



Theory of Constraints Activity-Based

and Costing:

Can we get the best of both worlds?

By Annabella Fu

C

ost accounting is “enemy number one of productivity”, claims Eliyahu Goldratt, creator of the Theory of Constraints (Noreen et al 1995, iii).

Goldratt argues that focusing on product cost cannot promote the global performance of a business. Indeed his books, including *The Goal*, aim to illustrate how his Theory of Constraints (TOC) can lead to dramatic improvement in both financial and operational performance without the use of product cost information.

Because the central premise of TOC is that a business’ goal is to “make more money now as well as in the future” (Goldratt 1990, 12), TOC gives primary importance to throughput, or “sales”, rather than expenses or inventory.

However, many businesses in manufacturing and service industries regularly use product cost information in their decision-making process. The use of activity-based costing (ABC) is shown to improve the quality of both strategic and operating decisions (e.g. see Swenson 1995).

Can these two apparently conflicting approaches – TOC and ABC – be combined to improve the financial and operational performance of businesses?

Studies have shown some remarkable improvements in performance after implementation of TOC (see Mabin and Balderstone, 1998). Similarly, numerous implementation studies (e.g. Kaplan 1989a and 1989b) have shown a growing, and successful, use of ABC.

Both philosophies contain compelling arguments for their adoption and the possibility of integrating TOC and ABC into a single system containing the strengths of each is very attractive.

To analyse the possible integration of the two philosophies, it is important to understand the ideas behind them, their relevance to businesses and the main areas of contention between them. ▶



Theory of Constraints

Goldratt and Cox (1986) first popularised TOC whose primary performance measure is throughput per constraint unit. TOC focuses on improving throughput by managing bottlenecks or constraints in the system.

The TOC philosophy is built on the premise that every organisation faces at least one constraint. A constraint is anything that limits the performance of a system relative to its goals. The constraint is the focal point because improvements in non-constraints do not translate to improvements in the whole system.

TOC provides five focusing steps for managing constraints:

- Identify the system's constraints.
- Exploit the system's constraints.
- Subordinate everything else to the above decision.
- Elevate the system's constraints.
- Go back to Step 1.

As a company's goal is to make more money now as well as in the future, measurements must directly relate to money (Goldratt 1992, 41). Goldratt proposes three measurements to evaluate whether a company is achieving this goal. These are:

- Throughput ("the rate at which the system generates money through sales") represents sales revenue less direct materials.
- Inventory ("all the money that the system invests in purchasing things which it intends to sell") is defined as including plant and building.
- Operating expense ("all the money the system spends in order to turn inventory into throughput") (Goldratt 1992, 42) covers all costs of conversion. No attempt is made to allocate these expenses to products.

Goldratt claims that conventional cost accounting focuses on operating expenses and places little emphasis on throughput. He advocates a new importance ranking and reasons that both inventory and operating expense reductions present only limited opportunities for ongoing improvement as they are inherently limited by zero.

An important performance measure under TOC is throughput per constraint unit (e.g. throughput per machine minute, if machine time is the constraint).

Goldratt maintains that throughput is the most important measure because it can, in concept, be increased without limit. Inventory should be ranked second in importance and operating expenses only as a close third (Goldratt 1992, 52).

Over the years, TOC has developed from a production scheduling tool into a "management philosophy", incorporating the TOC Thinking Processes that allow users to develop solutions to complex problems.

Goldratt's TOC has expanded from the job shop setting (Goldratt and Cox 1986) to marketing (Goldratt 1994) and project management (Goldratt 1997). Substantial reductions in lead times, cycle times and inventory levels, and significant improvement in due-date performance and throughput have been reported by users (Mabin and Balderstone 1998).

TO SUMMARISE, TOC:

- Manages constraints through the five focusing steps.
- Focuses on throughput, which is sales revenue less direct materials.
- Does not allocate operating expenses to products.
- Uses throughput per constraint unit as a major performance measure.

Activity-Based Costing

CAM-I (Consortium for Advanced Manufacturing – International) defines ABC as a method which recognises the causal relationship of cost drivers to cost activities by measuring the cost and performance of process-related activities and cost objects. Costs are assigned to activities based on their use of resources, then assigned to cost objects (i.e. the objects we want to calculate the costs for) based on their use of activities (Raffish and Turney 1991).

