Simulation: A tool to link Activity-Based Analyses and Strategic Decisions

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Abstract – An activity-based analysis can provide meaningful and relevant information that could improve the quality of strategic decisions. However, because of the long-term impacts that accompany strategic decisions and the associated costs and benefits, some of which are difficult to quantify, and because of the static nature of an activity-based analysis using financial tools alone is unsuitable. A simulation based decision support system (DSS) along with an activity-based analysis could enhance the quality of strategic decisions made in an organisation. In this paper I propose a conceptual framework for such a DSS

INTRODUCTION

In a highly globally competitive environment the factors that are critical for success are innovation, speed to market, service, marketing, efficient processes, and lower costs, to name a few. To harness these factors organisations require relevant, accurate, and timely information, and need to plan and manage strategically. To also be effective players in this environment organisations have had to re-think and re-structure their organisations and processes.

> *"...ABC by itself provides no benefits; ABC is only a tool – a tool for strategic and operating changes. The information ABC provides is a great catalyst for change. The benefits of ABC are in the actions taken from the information ABC supplies."* (O'Guin [1991], pp. 76-77)

This quotation supports the view that if the right decisions are not taken the information generated by an ABC system will not of itself generate any benefits. Strategic decisions are long term decisions, whose benefits/costs are not all immediately visible. Further organisations will not change their business, pricing, manufacturing, or distribution strategies from year to year. Therefore a decision support system that enhances management's ability to make 'correct' decisions with the information generated by an ABC system will be a useful tool.

The main point of this paper is that if an activity-based analysis is used to provide relevant information for strategic planning or strategic decision-making, it would seem prudent to develop a decision support system (DSS) that would assist the decision-maker with understanding the complex interrelationships that ensue between the strategic decision and the activities over the long term. Since some of these interrelationships can be quite complex and non-quantifiable, I suggest that simulation will be a useful tool to model the DSS.

The paper begins by providing an overview of how activity-based information has been used and its relevance for strategic planning and management. The next section presents arguments for why simulation would be a useful tool for linking an activity-based analysis with strategic decisions made on the basis of an activity study. The last two sections explain the conceptual framework for a simulation based decision support system for an activity-based study and strategic decision-making, and an illustration of how this could work in an academic unit in higher education.

ACTIVITY-BASED COSTING AND ITS USES

Activity based costing generates a range of information that can be used for strategic and operational decision-making. Cokins (1996) provides a classification of the various strategic and operational uses of activity based cost information. Table I contains these classifications.

Various studies have demonstrated how an Activity-Based study can be used. A range of case studies illustrate how ABC has been applied to identify profitable customers and products, to identify and eliminate non-value added products

and processes, to cost products and processes and for budgeting (Kaplan and Cooper [1998]; O'Guin [1991]; Cooper et al [1992]. Other studies describe how ABC has been used for capital budgeting (Coburn et. al. [1997]); strategic cost management (Wong [1996]) and accounting for scrap (Healy & Stephans [1999]).

Table 1

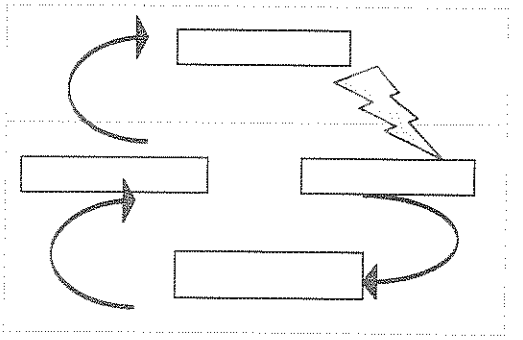
Strategic Application	Operational Applications
Order Quotations (pricing)	Business Process/Activity Value Analysis.
Product Profitability Analysis	Cost-of Quality Analysis
Customer Profitability Analysis	Cost Driver Analysis (Unit Costs Outputs)
Capital Expenditure Justifications/Capital Budgeting	Make-or-Buy Analysis
Performance Measurements	Business Process Re-engineering
Target Costing	Bench Marking
Life-Cycle Costing	Activity-Based Budgeting
	Unused Capacity Analysis

