Celebrate and record

The theory of constraints in services: part 2 – examples from health care

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Abstract

Several authors have investigated and proposed implementations for the theory of constraints (TOC) philosophy in manufacturing organizations. However, no study has addressed the application of TOC in service organizations. The second of two articles, illustrates how TOC can be applied to service and not-for-profit organizations. The first part explained the basic principles of TOC: in this issue those principles are applied in a health-care environment.

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Several authors[1-4] investigated and proposed implementations for the theory of constraints (TOC) philosophy in organizations which manufacture products. The theory has already been implemented successfully in several manufacturing organizations and some techniques, such as the drum-buffer-rope method (explained below) have been developed to support implementation of scheduling and decision making on the shopfloor[5]. Results show significant improvements in throughput, on-time shipments, inventory turns and other important factors which have a direct influence on companies' bottom lines. A question arises as to whether the TOC is applicable only to manufacturing organizations or whether it encompasses service type organizations as well. Other modern management philosophies such as TQM have been found very applicable and have already been successfully implemented in service organizations. Can service organizations benefit from the implementation of TOC?

First, let us consider the basic premiss of the theory, which is the existence of organizational constraints. From the manufacturing viewpoint, we tend to identify constraints as physical – not enough machining capacity, limited floor space, lack of materials and others. In fact, experience shows that most constraints in organizations are policy or procedural constraints rather than physical. In many cases, what limits or sometimes even diminishes the performance of an organization is actually the organization's management policies and operation procedures. As a simple example, capacity can be limited by an operational directive forbidding overtime. Service may be hindered as a result of the immediate service provider not being authorized to approve or perform certain necessary actions. We therefore frequently find that the biggest and most immediate gains in performance may be achieved by thoroughly identifying and changing harmful constraints in the organization. By providing a systematic questioning method to reveal and describe clearly problematic areas which supposedly are implicitly known to all, the TOC can be usefully applied, not only to the manufacturing industry, but also to the service industry.

Our intent is not to underestimate the importance of operating procedures and policies to organizations. They are crucial in service and manufacturing organizations to guide actions and behaviour, and provide solutions to specific problems. However, they

are seldom modified when the external environment changes. Some are so rooted in the organization that they are difficult to attack. The Socratic thinking process proposed by the TOC handles the inherent resentment to change by using a sequence of questions leading to self-revelation and creating a sense of ownership.

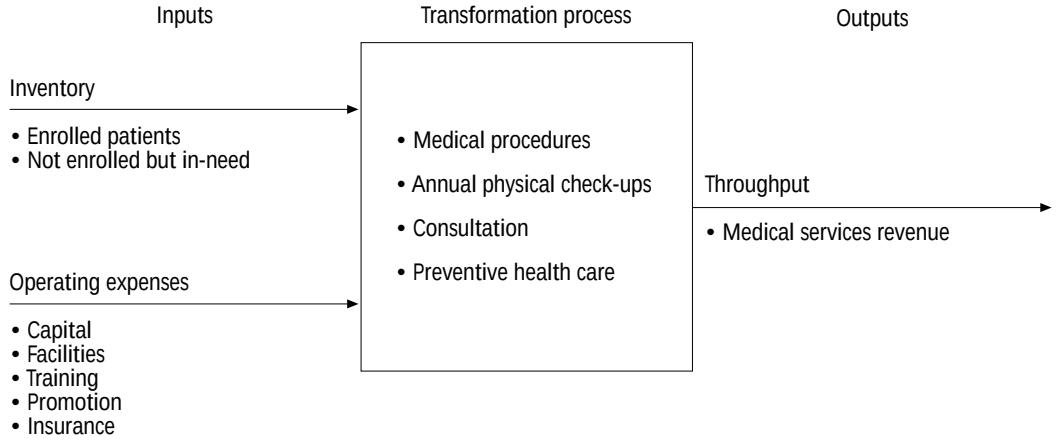
Next, let us examine the notion of ongoing improvements. The TOC holds that only improving the weakest link in the chain will create the desired effect on the organization's bottom line. To measure the effect of actions, we must first concentrate on defining the organization's goal. In manufacturing, we have already identified the ultimate goal as making profit. How would we measure goals in service organizations? For most of the service industry, we can continue to define profit as the organization's goal. Dealing with daily measurements, however, becomes a more difficult issue. Throughput, for example, is ordinarily considered to be a manufacturing term which has to do with the flow of products along a production line. Service organizations do not manufacture products. They do not carry limited capacity machinery. Some not-for-profit organizations are not even interested in making money. In order to apply the TOC, we therefore need to re-evaluate and define the basic measurements needed to guide decisions and provide essential feedback on improvement. We begin by trying to present a basic service organization as a system. A system is basically a process or a series of processes, in which inputs are turned into desired outputs. The TOC defines two basic inputs as inventory and operating expenses, and the output as throughput. It may be easier to analyse the application for a specific example – an organization providing medical services. A system representation of a surgical clinic is provided in Figure 1.

