

ABC ACCOUNTING SYSTEMS AN EXAMPLE OF TECHNOLOGICAL CHANGE AND DIFFUSION

Activity-Based Costing has been around for over a decade and is used extensively in the for-profit sector. Universities, however, are slow to adopt this innovative costing and management technique in spite of abundant literature encouraging its use. This paper uses a theory of fixed capital investment and a new data set to explore possible explanations for this.

I. Introduction

In the summer of 1988 Robin Cooper and Robert Kaplan of the Harvard Business School published an article in the *Journal of Cost Management* which unveiled a new cost accounting model they called Activity-Based Costing (ABC). The impact of their paper was almost immediate. In the academic world, the article sparked a flurry of research activity and the production of many books, articles, working papers and theses. In the private sector, the article affected accounting practice and many for-profit organizations adopted, either in whole or in part, ABC methods.

Large private-sector manufacturing establishments with a variety of product lines were the first to implement ABC methods. In these establishments the new costing and management technique complemented other managerial innovations, such as process reengineering and Total Quality Management (TQM), and allowed these organizations to reap significant gains by facilitating significant restructuring. ABC provided these early adopters a more accurate representation of the true costs of products and the forces at work in performing an activity which, in turn, allowed a more rational basis for restructuring. Other large organizations engaged in distribution, retail, and wholesale activities soon followed the lead of the manufacturing sector, and by the mid-nineties use of the technique had spread to both the service and government sectors. The use of ABC continues to spread. Indeed, the Public Sector Accounting and Auditing Board of the Canadian Institute of Chartered Accountants (CICA) established a study group which, in its December 1998 report, recommends the use of ABC in the public sector.

Activity-Based Costing is a classic example of a technological change and can provide a basis for an examination of the pattern of technological diffusion in the economy. The literature on diffusion of technological change identifies at least four, not necessarily sequential, stages in the diffusion process (see Aghion and Howitt (1998)). First, a broadly applicable general purpose technology (GPT)—a new idea, such as ABC—must be developed. In the case of ABC, the new idea was a result of the work of Cooper and Kaplan. Second, a new and costly set of intermediate goods and services must be developed before it is profitable for firms to switch to the new GPT. With ABC this not only involved the development of appropriate computer software but also the development of a new set of technical skills within the accounting profession. Third, at least some firms in individual sectors of the economy must acquire

information on the new technology and be willing to experiment with the new technology to discover how to implement it in their particular sector. Finally, other firms must find out about this experimentation and adoption, and either begin experimenting themselves or choose to reject the new technology.

At each stage in the diffusion process, for-profit firms and not-for-profit organizations face critical investment decisions. Moreover, the investment decisions are made in a context where the costs and benefits which accrue from the investments are uncertain and a decision to invest is irreversible. Investment is irreversible if once the capital is installed it has little or no resale value to the organization. Very little of an investment in an ABC accounting system can be recovered if an organization decides to abandon the system, since much of the investment is idiosyncratic (the collection and organization of data unique to the firm) or vested with employees who can leave the firm (i.e. skills acquired). A new theory of investment associated with Dixit and Pindyck was developed to provide insight into investment decisions in this context and provides a conceptual basis for an examination of the diffusion of ABC technology. An excellent overview of the new theory of investment can be found in Dixit, A. and R. Pindyck (1994) *Investment Under Uncertainty* (Princeton: Princeton University Press). Other recent papers include: Hubbard (1994); Ingersoll and Ross (1992); MacDonald and Siegal (1986); Pindyck (1991) and Sampson (1998).

In this paper we provide a succinct overview of our ongoing research on the diffusion of ABC technology in one sector of the Canadian economy: the Canadian university sector. The first section of the paper is descriptive and we attempt to answer the following questions: To what extent has ABC spread to the university sector? Have universities in Canada even considered using this management tool? Have any universities in Canada moved beyond simple consideration and actually experimented with the use of ABC?

In the second section of the paper we use the new theory of investment to examine the diffusion process in more detail. In particular, we use the new theory of investment and our data set to explain the pattern of diffusion in the Canadian university sector. In a brief concluding section, we shift our attention to the optimal rate of technological diffusion. The Canadian Institute of Chartered Accountants has struck a study group to make recommendations on the use of ABC in the public sector, and the recommendations are likely to have a significant impact on accounting practice in Canadian universities. Should the CICA play this role in the diffusion process? Why not give universities the unconstrained ability to choose to adopt or not adopt the new technology, based on their own individual assessments of the costs and benefits of adopting the new technique within their own institution?