ACTIVITY BASED ANALYSIS AND STRATEGIC PLANNING/MANAGEMENT

The strategy of an organisation can be defined as the alignment of long-term goals and paths of action of an organisation, so as to achieve an efficient allocation of resources. A strategy is created because a working organisation cannot be one hundred percent flexible and turn around instantly. It needs some long-term framework with targets and alternative outcomes, within which to manoeuvre its operations. Two main reasons make it difficult for an organisation to turn around instantly. Firstly resources available to an organisation are limited. Second, there are costs involved at two stages. On the one hand there are the direct costs associated with acquiring the resources to undertake a particular strategy and the opportunity costs of foregoing an alternative use of the resources. On the other hand there are the costs of withdrawing resources (wastage of resources) once they are committed to achieving a strategy, if one wishes to discard the existing path of action and proceed with another. Figure 1 illustrates how decisions influence activities, which in turn result in an organisation consuming resources and incurring costs. The analysis of the costs and activities feed in to influence decision-making. In the literature on activity-based methodology, activities are depicted as affecting resource consumption and costs. The representation in figure 1 extends this by explicitly incorporating the influence of decisions on activities, resources and costs; the explicit consideration of decisions in the analysis is a vital component in assessing the viability of strategic decisions.

An activity-based analysis is a useful tool to aid strategic planning, strategic decision-making and management (O'Guin [1991]; Kaplan & Cooper [1998]; Wong [1996]). An activity-based analysis enables an organisation to identify distortions in costs and areas where resources may be misallocated. It also generates more relevant financial information for use in traditional tools that are used for analysing a strategy – NPV, ROI, SHV, Strategy Portfolio analysis.

Figure 1



Shortcomings of an Activity-Based Methodology for Strategic Decision-Making

An activity-based analysis on its own has several shortcomings for purposes of strategic planning and decision making. Firstly, the methodology uses a static framework for analysis; it provides analysis at a particular point in time and it relies on past information for its analysis. It limits the quality of strategic decision-making by users of activity-based information. While the use of historical information is useful and a necessary aspect of determining goals and plans for the future – we can learn from the past - strategic planning using ABC information also requires some idea of how actions performed in the future will affect the expenditure, activities and resources of the organisation. One way with which to deal with problems associated with the use of past information is to use budgeted financial data. (Kaplan and Cooper [1998])

Second, the decisions taken are not explicitly incorporated in the analysis. Once an activity analysis is conducted and strategic decisions are taken in response to the results of the analysis, the impact of the decisions on the activities and expenses are unknown, until another activity

analysis is undertaken to assess the outcomes of the decisions. In this sense the decision process is external from the information analysis and outcomes of the model. The interactions between the strategic decisions taken and the activities performed can be quite complex. Although in an activity-based analysis the costs are causally linked to activities the flow-on longer-term effects from decisions and actions are not integrated in the analysis. This is particularly relevant for strategic decisions, because decisions made in the present have an impact on activities performed by the organisation both in the present and the future. There are costs and benefits that continue to flow on from these decisions.

Third, many activity-based systems are PC based and not integrated with the other systems of the organisation. With the introduction of Enterprise Wide Systems (EWS) like SAP, which incorporate activity-based modules in their software the issue of integrating systems across the organisation will be addressed. However, from informal discussions with organisations implementing EWSs like SAP, two limitations appear to be prevalent. First because the task of implementing an EWS is quite considerable and requires a great deal of adaptation, resources and training on the part of the organisation, in the initial stages of using an EWS an organisation is loathe to also attempt to incorporate an activity-based analysis. Second, EWSs are not particularly advanced for modelling strategic planning and management decisions.

Shortcomings Traditional Financial Tools To Aid Strategic Decision-Making:

Of their own the traditional tools such as NPV and ROI and the various strategy portfolio models which are used to assess strategic decisions also have their limitations. These measures give single values and provide a static analysis of the strategy. A static analysis alone is unsuitable for assessing strategic plans, because as explained above not all the costs and benefits that flow as a result of the strategic decision may be evident until sometime into the future. There are lags associated with a strategic decision and its outcomes, and the risks and uncertainties associated with the long-term nature of the decisions. Furthermore these traditional tools for assessing strategic plans do not incorporate behavioural aspects associated with strategic decision-making.

SIMULATION – A TOOL TO LINK AN ACTIVITY-BASED ANALYSIS AND STRATEGIC DECISION MAKING

Simulation is a useful tool for using to model complex situations, particular where there are several interactions across different components, and situations that cannot be adequately explained with mathematical formulae (Pidd [1992]). In the literature, simulation has been used to model decision support systems (DSS). Among the DSSs discussed are systems that would assist the strategic planner to assess the longer term impacts of investing in Advanced Manufacturing Technologies (AMT) (Kassicieh et al, [1993]), and systems to model the link between decision making, planning and the outputs in flexible manufacturing systems (Lozano et al [1999]; Young [1993]). These studies have included activity-based cost module as a component in the models.