Throughput can be defined as revenues from selling medical services. Revenue is directly related to the number of patients treated by the clinic at any given period. Operating expenses are composed of numerous costs and are relatively easy to identify. But what about inventory? Borrowing again from the manufacturing world, we look at the clinic's product as the wellbeing provided for patients. If so, the organization is actually delivering products and not services.

We can then refer to the common manufacturing terms of raw material supplies, work-in-process or finished goods as they apply to the medical organization. The inventory is composed of all those who are in need of medical care but do not use the clinic because, for example, it does not offer the type of service they need. Those patients who are engaged in pre-treatment activities may in fact be considered as work-in-process. We have now basically established an economical model of the organization which shows the relationship between throughput, inventory and operating expenses. Throughput is the rate at which the organization receives health-care payments in return for a patient's wellbeing, minus any totally variable costs directly related to these inputs. Operating expense is clearly the rate at which money is spent to deliver the product – wellbeing. Inventory, therefore, is represented by any potential patient outside the system who could be turned into throughput.

If we were to look for ways to improve the operation based on conventional approaches,

Figure 1 System representation of a health-care clinic



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we would begin by addressing operating expenses. Costs are visible, measurable, and significantly more controllable than externals like health-care revenues. But in fact, focusing on cutting the wrong expenses (such as training or advanced equipment) may actually reduce the level of treatment provided, and discourage patients from enrolling to the services of the clinic. We would then lose throughput revenue. We may decide to increase prices, but the net effect would be that less people would be able to afford the services.

Taking the TOC approach, we begin by looking at ways to increase health-care sign-up (reduce inventory, increase throughput). Through the process of Socratic questions we try to identify what is restricting the organization's ability to enrol more patients, provide better treatment, and increase throughput. It is important to identify the weakest link in the chain, since so many internal and external factors can affect enrolment and they cannot all be changed. We may find that the clinic is lacking some advanced medical techniques or equipment and is, therefore, losing patients. Certain procedures previously performed by the doctor may have matured and can now be performed by the nurses, freeing the doctor to care for other patients. The conclusion is that if the bottom line performance of this service organization is to be improved, it needs to provide more timely products to its customers. Interestingly, this is exactly what manufacturing businesses try to do.

The potential contribution of TOC may be even more appreciated when examining the results of applying TQM to the health-care industry. The literature regarding the application of TQM in health-care organizations is generally very supportive, although the actual body of evidence is limited. Geber[6] presented several examples where TQM was applied by hospitals and yielded significant improvement. Other authors describe significant difficulties in applying TQM. When analysing these results, we find that many hospitals select to apply TQM in steps, starting from an isolated unit or procedure.

It is apparent, however, that without subsequent identification of the weakest links, and application of the philosophy to these groups or processes within the organization, major improvements cannot be achieved. Can a group of dedicated nurses overcome the hospital's accounting gurus when it comes to arguing for new equipment? Although the literature does provide several interesting results for application of TQM, they are mostly limited to isolated procedures. Yes, they provide improvement in cost and quality, but these are usually local, and it is doubtful if they can drastically change the complete picture.

