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Inhalt

TOC and the essence of management	2
Example: David at Boing Microelectronics	2
Batching.....	2
Example: Batching Circuits in Boing Microelectronics	2
“Personal” batches	3
Example: Machine Shop:.....	3
Example: The amazing sheet metal center	4
Example: Extrusions.....	4
Example: Davids Glorious Failure	4
Getting to know the TOC: 1999	5
Becoming a consultant	5
Maxager Technology (Software).....	5
Papermill in Wisconsin.....	5
TOC Metrics	6
Example: Boing Microelectronics: Buy Faster Machine?	6
Example: Build new headquarter?.....	6
T-I-OE Method as decision support	7
What if T goes up but I and/or OE go up too?	7
Throughput Accounting.....	7
Benefits of TA	7
S-DBR	7
The buffer in S-DBR	8
Buffer management in S-DBR.....	8
Determining original buffer sizes.....	9
Safety stock and emergency stock.....	9
Red line time.....	9
CCPM implementation at Marine Corps Maintenance Center Albany, Georgia.....	9
Nuclear submarines at pearl harbor	10
TOC in Japan – public works revolution	11
Example: CCPM saves 30.000 lives.....	11
TOC: The essence of Management.....	12
TOC: Short and easy explanation for CEOs	12
Holistic Project Management.....	12
Inventing New Applications –The 4 points of Flow.....	12
Viable Vision and Strategy&Tactic trees.....	12
Personal Growth through TOC	13
TOC and Sales	13

TOC and the essence of management

Natural! Common sense!

Example: David at Boing Microelectronics

lower management rank

Goal: on-time delivery => after unsuccessful tries, perfect results with method similar to first 4 of The 5 focusing steps!

5 focusing steps of TOC:

- 1) Identify constraint (“drum”)
- 2) Exploit constraint(s)
- 3) Subordinate everything else to above decision
- 4) Elevate system constraint
- 5) Identify new constraint

Unintentional results: quality went UP! Costs of labour went down 2/3rds! (weil keine Überstunden!)

Cost-world thinking: “If I can reduce costs in every resource then the whole will cost less” is WRONG!

“If I improve every single resource, the whole improves” is WRONG!

❧ Instead concentrate on constraint and flow!!! Costs will follow!

Batching

Set-ups cost money is not true! But cost-world makes bigger batches to “save costs”: but: Labour doesn’t actually cost anything! The employees are there 8 hrs a day and get same (fixed!) pay, regardless of what they do! => It is ok to do small batches! It’s actually a very good idea!

Example: Batching Circuits in Boing Microelectronics

Tray for Circuit transportation within facility holds 12 circuits. => Tray is filled up, then continues to next step. Xx Only because the tray holds 12 circuits doesn’t mean there have to be 12 on it! Xx

But splitting Orders (Trays) is much (paper)work, which has to be done by managers! Say, a manager’s hour costs 262 \$:

What if 1 item on the tray is bad? 12 circuits go to trouble shoot! What if in the next check the item doesn't pass again? All 12 go to trouble shoot again and again. The 11 good parts do not get delivered!

Splitting orders is much work, work of highly paid managers => people don't want to split orders; but splitting orders does not cost money! Employees are here anyway! Even the expensive ones;

Better split and take out only bad items, so the good ones can be delivered!

Batches should be as small as possible, at best batch size 1.

“Personal” batches

people tend to wait until they have a number of items to work on, for personal “efficiency”; they send the work on as a batch, batches tend to stay together through whole corporation! Example: A cart driver doesn't want to waste time for transportation (“go around with one piece? No! wait till cart is full!”) => What is he subordinating to? The size of the cart, not the goal!

Example2: Person creating orders does not want to go up and down the stairs for one sheet of paper, waits until there is a bunch of orders to carry. => subordinates to stair!

If you find a batch, break it up and send it on as smaller batch / one by one.