Combining simulation with an ABC and strategy model would enhance the decision making of users for the following reasons. Strategic decisions and plans are long-range in nature and the outcomes of the plans manifest in the future. These strategic decisions made in the past create phases of stagnation and propulsion in an organisation overtime, which in turn create a unique pattern of investments and activities in a business. These patterns of investments and activities can be identified, analysed and modified (Segev [1995]). Because the nature of strategic management and planning is such that often the costs and benefits are not readily apparent at the time of making the decisions. There are risks associated with this uncertainty. Combining simulation with an activity based analysis and the traditional financial measures for strategic planning may assist users with making more effective strategic decisions. Simulation will allow cost estimates and cash flows to be constructed under a variety of sales scenarios (O'Guin [1991]). Other financial data which are essential to strategic planning but not part of the current cost management system can be incorporated, these include the opportunity costs of assets, the contingency costs, the tax effects of any alternatives, net changes in investment - inventory, receivables or installing new machines. Other non-financial factors that are external to the organisation and/or behavioural in nature – increased competitiveness, changed market perception of an organisation - have an impact on decisions and longer-term plans which is hard to quantify. These have to be addressed by other subjective techniques like simulation.

The individual strategic plans for aspects or business units of an organisation are components of the whole strategic plan for the organisation. The individual plans need to be combined in a way that produces the best synergistic benefit for the organisation as a whole (Segev [1995]). Simulation can help with providing a total systems view for strategic planning. Because simulation will enable the study of alternative strategic plans and actions before they are actually implemented,

simulation can help to integrate decisions and outcomes. The risks associated with changing a company's strategy may be easier to minimise. Finally, simulation is a very suitable and cost efficient alternative to implementing pilot projects. Pilot projects take time and effort. Using simulation to aid analysis could reduce the costs associated with analyzing and assessing the viability of strategic projects.

CONCEPTUAL FRAMEWORK FOR DSS LINKING ACTIVITY-BASED ANALYSES AND STRATEGIC DECISION-MAKING

A conceptual framework for a decision support system that would explicitly link decisions as part of the ABC and Strategic decisions making process.

The decision support system consists of an Activity-Based module, an output/analysis module and a Strategic Decision module and a simulation module – Diagrams 2 & 3.in Appendix A

The Activity-Based Module:

This will use the activity-based methodology to calculate or forecast costs of a particular plan or course of action, to identify value-added processes and activities for the whole organisation. Activity based costing uses activities performed as a basis for allocating costs to outputs of the organisation. Because of its use of activities to allocate overhead costs the costs are more accurate and representative of the factors that cause the costs to be incurred. In this way it differs from traditional cost accounting which lumps overhead costs into a single pool and uses a fixed percentage that is related to labour or volume to allocate costs. Using activity based costing projected financial statements can be prepared for the proposed strategic plan.

The Output/Analysis Module

Following each simulation the outputs of the activity-based module, and other financial information are fed into the output/analysis module and analysed. Examples of analysis that could be carried out include customer profitability analysis, performance measures such as shareholder value, NPV and ROI.

Decision Module

The decision module receives information from the output/analysis module as a result of each simulation run. The decision-maker compares this information against desired outcomes and the organisation's desired goals. If the outcomes are suitable the plan is implemented otherwise the alternative decisions are iterated through the simulation module yet again.

The Simulation Module:

The various decisions from the decision module, the activity-based information, and other external, behavioural and intangible factors are fed into the simulation module. Diagram 3 below, illustrates how each decision impacts on a variety of activities $\{A_1.....A_n\}$ and activity drivers $\{d_1.....d_n\}$ which are quantifiable measures of the activities. The impacts of individual decisions on activities and processes of the organisation and the effects of other external and behavioural factors are simulated and fed back into the output/analysis module and then on to the decision module for the decision maker to use the information.

Illustrating the Simulation and Activity-Based Decision Support System

Figure 4 (Appendix B) uses an academic unit to illustrate the conceptual framework discussed above. For purposes of illustration the strategic decision facing the unit is whether to increase of decrease the number of overseas students and by what percentage. To obtain an accurate estimate of future costs and cash flows the unit conducts an activity-based analysis. The information generated by an activity-based analysis along with other financial (forecasts of revenues) and non-financial information (e.g. demand for higher education by country, supply of higher education by country, skill levels of prospective students) are used to make a decision. To understand the longer term impacts of the decision the simulation module is run and the outcomes of the different decisions are then compared against performance measures to assist with making the final decision. Drawing on the conceptual framework illustrated in diagram 3 above, the decision to increase the intake of overseas students will may trigger the activities like marketing in international markets, support and induction services, which may by measured with the activity drivers number of media outlets and number of students respectively. Intangible costs and benefits like the flow-on benefits to the wider community may temper the final strategic decision to be implemented. A system of weights could be assigned to address the inclusion of difficult to quantify benefits and costs the flow-on.

