economic consequences are likely to involve many different spending/activity relationships. Therefore, the total spending change which results from operational changes in demand is composed of the changes in s_1 for every resources affected by the change. This is expressed as follows:

$$\text{Total spending} = s_1 \text{ of resource A} + s_1 \text{ of resource B} + s_1 \text{ of resource C}\ldots$$

or

$$\text{Total spending} = \sum_{s_1}.$$

Therefore total change in spending could be expressed as:

$$\Delta S = \left(\sum_{s_1} - \sum_{s_0}\right).$$

In order to use the step function described above to predict spending behaviour, proposed operational decisions must be translated into cost driver terms. Thus, the cost drivers can serve as the linking mechanism for recociling resource supply and demand. Applying this concept in practice requires a three step process.

1. Determine cost driver impact. The decision or proposed action must be translated into a set of estimated cost driver changes. For example, if management is considering a new product line, an estimation of how many new purchase orders, machine-set-ups, invoices, batches, and sales calls is needed. Similarly, if management discovers a way to improve the production process, an estimation of how many labour and machine hours, set-ups and stock movements can be saved is needed.

2. Determine relevant activities. Relevant activities are those which are driven by cost drivers which are expected to change as a result of the proposed action. For example, if the proposed action requires more purchase orders to be processed then the activity of processing purchase orders becomes a relevant activity. Similarly, if an increase in the number of sales calls is expected, the activity of making sales calls becomes relevant to the decision.

3. Establish a step function relationship between relevant activities and resources. A step function equation using ISI and IDI variables must be established for each resource that is traced to each relevant activity. However, when a single resource is traced to more than one activity, the relationship

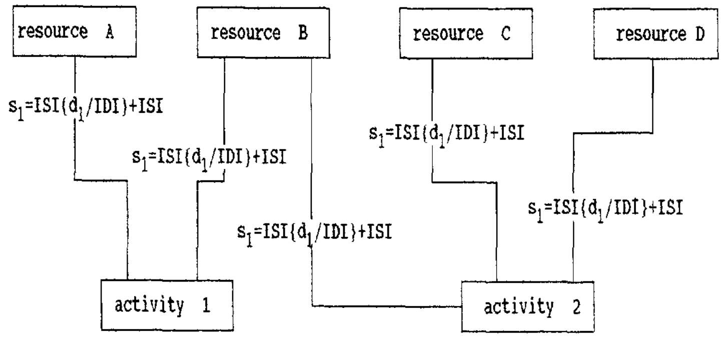

Fig. 4. Multiple relationships in resource supply and demand. A step function exists for each activity/resource relationship. When a single resource (resource B) is consumed by more than one activity, more than one relationship exists and therefore more than one step function is needed to express it. However, since the new capacity of resource B is being determined from changes in demand from activities 1 and 2, only one relationship must be selected to predict spending changes. The relationship which requires the largest new spending is therefore the new capacity needed to satisfy the new demand.

with the largest ISI must be used to estimate the change in spending. For example, if both the activity of making sales calls and the activity of processing purchase orders require an increase (according to the ISI), in the demand for telephone service, then the new capacity must be the activity relationship which places the highest demand upon the resource. The process is summarized in Fig. 4.

8. Discussion

Although the aim of ABC has historically been restricted to product costing, in recent years it has expanded into the management arena in the form of activity-based management (ABM) [9, 10]. Users of ABC began to realize the utility of using activity information for evaluating management decisions. As ABC began to be used in this way, it was erroneously believed that it could be used similar to the way in which contribution margin and cost-profit-volume analysis is used [11]. These traditional approaches provided management with information for assessing the economic consequences of proposed decisions, such as make-or-buy, drop-or-add, special order, scarce resource, and sell-or-process-further decisions. The fact that the early users of ABC systems attempted to use activity information in this manner underscores the necessity of having a cost management system to provide profitability information in a decision making context.

The expansion of ABC as a decision making tool raises the standard of ABC information and requires that it supports the decision maker by providing estimates on the profitability associated with certain proposed courses of action. It has been argued that ABC, even in its evolved ABM form, was never intended to provide short-term profitability information. Instead, Johnson and Kaplan [12] give a vague impression that over the long-term, changes in demand will ultimately affect spending. However, Corbey [8] suggests that although this argument is correct in principle, "it is precisely this long-term situation that is so unpredictable". Consequently, changes in demand may never effectively be linked to changes in supply in the long-term.