ABC is designed to remove distortions in product costs caused by allocating manufacturing overhead over a single overhead allocation base, such as direct labour hours (Anderson 1995, 14).

ABC establishes costs pools that are each homogeneous, in that each of them is caused by a single driver. Resource drivers assign resources to activities and activity drivers measure the demands placed on activities by cost objects.

Figure 1 illustrates the relationship between resources, activities and cost objects:

ABC assigns costs on the basis of the hierarchical level at which the costs are incurred in the production process. The standard case includes four levels: unit-level, batch-level, product-sustaining, and facility-sustaining.

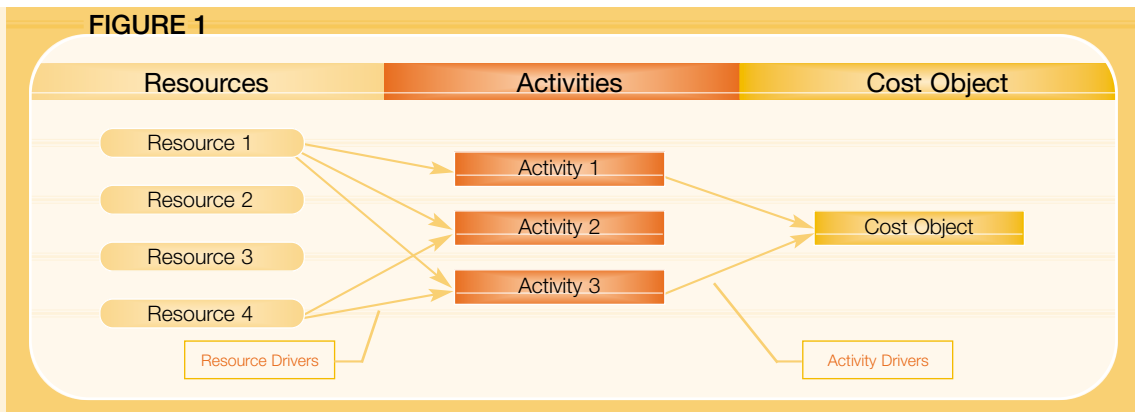
The use of multiple drivers and cost hierarchies enables ABC to more accurately model the relationship between resources used by activities and cost objects.

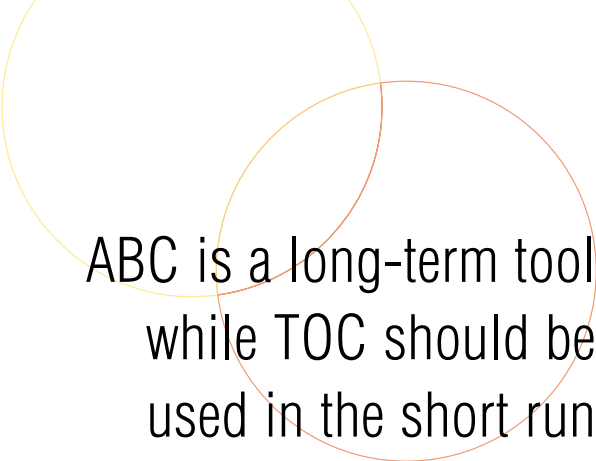
ABC models resource consumption, rather than resource spending. This means that ABC estimates the cost of resources used in organisational processes to produce outputs. Where resources are acquired as needed, the cost of resources supplied would generally equal the cost of resources used.

However, organisations may acquire resources that are supplied in advance of usage. Consequently, the expenses of supplying the service capacity from these resources are incurred independent of usage (Cooper and Kaplan 1992, 5).

While the cost of acquiring the resources may be fixed in the short run, the quantity of resources used each period fluctuates according to the activities performed for the outputs produced. Any resource acquired that is not consumed is classified as unused capacity.

Two conditions favour the adoption of ABC systems: a relatively high proportion of overhead in the firm's cost structure (Cooper 1992) and high diversity or complexity in organisational processes or products. ▶





ABC is a long-term tool while TOC should be used in the short run

ABC is not just a product-costing tool. For example, Swenson (1995) reports the use of ABC in strategic decision making (such as sourcing, pricing and product mix decisions) as well as operating decisions (such as process improvement and product design). It is also sometimes incorporated into firms' performance measurement systems.