II: Who is using ABC in the Canadian university sector?

To acquire information on the diffusion of ABC at Canadian universities, we distributed a detailed (50 questions in total) questionnaire to financial officers at Canadian universities. The support of CAUBO (the Canadian Association of University Business Officers), a professional organization of university business officers with a membership which includes all Canadian universities, was secured to increase the response rate and to assure questionnaires were completed by senior financial administrators. CAUBO took responsibility for distributing the questionnaire. In total, a population of 78 universities was chosen and 35 responses were received for a response rate of about 45%. This is a respectable response rate and the actual sample is broadly representative of Canadian universities (with small and large schools, regions of the country, etc. represented). However, it is likely that the sample reflects at least some self-selection bias, since we suspect universities with some knowledge and interest in ABC methods were more likely to respond. The results should be interpreted with this in mind.

Our survey revealed that only one university in Canada—The University of Sherbrooke—has chosen to implement a full ABC system. A number of other universities have selectively implemented some aspects of ABC; both the University of Alberta and the

University of Calgary, for example, attempt some ABC-type cost allocations to comply with provincial legislation which requires the submission of Key Performance Indicators. But, in general, Canadian universities are not currently using ABC.

In this respect Canadian university are not all that different from universities in the U.K and the United States. A survey of U.K universities by Mike Mitchell (Mitchell(1996)) found that only twelve of sixty-four universities responding (out of a total population of 100) were using any ABC-type cost allocation systems. Although no one has undertaken a comparable survey of US universities, anecdotal evidence (based on discussions with staff at the National Association of College and University Business Officers, the US counterpart of CAUBO) suggests that only a few US universities have adopted ABC.

ABC provides a formal and comprehensive system of cost allocation. It is possible that Canadian universities are using other, less formal, cost allocation systems. Our survey revealed that a few universities were attempting to allocate costs in some way. But even informal systems of cost allocation systems are rare. Tables 1 and 2 identify the use of formal and informal systems to allocate direct costs across main activities (teaching, research, and service) and indirect costs across programmes, faculties, departments, or courses.

Table 1
Do you allocate direct costs, such as salaries and other department expenses to teaching, research, and service components?

| | |
|-----|------------|
| Yes | 39.4% (13) |
| No | 60.6% (20) |

Table 2
Do you allocate indirect costs to:

| | Faculties | Departments | Programmes | Courses |
|-----|------------|-------------|------------|------------|
| Yes | 11.4% (4) | 11.4% (4) | 14.3% (5) | 2.9% (1) |
| No | 85.7% (30) | 88.6% (31) | 85.7% (30) | 97.1% (34) |

The survey also identified specific indirect costs which could be allocated. Again the results clearly showed that cost allocation methods are not generally used at Canadian universities. The few universities engaged in indirect cost allocation generally use traditional approaches; in particular, the allocation approach tends to be based on FTEs. The relevant responses to our questionnaire are reported in Table 3.

Table 3

Please indicate the option which best describes the way you allocate each of the following indirect costs.

| | No allocation | By FTE | ABC | Other |
|--------------------|---------------|----------|----------|-----------|
| Admissions | 85.7% (30) | 8.6% (3) | 0% (0) | 5.8% (2) |
| Registration | 85.7% (30) | 8.6% (3) | 0% (0) | 5.8% (2) |
| Financial Services | 85.7% (30) | 5.7% (2) | 2.9% (1) | 5.8% (2) |
| Computer services | 80.0% (28) | 2.9% (1) | 2.9% (1) | 14.3% (5) |
| Physical plant | 80.0% (28) | 2.9% (1) | 2.9% (1) | 14.3% (5) |
| Audio-Visual | 80.0% (28) | 2.9% (1) | 5.7% (2) | 8.6% (3) |
| Library | 85.7% (30) | 2.9% (1) | 2.9% (1) | 8.6% (3) |