Drum Buffer Rope is natural and universal, batching is devastating for lead-time!

BUT; DBR is not the answer to every conceivable kind of operation! Sometimes there are no batches! E.g. cable maker

TOC:

If you want costs to go down don't focus on them!

If you want quality to go down don't focus on it! => always focus on FLOW!

Aspects of flow by Ford

5 Focusing Steps and Thinking Process are foundation for all future developments in TOC; everything is governed by constraints; each application deals with leverage points of system => improvement regardless of industry, product, process;

Example: Machine Shop:

Show me constraint? This machine! Cost world: “buy another one” => not necessary!

Why are there three axis mills standing around idly? They are slower and thus more expensive; => everything through the one faster machine (=> subordinating to speed of machine!).

But TIME is the only important thing! Lower costs follow!

Should use the smaller ones too!

Example: The amazing sheet metal center

Routers take 100s of alloys and thicknesses, but only *full* sheets (4 x 12 ft) of aluminum;

6 mio \$ per machine, bought because big fast machines are efficient and save costs! Use of only full sheets reduces set-ups = most efficient! => they look what fits on one sheet, do future orders to fill it up; or have to throw away the rest (waste of material!); => unfinished parts lie around, lead times longer and longer, everything slowed down by parts not needed! => overtime

Answer: smaller batches (sheet sizes)!

What if suddenly AOG ("aircraft on ground" = 96 hrs to delivery!) comes in?

All sheets of special metal used up for future orders, nothing left now; buy expensive sheet for much higher price for speed, have nothing else to cut out from the sheet, cut out small part, throw away rest.

David: use small mill for that!

In the end they changed the machines so they could cut sheets in fours, so at least $\frac{3}{4}$ could be saved;

Example: Extrusions

6 expensive machines can produce any part, success criterium: efficiency, time running, product parts created; => producing for the future, parts lying around;

AOG! Need special extrusion, just issued 15mins ago, already used up! => call supplier, buy ONE special extrusion for horrendous price, delivery still takes 2 weeks!

Have to make extrusion themselves with bad-mill: shaves away all unneeded aluminum, reduce huge cube to metal scraps to produce the small part.

ð IGNORE *LOCAL* EFFICIENCY!!

Example: Davids Glorious Failure

1996: sheet metal center

65% scheduled, 35 % emergent = too much, big trouble

David sees no physical constraint! There is enough capacity!

Just build everything *on* schedule! Stop releasing parts ahead of time; only now and up to 10 days; Weeks of convincing superior, go to big boss, explain, permission but don't tell anybody Big Boss said so.

But: all 14 machine managers can release work if their machine is not busy. David gets the orders, holds them back and puts them into box. Progress of 2 Weeks done in 4 hours! But Managers only see their idle machines: Gets calls "where is my order?"; Day 3: managers come inspecting, not let into bureau; Day 4 12 Boxes of orders, managers force way in, angry, go to Big Boss, Big Boss: "How dare you? Put out all orders at once!"

Getting to know the TOC: 1999

Book by Eli: "Manufacturing at warp speed": Drum Buffer Rope; David had done DBR implementation before reading it! Because it is natural!

Have to make good case, get official buy in of top guys! Big companies very afraid of change/risk; Problem is no one wants to take responsibility alone!

Japan: takes such a long time to get a response because they actually get consensus of the whole company, but then they are ready!

Becoming a consultant

McDonald Douglas boss becomes Boeing boss: "No family! If you are not needed you get fired!"

Now Boeing people are back, TOC! 777 Aircraft fully TOC! Great and on time! But 787 dreamliner is late" devisionhead wants to do it his own way...

Lean-Office: 70% TOC people, Boss too! "lean+" = lean + TOC

Discovered project management

What about holistic company, whole TOC company?