SO ABC:

- Models the consumption of resources.
- Refines product cost calculation by the use of multiple-cost pools and drivers.
- Can play a role in strategic decision making.

TWO MAJOR POINTS OF CONTENTION

Goldratt argues that cost allocation and the common practice of adding overhead into stock as goods are produced, irrespective of whether they have been sold, can encourage sub-optimal behaviour. TOC does not seek to achieve the local optima, because it argues that global performance is not merely a sum of local performance.

This focus on global performance is different from ABC, as ABC has no mechanism to link the various cost pools to ensure global optima is achieved. Therefore, cost reduction can be achieved for one cost pool at the expense of other cost pools or other concerns such as quality.

This is an example of what Goldratt regards as “cost world thinking”, which, he claims, can lead to a declining spiral of cost cutting, falling output and more cost cutting.

TOC concentrates on maximising throughput, which can, in principle, be increased without limit. Product costing is seen as being unnecessary and artificial.

ABC, on the other hand, advocates the calculation of a more accurate product cost to improve decision making. Cost control is a main theme of ABC. It is not limited to product costing, however. It has strategic relevance because it allows a better

understanding of the activities and their resource consumption in a business.

As we can see, TOC and ABC appear contradictory. But both have been shown to improve performance of businesses.

As we are always searching for ways to improve a business' operational and financial performance, the possibility of combining TOC and ABC to reap the benefits of each is attractive.

REVIEW OF RECONCILIATION AND INTEGRATION STUDIES

A number of studies have been done on how ABC and TOC can be reconciled and integrated. These can be classified into two main groups.

The first argues that the difference between ABC and TOC lies in their respective time horizons – ABC is a long-term tool while TOC should be used in the short run.

The second group maintains that ABC and TOC can be integrated to make particular decisions.

SHORT-TERM VERSUS LONG-TERM DECISION MAKING

The first group of studies argues that TOC and ABC can be used in an organisation to make decisions with different time horizons.

TOC is more appropriate as a short-term tool as it assumes that all costs apart from direct materials are fixed. Therefore, it offers little help in long-term strategic decision making.

As ABC is a resource consumption model, in the short run changes in consumption do not translate to changes in spending, i.e. real cash savings are not made in the short run. Therefore, ABC is more suitable for long-term decision making.

These studies are summarised in **Table 1**.

TABLE 1

Study	Findings
Campbell (1992)	<ul style="list-style-type: none"> ❖ ABC can provide cost information on activities and TOC can provide management with direction by focusing on constraints. ❖ Product mix decisions should be made on the basis of throughput per bottleneck resource usage, adjusted for any ABC costs that represent a change in cashflow. ❖ In the short run, these ABC cost adjustments would be unlikely because product mix changes do not necessarily impact on actual costs in the short run.
MacArthur (1993)	<ul style="list-style-type: none"> ❖ ABC is useful in estimating long-term product costs and TOC is more appropriate as a short-term measure. ❖ ABC can complement TOC in areas of long-run pricing, profit planning, capacity management, etc, with its long-run emphasis.
Holmen (1995)	<ul style="list-style-type: none"> ❖ Examines the assumptions behind ABC and TOC and concludes that ABC is intended primarily as a long-term tool while TOC is useful in the short run. ❖ Leaves open the question “when does a TOC approach become invalid and ABC become the correct methodology?”
Fritzsich (1997)	<ul style="list-style-type: none"> ❖ ABC and TOC are based on opposing views of the nature of product cost – ABC assumes all costs to vary in proportion to cost drivers whereas TOC assumes all costs to be sunk (or fixed) with respect to product choice and production level decisions. ❖ Therefore, ABC approximates the long-run situation and TOC corresponds to a very short-run situation. ❖ Concludes that we should use TOC for short-term decisions, ABC for long-term decisions and direct costing for decisions that are neither short-run nor long-run.

