

## Evaporating Cash Constraint

Many organizations some times get into the most undesirable situation of running out of cash. This impacts the very survival of the organization. Almost the entire time and attention of the top management is consumed in fighting one payment crisis after another. This paper shares some unorthodox solutions for getting out this life threatening financial crisis using Theory of Constraints (TOC). In most cases it is possible to overcome this constraint within 15-20 weeks.

### Definitions

Definitions of various entities to explain various concepts are given below.

1. **Cash to cash cycle time** is the total time it takes from taking cash outflow to cash inflow (**n**) periods
2. **Totally Variable Cost (tvc)** is the cost saved when one unit of output is not produced and sold
3. **Operating Expenses (OE)** are all those expenses that will be incurred irrespective of the production and sales volume.
4. **Throughput rate ( $\underline{T}$ )** is defined as the contribution per unit of constraint resource over one period of time. When cash is the constraint, it is defined as the contribution in \$ per unit of time per \$ of cash available.  $\underline{T} = ((s/tvc)^{1/n} - 1)$  per unit of cash for one period of time where **s** is the unit selling price and **tvc** is the unit totally variable cost. Table 1 details the calculations for throughput for two different products P & Q.

**Table 1**

Parameter	P	Q
Selling price per unit (s) in \$	100	80
Totally Variable Cost per unit (tvc) in \$	50	50
Manufacturing lead time in weeks	2	2
Credit period in weeks	4	1
Total cash to cash time (n)	6	1
$\underline{T} / \text{Week} = \{(s/tvc)^{1/n} - 1\}$	0.12	0.17

5. **Throughput ratio (t)** =  $s/tvc$
6. **Survival Time:** This is the time the organization can run with current cash. Survival time = Cash/OE
7. **Minimal cash** required for survival =  $n*OE$
8. **Adequate survival cash** =  $n*OE*\{t/(t-1)\}$

9. **Sufficient cash** =  $n \cdot (OE + \text{Cash required for full capacity utilization for one period})$   
 Table 2 provides sample calculations for above parameters.

**Table 2**

Parameter	P	Q
Throughput ratio (t) ~ s/tvc	2	1.6
Total cash to cash time (n)	6	3
OE / week in \$	500	500
Cash available in \$	2000	2000
Survival time in weeks	4	4
Survival cash requirement: $n \cdot O.E.$	3000	1500
Adequate cash requirement: $n \cdot OE \cdot \{t/(t-1)\}$	6000	4000
Cash required / week for full capacity	1000	1000
Sufficient cash requirement: $n \cdot (OE + 1000)$	9000	4500

### **Theory of Constraints**

Every organization is a system. Every system has more than one link. The performance of the system, like the strength of a chain, is governed by the performance of its weakest link. Often organizations, struggling to improve their performance, try to improve every area thereby either getting very little improvement or some times none at all in case the weakest link is missed. Most organizations do not know where is their weakest link, thus jeopardizing their entire time and effort! The underlying belief in most organizations is that global performance is sum total of local performances. This erroneous assumption leads to local optimization. In the TOC world global performance is governed only by the performance of the weakest link-the constraint.

Dr. Eli Goldratt, the creator of TOC, has developed a very simple five step Process Of On Going Improvement (POOGI).

The Five focusing steps are:

1. Identify the constraint. Find the weakest link
2. Exploit the constraint-make the most of what you have. Do not waste the constraint.
3. Subordinate all other functions, departments, measurements to take out the most out of the constraint.
4. Elevate-strengthen the weakest link.

5. Go back to 1-identify the new constraint in case the constraint has changed.

### **POOGI –step 1: Identifying Organizational Constraint.**

TOC improvement methodology POOGI provides us a very simple and effective process for systemic improvement.

The first step exhorts us to identify the weakest link-the constraint. In the specific case under discussion i.e. in cash constraint situation, the constraint is cash.

Identifying organizational constraint is not at all rocket science. The following step by step approach will help identify the constraint of a “For Profit” organization.