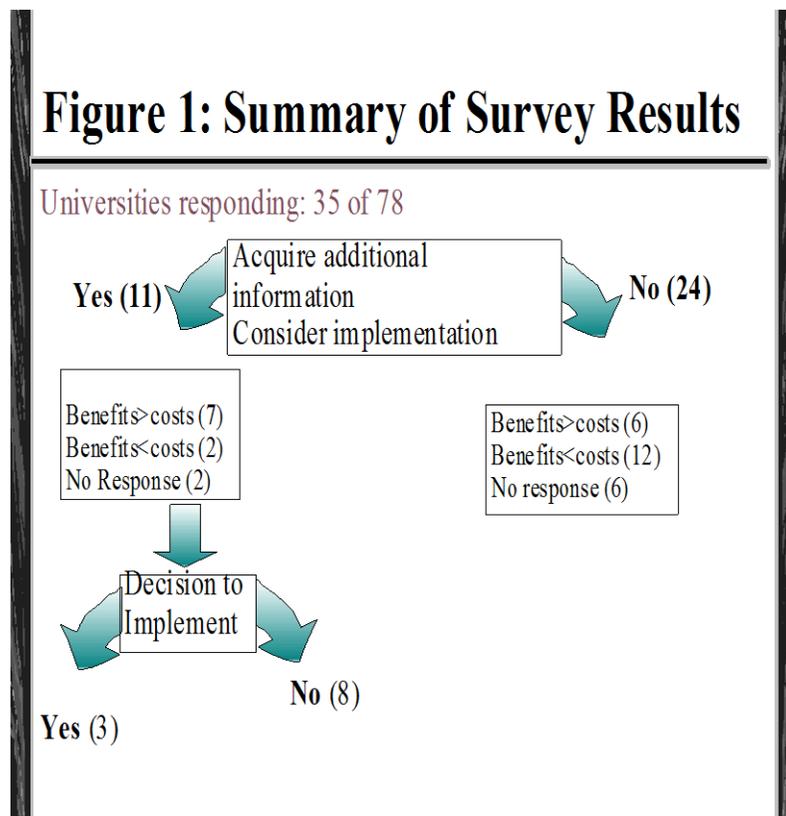
III. The Pattern of Diffusion

Why is ABC being used at only a couple of Canadian universities? Real fixed capital investment theory suggests a number of possible explanations. First, the key decision-makers may not be familiar with ABC and consequently continue to use traditional accounting methods. The acquisition of information about new technology is a costly activity and is appropriately considered an investment, since returns accrue in the future. Second, it is possible that most university business officers have concluded (based on either a serious review of ABC or simply a "gut" reaction) that the present value of expected costs of ABC exceed the discounted value of expected benefits. Third, key decision-makers may have concluded that the present value of expected benefits outweighs expected costs but choose to delay the implementation decision, since postponement allows the decision maker to accumulate additional information or take advantage of potential declines in the cost of software or consulting services. Postponement is a critical component of the new theory of investment (Dixit and Pindyck(1994)) since postponement is considered to be equivalent to the purchase of an asset. Like the purchase of a financial call option, postponement gives the firm the option of investing in the future. Consequently, in the new theory of investment a positive net present value is a necessary but not sufficient basis for an investment decision and the formal theory of option pricing developed in finance acquires a role in real capital budgeting. Finally, organizational impediments - "political factors", aversion to borrowing, inability to treat expenditures on ABC as a capital investment- may make it impossible to consider implementation of ABC.

Our survey of university business officers provides enough information to allow us to begin isolating each of the possible explanations for the slow diffusion of ABC in the Canadian university sector. Figure 1 visually presents some of the key results of our survey in a very simple and intuitive way (the model could also be presented using conditional probability statements) and provides information which allows us to begin exploring the four possible explanations.

Our approach begins by separating respondents into two subsets: those knowledgeable about ABC and those without the knowledge required to make a rational investment decision. A large number of universities did not have sufficient information to make a rational decision re:investment in ABC. Indeed, fifteen of the thirty two responding to a direct question (approximately 47%) indicated this directly by stating that a lack of knowledge of ABC was an

important or very important factor in their decision not to implement an ABC system. Given that respondents to mail surveys are often unwilling to admit ignorance, this is a very large proportion of the sample. Answers to another question - which asked respondents to estimate the cost of implementing an ABC system - clearly indicated that four additional respondents who claimed to be knowledgeable did not have enough knowledge of ABC to arrive at a cost estimate in the same ball park as a reasonable estimate of actual cost. A third question - which asked respondents if they had seriously considered adopting ABC - reveals that only eleven financial officers claim that their university seriously considered ABC. Thus, we can conclude that 60% or more of universities which did not adopt ABC failed to do so because they had insufficient knowledge, and incomplete information is the most important explanation for the low rate of diffusion of ABC at Canadian universities. Note that our conclusion is not that the benefits of ABC exceed costs or that these universities should have adopted ABC. Our conclusions focus exclusively on the reasons for the slow rate of diffusion of ABC.