INTEGRATION OF ABC AND TOC TO MAKE PARTICULAR DECISIONS

This second group of studies argues that ABC and TOC can be combined for the purpose of making particular types of decisions. These studies are summarised in Table 2.

CAN WE GET THE BEST OF BOTH WORLDS?

Here we look at whether the studies outlined above are successful in fully integrating TOC and ABC so we can reap the benefits of both approaches.

The first group of studies suggests that ABC and TOC are only different in terms of their time horizons.

ABC is a long-term tool because it assumes all costs are variable and TOC is a short-term tool because it assumes everything except direct materials is fixed.

This line of thinking has a number of problems. First, ABC and TOC are not different only in terms of their time horizons. To simply label TOC as a short-term tool and ABC a long-term measure is to neglect the full implications of these two approaches.

TOC is more a management philosophy than a marginal costing technique. It argues that product costing is an unnatural way of breaking up total costs and only helps promote the local optima, not the overall goal of the business. It is important to recognise TOC as a way of thinking, not an alternative product costing method.

Similarly, ABC allows better understanding of organisational processes and control of drivers of costs and activities. ABC should also be recognised as a management philosophy, rather than just a product-costing technique. Their difference is more deep-rooted than their differences in time horizons.

Second, the distinction between the short run and the long run is not clear cut in reality. It is difficult to label any period as the short run or the long run, or any kind of decision as a short-run decision or a long-run decision. ▶

TABLE 2

Product mix and pricing decisions

Spoeede et al (1994)	<ul style="list-style-type: none"> ❖ The real potential of ABC is its ability to generate the data necessary to support the TOC management process. ❖ ABC provides details of capacities available and processing times required. ❖ This data can be used to solve product mix decisions according to TOC by recognising constraints as throughput per constraining factor. ❖ Result shows the use of both ABC and TOC improves the quality of product mix decisions.
Kee (1995)	<ul style="list-style-type: none"> ❖ Uses mixed-integer programming, a mathematical model, to integrate ABC and TOC to reach the optimal product mix. ❖ The model can explicitly recognise the capacity of production activities and identify constraints and non-constraints. ❖ The result shows that the integrated model yields substantially higher income than the ABC-only model and a slightly higher income than the TOC-only model.
Campbell et al (1997)	<ul style="list-style-type: none"> ❖ The decision to use ABC or TOC should be made on a department-by-department basis rather than a company-wide basis. ❖ ABC should be used in people-intensive departments and TOC in machine-intensive departments.
Hall et al (1997)	<ul style="list-style-type: none"> ❖ Proposes a tool called constraint-based profitability analysis (CBPA) which combines ABC and TOC to solve the optimal product mix. ❖ ABC profit per unit for various types of products is translated into profit per hour across a constraint process. ❖ The product with the highest profit per hour receives first priority for the bottleneck processes. ❖ A case study is reported with a company using CBPA experiencing a 20 per cent improvement in operating income.
Baxendale and Gupta (1998)	<ul style="list-style-type: none"> ❖ ABC information on unused capacity can be used to identify constraints – an activity with zero unused capacity is a constraint. ❖ Uses a custom screen printing business to illustrate the application of the five focusing steps. ❖ TOC will then aid in the management of these constraints.
Demmy and Talbott (1998)	<ul style="list-style-type: none"> ❖ A combined approach helps discover products that are being mis-priced. ❖ ABC is used to allocate only the indirect fixed costs to cost objects. ❖ Suggests that this approach requires less effort than a traditional ABC implementation and provides more information than the standard TOC approach.

Cycle time reduction decisions

Campbell (1995)	<ul style="list-style-type: none"> ❖ Reports a steel service centre using a pricing model that combines elements of both ABC and TOC to trim cycle time. ❖ ABC is used to calculate costs associated with cycle time. ❖ TOC will direct cycle time reduction efforts to constrained processes.
-----------------	---

Process engineering

Salafatinos (1995)	<ul style="list-style-type: none"> ❖ Use of activity mapping to identify constraints by employing the techniques of Gantt chart and dependency grid. ❖ Suggests that a bottleneck occurs where demand on a set of activities exceeds the capacity of that set of activities to support the demand. ❖ Argues that a constraint is more likely to occur because of a complex web of connecting activities rather than a single activity. ❖ Activity mapping also assists in finding out causes of constraints and ways to elevate them.
Buchwald (1996)	<ul style="list-style-type: none"> ❖ Reports how a Fortune 150 company combines TOC and ABC to support process re-engineering. ❖ “Activity Based Business Diagnostics”, combining activity management and constraints management, enhances the understanding of inter-relationships of the activities and helps prioritise re-engineering efforts.
Gupta et al (1997)	<ul style="list-style-type: none"> ❖ Uses the example of a healthcare company to illustrate how the use of ABC together with TOC creates an environment of continuous process improvement.