1. The organization has a **constraint in the market** if it has a very large (~ 50%) market share of the world market. Most organizations other than Microsoft, Intel or some niche players are unlikely to have this constraint.
2. An organization has a **constraint in orders** if it delivers consistently (>99% +) On Time in Full (OTIF). OTIF is rather a stringent measure to achieve. If an organization has orders for 10 items, its OTIF measurement will be zero if it misses the delivery of even one item by just one day. Most organizations do not have OTIF even close to 50%.
3. An organization will have a **constraint in operations** if it is not achieving OTIF ~ 99% though it gets input materials on time. In case any of its equipment has an Overall Equipment Effectiveness (OEE) is more than >90% on 24X7 basis, then it has a constraint in this equipment. Otherwise its operational policies are responsible in generating an artificial constraint in making one of its equipment as the constraint.
4. When an organization is having OTIF < 99%, and it is unable to get its input materials on time due to organization’s inability to pay its suppliers on time, the organization is having the most difficult situation i.e. **CASH CONSTRAINT**. Cash shortage is not the same as cash constraint though cash shortage will lead the organization into cash constraint in due course of time.

### **POOGI-step 2: exploiting the constraint**

The second step-exploiting the constraint-implores us not to waste the constraint. In cash constraint situation, we must squeeze as much throughput as is possible through effective utilization of existing cash. A small increase or reduction in cash can make or break the organization. This unique property of cash impacting throughput non-linearly could help organizations to overcome cash constraint in a very short period of time. In most cases it may be possible to come out of cash constraint in less than 13 weeks through **increasing cash to cash velocity**.

Cash to cash cycle time (n) reduction has huge non-linear impact on throughput, cash availability, survival time, adequate cash requirement etc. Often just shrinking cash to cash time is good enough to come out of cash constraint provided right measurements are in place.

Table 3 depicts the data of a cash constrained organization. It can be observed that the organization will run out of cash in week 13. However if we could somehow shrink cash

to cash time from 6 weeks to 3 weeks, it is sufficient to overcome the cash constraint in 3 weeks (Table 4). We will discuss three different tactics to reduce cash to cash time.

1. **Reduction in customer payment time.** Often customer payment time is the largest component in the cash to cash cycle time for most of the organizations. The belief in most organizations is that if we reduce payment time by one week, we are just saving interest for one week on the amount to be received. In cash constraint situation, cash to cash cycle time impacts throughput non-linearly. Hence all efforts must be made in shrinking customer payment time. As we can get huge benefits from shrinking cash to cash time, we must explore all possibilities including significant discounts for immediate payment. We can observe from table 5 that even after providing 20% price discount to shrink customer payment time from 4 weeks to one week, it will serve the organization well as it will come out of cash constraint in the 10<sup>th</sup> week.
2. **Shrinking manufacturing lead time.** Drum-Buffer-Rope (DBR), the production solution of TOC, shrinks the manufacturing lead time by a factor of 2-10. This is particularly effective where manufacturing lead time is quite significant. For organizations that make capital goods, this is of immense help. Shrinking manufacturing lead time not only reduces cash to cash time, it also reduces the work-in-progress, thereby releasing cash. In many cases this paves the way to increase selling prices by offering reduced lead time. Organizations that produce to stock also benefit by shrinking lead time. First, due to reduction in cash to cash cycle, throughput increases significantly. Reducing manufacturing lead time leads to reduced Work In Progress (WIP). Thus we are able to squeeze additional cash through reduction in WIP. Due to reduced WIP, process defects are noticed earlier to initiate corrective measures and thereby increasing throughput. Moreover manufacturing lead time reduction helps reduce Finished Good inventory thereby releasing more cash.
3. **Reducing supplier lead time.** Reduction in supplier lead time also crashes the cash to cash time. Additionally the raw material inventory holding requirements also comes down with the reduction in supplier lead time. We must not dismiss the very thought of increasing supplier price as this will decrease our throughput / profit. We should evaluate the impact taking into consideration input price increase, reduction in cash to cash time, reduction in raw material inventory requirement.

The cash simulator helps us to look at various options. However current organizational measurements like sales, profit, or even throughput measured conventionally will prevent the organization from adapting the above tactics that can prevent bankruptcy.