The TOC is providing a method of focusing improvement on the critical areas, and thus has the potential for much faster improvement towards a more global goal. The TOC can also contribute by emphasizing methods of dealing with change. The main obstacle for broader implementation of TQM in hospitals, for example, is as in many industrial organizations, the need to win over those who do not believe in the method and who find it difficult to wait for TQM payoffs when they are battling daily problems. In the case of hospitals, the problem is even greater, mainly with the doctors. The physicians are in many cases not hospital employees and are therefore considered important customers of the hospital. Hospitals are very sensitive and reluctant to impose any changes or new requirements on doctors.

The TOC provides some answers to these problems by contributing the Socratic thinking process for dealing with change, and potentially creating ownership and commitment throughout the organization. The focus on the weakest links helps also in accelerating the improvement and generating more apparent results at a quicker pace.

Contribution to not-for-profit service organizations

As was previously briefly discussed, some organizations do not even have the goal of making profits. They are, however, operations that clearly require effective management to survive. How would they then apply modern management philosophies, if the basic motivation that drives our economic models does not exist?

The answer lies in the fact that each organization, even a not-for-profit one, has to have a specific goal or else there is no purpose for its existence. The process of identifying the goal is, however, significantly more complicated for not-for-profit organizations than it is for profit-seeking ones. Once the goal is determined, it is important to define measurements which would assist in judging whether actions bring the organization closer to or away from its goal. Throughput, operating expense and inventory, comprising the TOC set of measurements, are also not obvious.

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The definition of the right goal is critical if we want to identify the correct measurements and effectively improve performance.

Taking as an example a relief organization such as the Red Cross, we may mistakenly identify its goal solely as providing aid to those in need. We may then measure our progress in terms of how many tons of food or medical supplies were delivered, or how many aid workers were deployed. A more appropriate goal may be to improve the level of wellbeing for people in crisis. We then would measure our success not just by the quantity of relief supplies or teams, but by how fast a disaster area would actually be able to return to normal functioning. As a result, instead of arbitrarily increasing aid shipments, we may identify the real performance constraints as insufficient distribution systems or the lack of technical financial infrastructure needed to accelerate rebuilding of the area by the people themselves. The contribution of the TOC in this case is to force the discovery of effective measurements.

Although not identified as a main goal, even not-for-profit organizations cannot survive without money. The conventional measurements of throughput, operating expenses and inventory are valid for achieving financial stability as demonstrated in the previous section, and can be applied as well.

Drum-buffer-rope control for a service organization

It has been shown that the basic philosophy of the TOC is generally applicable to service-type organizations. Goals should be clearly identified, correct measurements should be taken, and the constraints, be it physical or policy, need to be carefully managed or changed to assure ongoing improvement. It is interesting now to check whether some of the practical methodologies developed for the application of TOC in manufacturing can be adopted for use in the service environment. The drum-buffer-rope shopfloor control technique now being implemented in a growing number of manufacturing organizations enables better scheduling and decision making on the shopfloor. As described by Schragenheim and Ronen[3], the drum is the exploitation of the constraint of the system; the constraint that dictates the overall pace of the system. The constraints may be a resource, market demand, scarce raw material, or management policy. The important thing is that the drum has to include a detailed schedule in order to assure full exploitation of this constraint.

A buffer may be defined as protection time. Buffers are used to protect critical areas, such as the constraints from disruption of their operation. Disruptions may occur as a result of problems such as breakdowns, unreliable suppliers, set-up time fluctuations or unavailability of resources. A rope is a mechanism designed to force all the links of the system to work up to the pace dictated by the drum and no more. In manufacturing implementation, this is done by creating a detailed schedule for releasing raw material onto the shopfloor.