DICUSSION AND FURTHER RESEARCH

Simulation is a useful tool that could be combined with and activity-based analysis to assist with strategic decision-making. This is because the activity-based analyses are done at a particular point in time and the long-term nature of strategic decisions whose costs and benefits materialise in the future may not be readily apparent at the point of decision making. Exploring alternative scenarios associated with different decisions and

external and behavioural factors along with the financial and performance implications will be of significant benefit to the strategic decision maker.

The study can be developed by further research that incorporates alternative models of decision making and by carrying out empirical research on the experiences of organisations making strategic decisions.

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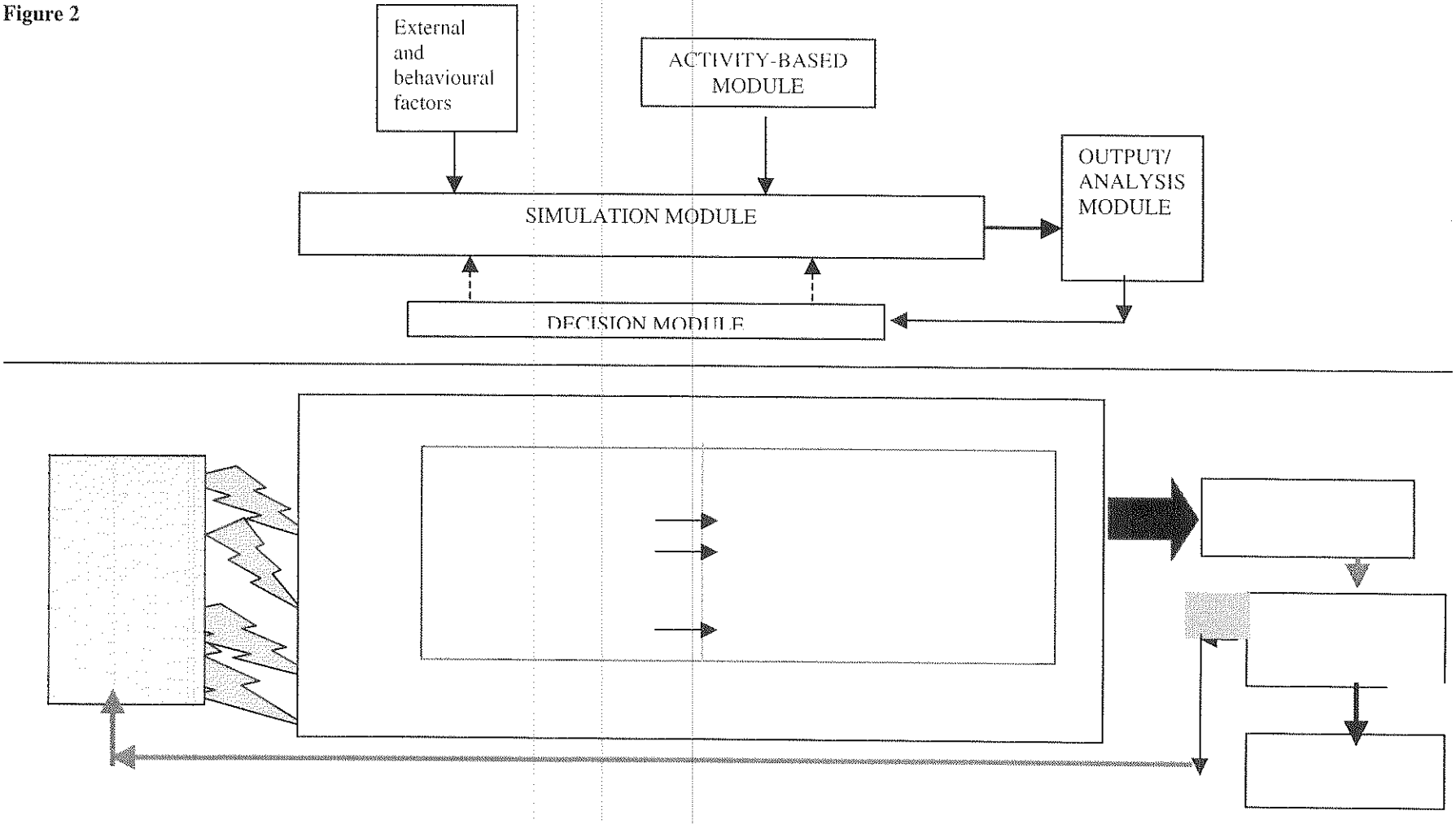
APPENDIX A

Figure 2



APPENDIX B

Figure 4

An Academic Unit – A Simulation Based Decision Support Systems for Activity Based Analysis and Strategic Decision-Making