This paper also give some insight into how to determine the cost of resource usage and the cost of excess capacity. By calculating the cost of resources used in the conversion process, management can evaluate special order type decisions more effectively. For example, knowing the level of excess capacity would help determine whether to accept or reject a special customer order at a price below full cost. Traditional analysis preaches the acceptance of orders which merely cover variable costs as long as excess capacity exists. However, when faced with this problem, management has often lacked a method of calculating current capacity. In addition, possessing quantifiable measures of capacity may offer a new avenue for performance evaluation, which may lead management to focus on increasing resource supply flexibility.

The model presented in the paper is a form of incremental analysis, but differs considerably from traditional applications. Traditional incremental analysis bases incremental change on unit volume. Costs are split into variable and fixed according to their relationship to the expected number of units produced. In contrast, the incremental analysis in this paper does not restrict the activity basis to unit volume alone. Instead, the incremental impact is a function of cost to a unique cost driver. Therefore, expected spending changes are not exclusively dependent upon changes to unit volume.

No accounting system or model actually make decisions, but all are directly or indirectly intended to support the decision making process. Kaplan et al. [2] argues that ABC is not a decision focused system, but rather a general purpose system. However, his claim is more of a consequence rather than a design feature of ABC. Kaplan explains that incremental analysis is too complex and consequently not worth doing. But this precisely is why models are useful. To simplify and reduce complexity, sacrificing absolute accuracy for relative clarity.

Incremental analysis is used frequently in a decision making context in the form of contribution margin analysis, cost-volume–profit analysis, and break-even analysis. These models are based on simplifying assumptions that give guidance to management decisions. Businesses do not only rely on these models to break down complexity, but more importantly, to provide insight into future economic consequences of proposed courses of action. Regardless of the system or model employed, profitability remains the primary measure of quality management decisions.

The model suggested in this paper is not intended to consider all possible variables, but rather to merely provide a simplified view of the problem in order to aid in the decision making process. The model is limited to resource/activity relationships and does not consider the relationship between activities and products. It is intended to provide a link between changes in operations and spending changes (e.g. process redesign, elimination or modification of activities, reduction of cost driver transactions, and resource adjustment and reallocation).

In an ABC system, cost drivers are used to establish a cause-and-effect relationship between each resource (or group of resources) and each activity (or group of activities). Although this process is very complex, it is exactly how ABC systems are built. The paper suggests that in addition to cost drivers, a step-function could be established for each resource/activity relationship that could be used to model changes in spending. Therefore, no new relationships are necessary.

As with any model, the step function approach described in this paper is an oversimplification of reality. It reduces the complex and dynamic organizational environment to a system of predictable outcomes supported by a set of assumptions. There are a number of assumptions used in the model which could be questioned. For example, the ISI is assumed to be constant for each layer of demand. However, the market characteristics for acquiring resources are likely to fluctuate over time. For instance, the cost of office rent may increase over time as property values rise in response to economic conditions. In addition, the degree of supply flexibility may change as management perfects its control over spending, transforming pushed resources into pulled resources. An example of this has occurred over the last decade as businesses began to make extensive use of temporary workers. This has increased management's ability to adjust resource supply with demand. In spite of these assumptions and oversimplifications, the model can be a useful tool for decision making, as long as its limitations are considered.

As Cooper [13] suggests, the measure of a cost system should be how useful it is to the organization. ABC provides management with useful information about how activities drive costs. This new way of viewing the organization has helped management understand and control overhead costs. However, one of the most important aspects of a costing system is to provide management with a tool for dealing with uncertainty. In an increasingly volatile and competitive market, management needs, as never before, tools to help make decisions in the face of this new uncertainty. Proposed courses of actions need to be analyzed and projected into the future before the changes are implemented. ABC systems have used technology to bring new visibility to cost behaviour. Just as engineers use computer simulation to test their building designs before they are built, and doctors use computer technology to perform mock operations before engaging in dangerous surgery, so too should management possess a system which enables them to test the consequences of their decisions before they are unleashed to the uncertainty of the organization and the market place.

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