The drum-buffer-rope technique stems from the theory of constraint's five step ongoing improvement cycle provided in Part 1, Figure 1. Let us try to apply this cycle to a service case, for example the Red Cross operation in Florida after the hurricane storm Andrew. Remembering that the primary goal of this operation was to aid in restoring life to normal, we start by identifying the operation's constraints. Surprisingly, these are not the availability of supplies, nor the availability of transportation, but the control and distribution of the support to the right people, with proper training and assistance to stimulate rebuilding by the people themselves. Next, we choose the best way to exploit the constraints. The Red Cross may choose a detailed implementation schedule to be derived in order to satisfy the maximum sectors of the area. Physically, the constraints may be composed of the pull of available skilled relief workers who can guide the operation at various locations. Scheduling of the constraint has an important implication on the constraint's exploitation because the subordination areas have to be aware, in advance, of the drum needs.

The purpose of the third step, subordination, is to keep the exploitation intact. We do that by planning supply buffers in critical areas, in order to prevent disruptions of the operation. We use another mechanism, the rope, to assure that non-constraints will contain only supplies that are scheduled by the drum in the next buffer timeframe. We would prevent, for example, excessive shipments of relief supplies to locations where they cannot be fully used and may even be wasted or spoiled. Next, we devise plans to elevate the constraint. In the given example, constraint elevation may include sending in additional social workers, upgrading the communication systems, or providing financial loans to the people so that they can start rebuilding. The

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fifth step is designed to assure ongoing improvement by closing the cycle and directing attention to newly established constraints.

Geber[6] describes the case of the University of Michigan Hospital, which tackled the problem of an inefficient admission and discharge system. Delays in discharging patients caused an average of three hours' delay in accepting incoming patients, who had to wait for their rooms to be prepared. A cross-functional team was able to find several ways to reduce the complexity of the admission and discharge system and improve the process. Initially, the hospital cut the average admission time from three hours to 21 minutes and then to 11 minutes. One of the key methods for achieving such dramatic improvement was better scheduling of housekeepers for cleaning dismissed patients' rooms by the utilization of beepers. Clearly, by identifying and better exploiting the constraints with the aid of a "drum-rope"-type mechanism, the hospital was able to cut down on the inventory of non-admitted patients and to increase its output. According to Geber, the cross-functional team is still in operation, and has the goal of zero admission time – from the hospital's door directly to the patient's room.

In another example provided by Geber, the University of Michigan Hospital significantly improved the utilization of its operating rooms by the use of a drum-buffer-rope-type solution. The hospital's operating rooms were running inefficiently at more than capacity. After analysing the scheduling process and identifying the constraints, a hospital team made several significant changes. The operating room schedulers were assigned to work exclusively with a particular group of specialists, so that each scheduler could become familiar with each doctor who practised that specialty. The scheduler, for example, would know that if a certain doctor asked for 15 minutes he should reserve at least 30 as a buffer. In addition, operating room clean-up teams were established to expedite clean-up after each procedure.

It is evident from these examples that techniques and methodologies developed originally for manufacturing organizations can be adopted and used in service operations. These applications require a certain degree of abstraction. However, abstraction may sometimes be a necessary ingredient of any thinking process to ensure its success.

Conclusion

Management philosophies used by manufacturing organizations can be applied to improve the performance of service-oriented organizations, even those which are not for profit. The concepts outlined by TOC can be used effectively to identify the organizational goal, locate the constraints to achieving maximum performance, and develop practical measurement to assure a process of ongoing improvements in the direction of the global organization goal.

Since constraints are frequently found to be policies and procedures rather than capacity or equipment, the same thinking process can generally be used in manufacturing and service environments. Service organizations can be modelled as systems with measurements comparable to manufacturing. Metrics such as throughput, operating expense and inventory can be identified in order to measure progress towards the global organization's goal.

Although requiring a higher abstraction level, even shopfloor control techniques, such as the drum-buffer-rope methodology, can be applied to service organizations in support of effective exploitation of constraints and subordination of resources to it.

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