The remaining three explanations assume that the decision-maker is knowledgeable; so we restrict our attention to the set of knowledgeable decision-makers. We assume that the eleven respondents who seriously considered adopting ABC are the "knowledgeable" decision makers. Of these, seven indicated that the net present value of benefits exceeded the net present value of costs. Only two respondents indicated that costs exceeded benefits. We interpret this as very strong evidence against the conclusion that the slow rate of diffusion of ABC in the university sector is due to expected costs exceeding benefits. In other words, most knowledgeable decision-makers believe that ABC has a positive pay-off.

However, fewer than 50% of those concluding that ABC has a positive pay-off actually decided to implement ABC. Consequently, it is possible to conclude that although most "knowledgeable" decision-makers believe ABC offers net benefits, either uncertainty about future costs and benefits leads them to choose the option of investing in the future rather than today or personal or organizational impediments interfere with implementation. Respondents to our survey indicated that internal political difficulties and aversion to borrowing were the two most important organizational impediments to implementation. Political difficulties clearly emerged as the most important organizational impediment to implementation for respondents as

a whole, with 19 of 28 (or 68%) responding to our question claiming that these are either an important or very important impediment to implementation. But among those who seriously considered implementing ABC, only 44% considered political difficulties to be an important or very important factor and only two respondents identified political difficulties as the decisive factor in their decision not to move to implementation. In answers to an open-ended question these respondents indicated that they were unable to convince other senior management that ABC was a worthwhile investment. Three other respondents noted that they have not moved to implementation because neither they nor their staff have the time to devote to the project. With well functioning capital markets staff time should not be an issue, since an organization which believes the present value of expected benefits exceeds costs can borrow to hire staff needed and still earn a return sufficient to yield net benefits. Our survey contained two questions on capital market imperfections. 50% of respondents who seriously considered ABC considered aversion to borrowing to be an important or very important factor, and 31% consider an inability to treat initial cost as a capital expenditure an important or very important factor.

Given that lack of information, negative assessments of NPVs, and organizational impediments explain most of the slow rate of diffusion of ABC in the Canadian university sector, we can conclude that postponement based on the value of the option to invest is not a major factor.

IV. The Optimal Rate of Diffusion

The conventional theory of general equilibrium welfare economics suggests that decentralized investment decisions in an environment where organizations are price takers, where markets for risks are complete, where all information is evenly distributed among decision-making units, and where there are no public goods or externalities will generate an efficient outcome. This conclusion continues to hold in the new theory of investment (see Dixit and Pindyck(1994, Chapter 9). Thus, there is no need for any intervention by a governing body—be it the government, the CICA, or CAUBO—to regulate investment decisions. Indeed, intervention will result in worse outcomes since regulation (such as a requirement that all universities adopt ABC) will result in some organizations adopting the new technique when there are no net benefits from doing so.

Our research suggests that the strong information assumption required for this conclusion does not hold. University business officers do not possess the information required to make rational investment decisions. Thus, there may be a scope for intervention by a governing body. The example provided by the one university—the University of Sherbrooke—which has implemented a full ABC system shows that the technique holds more promise than generally supposed by the university officials. Indeed, University of Sherbrooke officials claim that their investment in ABC had a very short pay-back period.¹ One area which offered significant gains at the University of Sherbrooke was in space allocation. Sherbrooke faced a serious space problem in its library system. Two options were available: expand the library by constructing a new facility or reallocate space within the system. It was known that one division possessed a library which was under-utilized and more efficient utilization of this space could solve the space problem. However, the faculty involved worked hard at the University Senate to protect its space and rational reallocation was politically impossible. However, with the implementation of an ABC system which allocated library costs to the division involved, university officials were able to point out the very high cost per student in that faculty. Political

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¹Our information on the University of Sherbrooke was collected during a visit to the University and a presentation by the University of Sherbrooke during a CAUBO conference.

support for the division waned and the faculty voluntarily decided to share its facility. The resources saved may well have been sufficient to cover the costs of implementing the ABC system.

Because the primary problem identified in our research is information, it is possible to conclude that governing bodies can improve the allocation of resources by disseminating general information about the new technology. In other words, there is an important educational role for these agencies, but our research does not provide arguments to support a regulatory role for governing bodies.

CAUBO, the CICA, and other professional accounting organizations have taken their educational role seriously. They have made available a significant supply of easily accessible information on ABC methods to university business officers to supplement the large technical and academic literatures. In particular, CAUBO and professional accounting organizations have made ABC a subject of conference sessions and of numerous articles published in the professional periodicals. Because information is available there appears to be a problem on the demand side of the equation; the potential users of the information are not taking advantage of its availability. In future work, we plan to explore the demand side in more detail focusing on the role of factors such as motivation, incentives and institutional constraints in the diffusion of information about ABC.

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