**Table 5**

Weeks	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Parameter																
Money received from customers	550	500	450	2000	1950	300	1600	1600	1200	1600	1600	1440	1600	1600	1600	
Loan taken / (returned)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cash opening	2000	1050	50	0	500	950	0	100	200	0	100	200	140	240	340	
OE	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	
Interest rate on loan / week	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	
Cash closing	1050	50	0	500	950	0	100	200	0	100	200	140	240	340	440	
Throughput ratio	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	
Sales	1600	1600	0	1600	1600	1200	1600	1600	1440	1600	1600	1600	1600	1600	1600	
Cash to cash time	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
% Capacity utilization	100%	100%	0%	100%	100%	75%	100%	100%	90%	100%	100%	100%	100%	100%	100%	
Current Data	Selling price reduced by 20%, thereby throughput ratio changes to 1.6															

**POOGI-step 3: Subordinating to the constraint**

Functions in organizations do not work in vacuum. Actions and decisions one department impacts performance in other functions. The step 3 of POOGI-Subordinating to the Constraint deals with aspect. In simple words it means that all functions, departments, decisions should be aligned to get the most out of the constraint. However this step is often the most difficult to implement as this requires changes in existing practices and policies of local optimization. Specific examples that prevent subordination in cash constraint situation are shared below.

- ◆ **Purchase more than immediate requirement** to take advantage of quantity discount. Many organizations waste their most precious asset Cash for purchasing more than immediate requirement just because the purchase manager can get volume discount by buying additional quantity. In turn this additional cash outflow starves the organization of other required materials, thereby jeopardizing full material

availability and throughput. This increases cash to cash cycle time and hastening bankruptcy. It is recommended to buy just the bare minimum required.

- ◆ **Produce more than immediate requirement** for better capacity utilization. Many production managers produce more products than immediately required to save on set up times. However when products of one type are produced more than required, cash is wasted in more than one way. First some other required products are delayed and thereby delaying the cash inflow. Secondly the additional products produced block cash and increasing cash to cash cycle. The recommendation here is to produce that is required immediately.
- ◆ **Combine supplies to get freight advantage.** Many times the logistic / purchase managers try to reduce freight cost by combining supplies of many materials, and thereby delaying the material that is required urgently and thereby increasing cash to cash cycle with its significant negative impact on cash flow.
- ◆ **Batch dispatches to reduce freight cost.** This is same behavior as discussed earlier i.e. combine supplies to get freight advantage. However here the impact is more severe due to delay in cash inflow along with possibility of customer dissatisfaction due to delay in delivery.
- ◆ **Not selling obsolete material below purchase price / book value.** Surprisingly this behavior is observed universally in almost all organizations. For many organizations the cash generated by selling obsolete material is more than sufficient to get the organization out of cash constraint situation. The following example will illustrate this in detail

This is the case of an organization that manufactures stainless steel bars. Its annual sales turnover is \$ 180 million, and annual loss is \$ 12 million. Its capacity utilization is about 50%. The manufacturing lead time is two weeks. The totally variable cost (tvc) is 50%. There is a heavy demand for these products. Customers pay immediately on delivery. This organization is short of cash and hence is unable to buy sufficient raw material.

Since the current capacity utilization is 50%, theoretically it can increase its sales to more than \$ 360 million without increasing its fixed expenses.

It can break even if it could generate additional throughput of \$ 12 million or \$ 1.0 million per month or \$ 500,000 every two weeks. As its tvc is 50%, it needs to generate additional sales of just \$ 24 million per year or just \$ 1.0 million every two weeks.

It has some obsolete material in its stock for more than 2 years. This can be sold for \$ 40,000. However its book value is \$ 100,000. Since it cannot be sold at book value, the management was unwilling to sell this at a loss.

Now let us examine the situation if the management takes the unorthodox path of selling it at a loss for \$ 40,000.

As the manufacturing time is 2 weeks, this additional cash of \$ 40,000 can be converted into saleable material of \$ 80,000 in 2 weeks. In turn \$ 80,000 can generate sales of 160,000 in the subsequent 2 weeks i.e. within a total of 4 weeks \$ 40,000 can become \$ 160,000. In the next 4 weeks this \$ 160,000 could become \$ 640,000. At the end of 8 weeks the organization could have a cash of \$ 640,000. This cash of \$ 640,000 is sufficient to generate additional sales of \$ 1.28 million

every two weeks. This is sufficient to turn around the organization within 10 weeks by just selling obsolete material!