Departments now have two sets of vocabularies, one of “throughput” and one of “costs”

Arguably, any changes made in the short run would have implications for the long run as they contribute to the long-run survival and profitability of a business.

Third, it is difficult to incorporate ABC and TOC in their entirety in one organisation to make various decisions. This line of research seldom operationalises the idea of integration. All of the studies in this area leave open the question of “when does a TOC approach become invalid and ABC become the ‘correct methodology’?” (Holmen 1995).

There would be the problem with drawing a line between short-run and long-run decisions. There would also be co-ordination and communication problems, as departments now have two sets of vocabularies, one of “throughput” and one of “costs”.

Fourth, there may be a conflict of goals and performance measures, as measurements used by ABC and TOC are different.

Many of the studies in the second group choose particular aspects of ABC and TOC to form a new system. A common combination is to use ABC information and TOC’s notion of constraints. This is a good suggestion as it is relatively easy to operationalise. Such integration also minimises co-ordination and conflicts.

The main issue with such integration is that it ignores important features of either ABC or TOC. For example, only incorporating the notion of constraints into ABC ignores TOC’s unfavourable view of product costing. It also ignores the fact that much of the power of TOC lies in its ability to influence thinking and behaviour.

TOC’s focus on the global optima is in direct conflict with ABC’s use of separate cost pools.

Other studies in this group combine ABC and TOC differently. Campbell et al (1997) argues that ABC and TOC should be adopted on a department-by-department basis. A distinction is made between people-intensive and machine-intensive departments.

This may create communication and co-ordination problems and it ignores interaction between departments. Also, it may not ensure that global interests, instead of departmental interests, are optimised.

Buchwald (1996) combines activity management and constraints management. Activity management helps us understand the inter-relationships among activities, and constraint management helps prioritise process re-engineering efforts.

This is different from the other studies as it does not incorporate activity costs in the system. This solves the difficulty TOC has with calculating product costs. The strength of this suggestion is the harmonious integration between the components.

In summary, this second group of studies operationalises the integration of ABC and TOC by incorporating only particular elements of each of the two approaches and for making particular types of decisions.

The main issue with this approach is the trade-off between the extent to which the two approaches are incorporated and the ease of integration.

For example, using activity analysis with TOC is conceptually more harmonious than applying TOC with ABC product-cost information.

Also, by narrowing the scope of integration to particular types of decisions, it is difficult to ascertain whether ABC and TOC can be integrated as a general management control system. ▶

CONCLUSION

This paper begins by explaining ABC and TOC and highlighting their main areas of contention. We see that TOC, with its focus on constraints, denies the need for product cost information. Studies have shown some remarkable improvements in performance after implementation of TOC.

At the same time, numerous ABC implementation studies (e.g. Kaplan 1989a and 1989b) have shown a growing, and successful, use of ABC.

Given these success stories, one would be tempted by claims that ABC and TOC can be integrated into one system, containing the strengths of each of ABC and TOC.

Studies on integration suggest some promising results, showing that a combined system is superior to using only ABC or TOC. As we have seen, however, there may be implementation difficulties to overcome.

With careful and proper design, these difficulties may be overcome to ensure that ABC and TOC are integrated in a synergetic way.

FURTHER READING

Goldratt and Cox's (1986) book is an excellent introduction to the basic ideas of the theory of constraints. Goldratt's other books are also highly readable and illuminating. Cooper and Kaplan's (1992) article is a useful source of information on activity-based costing.