Left boing disillusioned 2000

Maxager Technology (Software)

Quasi-TOC company (Only quasi Throughput Accounting)

Produced quasi TOC software

Sent him to Japan for the first Time in 2000

Papermill in Wisconsin

Running at 20% of capacity => should produce all they can get! Throughput of each product doesn't matter! Need market offer, not software!

=> David fired by Maxager Technology, unemployed for a short time in 2001, could go back to being any time but not comfortable with it;

Key learnings:

- Throughput Accounting
- Most organizations don't have physical internal constraint! There is hidden capacity everywhere! Only policy constraints!

TOC Metrics

Throughput (T): rate of generated money through sales

Investment (I)

Operating Expenses (OE): money a system spends in turning inventory into throughput

Order of questions important! **T** up? **I** down? **OE** down?

Example: Boing Microelectronics: Buy Faster Machine?

A micro circuit is sold for 800\$, 2 hours of labour, 1 hour 262 \$ (= burden rate, incl. all fixed costs)

Buy new, faster machine?

- Machine: 1,4 million \$
- Maintenance: 100.000 \$/Year
- Saves ½ hour = 131 \$ / circuit => 10.000 circuits per year = 1,3 million \$/ Year saved!

Buy! says cost world.

Ask TOC questions!

- 1) Will the new machine increase Throughput? => No!
- 2) Will the investment decrease? => No!
- 3) Will the new machine decrease OE? => No!

They still bought it, only solution: fill up the new capacity! Sell sell sell!

Example: Build new headquarter?

Why? Modern, nice to look at, impressive, representative

- 1) Will Throughput go up? No! (only of customers buy only because of pretty building)
- 2) Will Investment go down? No! (costs a lot!)
- 3) Will OE go down? No!

T-I-OE Method as decision support

- 1) Will the decision increase Throughput of the system?
- 2) Will the decision decrease investment in the system?
- 3) Will the decision decrease OE of the system?

can be used for anything!

For Example: Should I work overtime this weekend?

What if T goes up but I and/or OE go up too?

$$\Delta T > (\Delta I + \Delta OE)$$

Throughput Accounting

(see picture in Davids presentation)

- Does not assign costs to an individual product
- Treats traditional variable expenses as fixed (e.g. labour)
- Systemic approach with transactions
- Decided at boundary of organization

Benefits of TA

(See presentation for pictures)

Implementing TA creates atmosphere conducive to other elements of TOC being successfully implemented and sustained!

=> TA first!

Then TOC everywhere else! Would maybe even develop by itself

Because local efficiency looks bad! Only the whole system is better!

Experience in huge company is good for consultants: can emphasize with company and people better

TOC consultant should first see a company from the inside, then from the outside to see white spots of company!

S-DBR

DBR:

Only when true physical constraint on the shop floor!

Or when resources are operating near capacity but are not constraining

Even resources that are historically overloaded can be helped by 5 focusing steps

S-DBR:

In reality constraints caused by policies, manifesting physically

The market/customer demand (or rather **our ability to sell!!!**) almost always major constraint

If market is constraint, drum schedule based on master production schedule we create

Don't sell products, sell capacity! Use capacity most effective! If not enough demand to fill capacity, find *anything* to fill it! Never concentrate on one product! Be flexible! The goal is to sell capacity, not products!

Subordinate to and buffer customer demand!

Monitor fluctuating market demand and balance internal resource capacity; *anticipate* constraints!

Many want constraint to be inside, so it can be controlled => No! we want it outside (sales)! Monitor inside, but never bring constraint inside!

Rising market demand (eg. too much sales) will cause internal constraint! Anticipate, react in advance

The buffer in S-DBR

In CCPM: buffer is at the end

DBR: buffer is *not* at the end! And not physical! It's the time from raw material to constraint!

S-DBR: liberal estimation of the lead time from raw material release to shipping; it contains actual processing time (set-up and run), transport, reduced Queue time – less queue time overall than in conventional systems but still enough to help protect against Murphy (what *can* go wrong will!)