#### **POOGI-step 4-elevating the constraint**

In most cases exploitation and subordination are sufficient to take an organization out of cash constraint in a few weeks. However there may be situations where the above steps may not be sufficient. In such situations we should explore the possibility of augmenting cash by borrowing additional cash. This is not at all new. Every organization that is having cash constraint does try to get additional cash. However quite often time is lost in getting cash at lower interest. This obsession to keep interest cost low could be fatal. The need of the hour is to get sufficient cash as early as possible to come out of cash constraint even if it means paying high interest.

In most organizations finance managers are prepared to accept higher (2-3 %) over normal (10-12%) annual rates of interest. Organizations facing cash constraint find it quite difficult to get additional life line-cash- at some what increased (2-3%) interest rates. Though cash may not be available at these slightly higher interest rates, however it may be possible to get cash at 30-60% interest rates! Now it is not the availability of cash that is an issue. It is the finance manager who will just not even allow such a preposterous thought to enter any one's brain!

Since computer simulations afford the luxury of entertaining such 'out of box' thinking, it is possible to check out the impact of taking loan @ 4% per week! The simulation assumes that the interest will be 4% week. Yes, we are talking about borrowing at 208% per year as against normal interest rates of 10-12 % per year!

The simulator results (table 6) demonstrate that we can take a loan of \$ 6,000 @ 4% week and get out of cash constraint within 26 weeks after repaying both interest and loan of \$ 6,000! And of course the plant runs at 100% capacity utilization from week 1 itself!

The purpose of this example is not to encourage borrowing at abnormally high interest rates. Rather the idea is not to rule out borrowing at high interest rate to get out of cash constraint! Needless to emphasize that in most cases exploitation and subordination are sufficient to overcome cash constraint.

#### **POOGI-step 5: Go back to 1-identify the new constraint**

The 5<sup>th</sup> step is to identify the new constraint as the organization comes out of the cash constraint. Ideally speaking one should decide where to have its constraint. The constraint should be either in operations (an expensive equipment) or orders. The most important learning the organization must imbibe is to never again get into cash constraint!

**Table 6**

Weeks	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Parameter														
Money received from customers	550	500	450	400	350	300	2000	2000	2000	2000	2000	2000	2000	2000
Loan taken / (returned)	6000	0	0	0	0	0	0	0	0	0	0	-1000	0	0
Cash opening	2000	6810	5570	4280	2940	1550	110	370	630	890	1150	1410	710	1010
OE	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Interest rate on loan / week	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%
Cash closing	6810	5570	4280	2940	1550	110	370	630	890	1150	1410	710	1010	1310
Throughput ratio	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Sales	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Cash to cash time	6	6	6	6	6	6	6	6	6	6	6	6	6	6
% Capacity utilization	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	Current Data	\$ 6,000 borrowed @ 4% per week										Repayment of loan		

## Implementation obstacles

**Measurements:** The main obstacle in subordinating to cash constraint is the wrong measurements organizations continue to monitor when in cash constraint. **The impact of using wrong measurements does more damage than by not using the right measurements.** Measurement like sales, profit, market share, production volume (tons, Number of units etc.), unit purchase price, margin % etc. are of no consequence. These must not be used during the cash constraint crisis. Sometimes we may even have to stop measuring throughput as measured conventionally (sales-totally variable cost) while the cash constraint exists.

The most important measure in cash constraint situation is **survival time (cash in hand / OE)**. Any action that has beneficial impact after the survival time is of no consequence. Hence the first most important measurement is survival time. All actions should be taken to increase survival time either by increasing cash availability or by reducing OE. Since organizations would have already curtailed OE, any further reduction in OE would be marginal. Increasing cash availability through shrinking cash to cash time, and eliminating all actions that waste cash must have top priority.

The second important measurement is **outstanding financial commitments**.

The third parameter is **Throughput rate ( $\underline{T}$ )**. Throughput should be calculated by using the formula  $\underline{T} = ((s/tvc)^{1/n} - 1)$  rather than conventional method of sales less variable cost.

## Summary

1. Cash constraint is the worst constraint
2. Exploiting and subordinating cash constraint also *elevates* cash constraint
3. Cash constraint impacts throughput *non-linearly*
4. Cash Constraint is the fastest constraint to shift!
5. Eliminate wrong measurements and institute right measurements
6. Shrinking cash to cash may be sufficient to take care of cash constraint in most cases.
7. Some times borrowing cash at very high interest rates could solve cash constraint.