Annabella Fu

POSTGRADUATE STUDENT

Department of Accounting and Finance
University of Auckland Business School
Email: bella@ihug.co.nz

REFERENCES

- Anderson, S. W. (1995). A framework for assessing cost management system changes: the case of activity based costing implementation at General Motors, 1986-1993. *Journal of Management Accounting Research* 7 Fall, 1-51.
- Baxendale, S., and Gupta, M. (1998). Aligning TOC and ABC for silkscreen printing. *Management Accounting (US)* 79(10), 39-44.
- Buchwald, S. (1996). How can the theory of constraints and activity-based management co-exist to support process engineering? A Case Study. *APICS (Australasia) 8th Conference Proceedings*, 19-21.
- Campbell, R. J. (1992). *Competitive cost-based pricing systems for modern manufacturing*. Quorum Books.
- Campbell, R. J. (1995). *Stealing time with ABC or TOC*. *Management Accounting (US)* 76(7), 31-36.
- Campbell, R., Brewer, P., and Mills, T. (1997). Designing an information system using activity-based costing and the theory of constraints. *Journal of Cost Management* 11(1), 16-26.
- Cooper, R. (1992). How activity-based cost systems help managers implement new strategic directions. *Advances in Management Accounting* 1, 81-95.
- Cooper, R., and Kaplan, R.S. (1992). Activity-based systems: measuring the costs of resource usage. *Accounting Horizons* September, 1-13.
- Demmy, S., and Talbott, J. (1998). Improve internal reporting with ABC and TOC. *Management Accounting (US)* 80, 18-24.
- Fritzsche, R. B. (1997). Activity-based costing and the theory of constraints: using time horizons to resolve two alternative concepts of product costs. *Journal of Applied Business Research* 14(1), 83-89.
- Goldratt, E. M. (1997). *Critical chain*. Great Barrington, MA The North River Press.
- Goldratt, E. M. (1994). *It's not luck*. Great Barrington, MA: North River Press.
- Goldratt, E. M. (1992). *From cost world to throughput world*. *Advances in Management Accounting* 1,35-53.
- Goldratt, E. M. (1990). *The haystack syndrome*. New York: North River Press.
- Goldratt, E. M., and Cox, J. (1986). *The goal: a process of ongoing improvement*. New York: North River Press.
- Gupta, M., Baxendale, S., and McNamara, K. (1997). Integrating TOC and ABCM in a health care company. *Journal of Cost Management* 11(7), 23-33.
- Hall, R., Galambos, N.P., and Karlsson, M. (1997). Constraint-based profitability analysis: stepping beyond the theory of constraints. *Journal of Cost Management* 11(7), 6-10.
- Holmen, J. S. (1995). ABC vs TOC: it's a matter of time. *Management Accounting (US)* January, 37-40.
- Kaplan, R. (1989a). John Deere Component Works. 9-187-107/8. Boston: Harvard Business School.
- Kaplan, R. (1989b). Kanthal. 9-190-002/3. Boston: Harvard Business School.
- Kee, R. (1995). Integrating activity-based costing with the theory of constraints to enhance production-related decision-making. *Accounting Horizons* 9(4) December, 48-61.
- Mabin, V., and Balderstone, S. (1998). A review of Goldratt's theory of constraints (TOC) – lessons from the international literature. Presentation at the University of Auckland 16 October 1998.
- MacArthur, J. B. (1993). Theory of constraints and activity-based costing: friends or foes? *Journal of Cost Management* Summer, 50-56.
- Noreen, E., Smith, D., and J.T. Mackey. (1995). *The theory of constraints and its implications for management accounting*. The North River Press Publishing Corp.
- Raffish, N., and Turney, P.B.B. eds. (1991). *The CAM-I glossary of activity-based management*. Arlington, Texas: Consortium for Advanced Manufacturing-International.
- Salafatinos, C. (1995). Integrating the theory of constraints and activity-based costing. *Journal of Cost Management* 9(3), 58-67.
- Spoede, C., Henke, E.O., and Umble, M. (1994). Using activity analysis to locate profitability drivers. *Management Accounting (US)* 75(May), 43-48.
- Swenson, D. (1995). The benefits of activity-based cost management to the manufacturing industry. *Journal of Management Accounting Research* Fall 7, 167-180.