Touch-time $\neq$ lead time

Buffers are used to overcome common delays for more serious disruptions

Buffer management in S-DBR

Buffer management is a control mechanism: alerts when due dates are threatened (not when too late!)

Order not complete a set time before due date = almost late => investigate immediately! Only if due date will not be reached, expedate

Buffer management insures that buffers have the right size: never red line reports = wrong size; too many red line reports = Problem! Constraint!

Effective when data is inaccurate

Suddenly many almost late orders: whole system stability in danger!

Determining original buffer sizes

Ask: what is your existing lead time?

- Cut 25-30% off (won't need after implementation)
- Final 1/3 of lead time is emergency zone (red zone)

Actual touch time should fit completely within emergency zone:

- If touch time is very small compared to lead time: S-DBR!
- If touch time is 35% of lead time or more: this is not S-DBR! Only PM!

Local area managers get relieved a lot! Only have to deal with 5% of orders (red line); dispatch list only for info, don't manage by it;

Don't worry about orders in time! They manage on their own! Only 5 % need help!

Safety stock and emergency stock

We need stock to protect ourselves

Level of stock: determine for how long a period we need to maintain stock (at least supplier's delivery time)

Red line level for raw materials: warning device tells us when red line reached *and* consumption continues! Red line report: investigate! Check accuracy of inventory count, check do we *need* more?

If we hit red line more and more frequently: investigate! Problem?

If we never hit red line: too much stock! Or wrong red zone!

Optimally we order stock one for one as we consume it in the green zone= **continuous replenishment**

We do *not* collect up a batch before ordering! Red line report: investigate and order big enough replenishment

Red line time

If stock count is frequently inaccurate, if vendors/suppliers are unreliable,...

Red line buffer signals us to verify material is in hand at predetermined interval prior to lead time:



CCPM implementation at Marine Corps Maintenance Center Albany, Georgia

2001 worst maintenance center in the US, 2004 best!

MRO = Maintenance and repair organization; Military, Aviation context

Disassembly of vehicle => repair/produce damaged parts => reassembly of vehicle
CCPM SDBR CCPM

Different shipping times for different parts => finished parts lie around and are in the way!

Stock finished parts in a separate stock location so they aren't in the way; stock organization in pallets with dates, there all parts that are required at this date for this project;

Staging area: All necessary parts are:

- ø physically secured (locked down; against theft!);
- ø identified,
- ø packaged,
- ø start to put things on pallet at red line! Not before! (really? Where are finished parts before)
- ø arrive at right time = 1 day before assembly check if everything is on the pallet

Success prerequisites

- ø a lot of coaching, everyone knows CCPM, TOC,...
- ø adopted Throughput Accounting
- ø Colonel Forman: courageous, took heat from above; said Let's do it!
- ø Got the union in! they got to see it as best job security
- ø Road-runner work ethic: work fast, if no work, stop! If new parts arrive, work full-speed!
- ø Colonel Forman believed it! Built air conditioned break room in factory! Do anything you want there
- ø No-one gets fired for not working because there is no work

2004 Rumsfeld in Irak:

Soldier: Why are our humvees not armored?

Rumsfeld: "matter of physics" prevents faster production of armored humvees

But internal turmoil in Military, what can we do? Who can do it?

Albany put hand up, said, we do it!

They did it without even impairing day to day work

Friend of Davids, years later: your saved my sons life! He was in 11 Explosions, in three he would have died if not for the armor on the humvee.

Companies who fully adopt TOC benefit far more than those who make compromises and keep something

Nuclear submarines at pearl harbor

...but we are different.

Truck Company: Have you worked with a MRO? – "No, but I can do it!" And did it.

Airplane Company: Have you worked with a MRO? – Yes in trucks. – Well we are different!

Submarines: Have you worked with a MRO? – Yes, in trucks, airplanes,... - well, we are different!

Synchronized Solutions – MRO View (see picture David's presentation)

Maximal on time delivery supply chain wide

Minimal practical inventory levels supply chain wide

Improves current level of performance

Brings TOC solutions together

TOC in Japan – public works revolution

June 2003

Asked to do presentation of CCPM by Murakami Satoru, Boss of Goal Systems (did only DBR)

Kishira Yuuji dort! Er war bei Kyocera (Keramik) und ehemaliger Kollege von Murakami

August 2004

Jonah Program: Personal interest in Yuuji's work; put together CCPM plan for public works

Yuuji hired by Being Corp. as COO; Beeing software company: did cost estimation software for public works;

Dilemma: Market saturation 100% of flagship product; government spending cut in half; small companies failing, struggling

Public Works: spiraling costs, unhappy public (inconvenienced for long time); late projects cost lives!

CCPM is the Solution to both dilemmas

Kishira had contacts in construction and government; Goal: rescue construction industry

Being does basic training of employees

FY 2005 1 pilot project,

FY 2009 100% of public works construction projects on TOC!

All huge Electronics companies start to work with CCPM single project software of Being

Japan: The Choice 100 000 copies in first week

Key Learning: Anything is possible! Not intimidated by size,...

Surprise: even government can be helpful! Promised 1-day-response for all tasks on critical chain!

Example: CCPM saves 30.000 lives

Taifun season in September

2008 Dam in taifun area; below dam was community, plan: 28th of July finished; finished early! June 28th! July 5th earliest taifun ever!

TOC: The essence of Management

Given that constraints are inherent in all systems

Managing constraints is an imperative! If not, they manage you!

Successful management = successful continuous execution of projects

Managing money is most effective when counted and measured as close to cash as possible

Then TOC is more than just another improvement methodology!
It in itself is **The essence of management!**

TOC: Short and easy explanation for CEOs

TOC results in greater flow, shorter duration

More projects in the same time, and with the same resources

Holistic Project Management

Definition of successful management is continuous successful execution of projects

Everything is a project!

Successful project execution = successful company

Inventing New Applications –The 4 points of Flow

Based on the concept of Flow (Ford)

- 1) Improving flow (or lead time) is a primary objective of operations
- 2) This primary objective should be translated into a practical mechanism that guides the operation when **not** to produce (prevents over production)
- 3) Local efficiencies must be abolished
- 4) A focusing process to balance flow must be in place

Take this as guide when going into a company!

Viable Vision and Strategy&Tactic trees

Build S&T trees using 4 Points of Flow!

1999 E-Mail from Goldratt about S&T trees, but more important to do, so lost it again

Viable Vision: Reservations: too early, failed

S&T resurrected: supposed to take place of PRT in very large implementations

Now S&T trees are detailed down to level 5; software to build: **Harmony**

The S&T tree is not holy! Up to eight trees now, need more! Adapt! Change!

Invent new TOC solutions!

Eli Goldratt found his Inertia: Make to availability $\neq$ S-DBR!

Personal Growth through TOC

- 1) Reality is simple (the bigger the challenge the simpler the solution!)
- 2) Any conflict can be removed
- 3) People are good (resistance to change is a misunderstanding!)

TOC and Sales

Book: "the cash machine"

Division of Labor! Free up sales people to sell! (have specialized customer support, more team work)

Game: Attive by Zero to Quarter: Sort out Marble Eggs (business opportunity that will never hatch!) from real chicken eggs; Describes sales as a process!

Identified constraint:

High attrition business: many opportunities, few closed deals => What is the attrition rate?

What number of opportunities needs to be in process to get needed number of closures?

Idea of attrition (Ausfall) is from Halbleiter-Industrie: Monitor each process step, have right number of parts in each step;

For Sales:

= Need enough opportunities at each step! Else not enough get through/become closed deals!

Too many companies rely on superstar salespeople!

They should focus on Process! If process is sound, everyone can sell more!