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Managing Complex Organizations: A Simplified Approach

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Abstract
Complex organizations and complex endeavors form skill areas to accelerate performance. Each skill area is encouraged to do the best it can. Yet, most important work flows across the boundaries between the skill areas. Most complex organizations are essentially matrix organizations with skill areas acting like supply chain entities (each seeking local optima) while work products flow between the entities. These local skill performance measures are often in conflict with each other and not consistent with the goals of organization. This paper explains a simple method to make sure local optima equals global optima. The Theory of Constraints Replenishment measures of Throughput-Dollar-Days and Inventory-Dollar-Days can be modified slightly to achieve both local and global effectiveness in large companies. These measures can quickly evaluate where there are problems and allocate or realign resources for a much improved level of system performance. A sample spreadsheet is included.

Keywords
Organizational silos, product flow, reliability measures, efficiency measures.

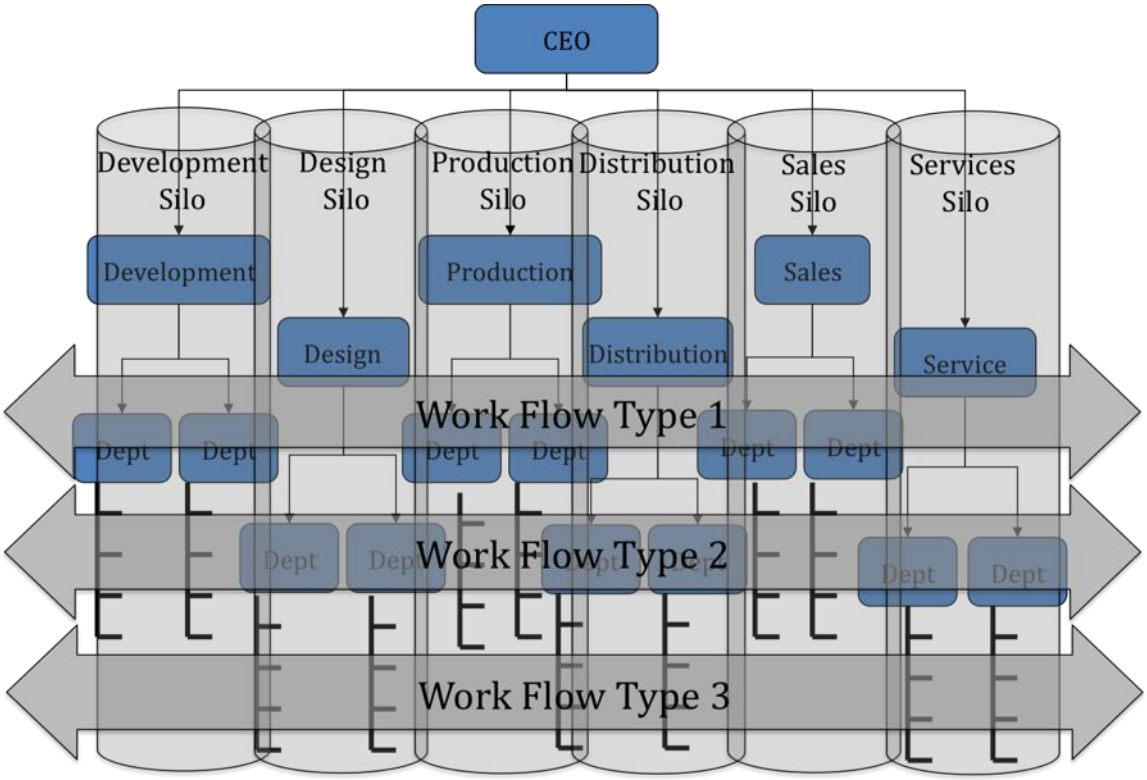
Introduction
Large companies have many work flows that go through different elements of the company. The different elements of the company depend upon each other. Traditional management tries to "divide and conquer" the management challenge by asking each element to perform to the best that it can. Local performance measures are often in conflict with each other and not consistent with the goals of organization. The conflict between organizational elements creates disharmony and reduces overall organizational efficiency and effectiveness. The first step in improvement is to have individual element of a company be reliable in meeting their obligations. The second step is to improve local elements to benefit the whole. This prepares the organization for even further improvements.

The Commonality and Enormity of the Problem
Large organizations are divided into divisions, departments, sections or offices to make management easier and to group special skills. For example, an Engineering Division may be sub-divided into the Research Department, the Development Department, the Design Department and the Production Support Department. And, each Engineering Department further sub divides itself into specialty areas. The same thing happens for each of the major divisions of the organization: Production, Sales, Distribution, Finance and others. And, each division has its departments and sub sections.

In these large organizations, each division, department, section or office has its responsibilities and assignments. And, all these offices try to perform their assigned work as best as they can. And, each division manager tries to manage the departments, section or offices under their responsibility to the best of their ability. This hierarchy of responsibility over a particular specialty area creates a specialty silo. The head of the Engineering Division watches out for the talent, skills and abilities of the Engineering Silo that includes all the departments, sections or offices falling under the Engineering responsibility. Other division heads have the same responsibility for the offices under the skill specialty.

The products, or deliverables of large organizations, however, flow across many organizational silos. The initiation of a product could begin somewhere in the Sales Silo. The planning could be done somewhere in the Engineering Silo. The execution of the plan probably occurs in many different parts of the Production Silo. The logistics of delivery and the financial matters are handled by other silos. The products flow (the physical flow, the information flow, the decision processes) across many silo boundaries. (See Exhibit 1.)

Exhibit 1. The Organizational Silos and Cross Silo Flows of Products.



In large organizations there are many different products or deliverables. Some flow across many expert silos and others flow across just a few. Figure 1 shows that most large organizations have functional matrix structures with expertise silos and cross silo products or deliverables. And, since the work flows have independent and variable demand, the workload on any silo or office varies significantly over time. And with limited resources, it is inevitable that some specific area will be overloaded from time to time while other areas may have excess capacity from time to time.

Managing many flows and the size of the many different resource pools amid an environment of variability is a complicated and complex problem prevalent in almost all large organization.

Areas Where Solutions Have Been Found That Can Help Solve the Problem

Management of large and complex organizations is similar to the management of a supply chain. In a supply chain, each element is trying to do the best it can to meet its obligations in the most effective and efficient manner in order to maximize its own profit and loss statements.

The Theory of Constraints Replenishment Solution (Goldratt, Eshkoli, & Brownleer, 2009) suggests two simple measures that are very effective at helping supply chains improve. They are Throughput-Dollar-Days (TDD) and Inventory-Dollar-Days (IDD) (Iowa State University of Science and Technology, 2013).

Throughput-Dollar-Days (TDD) is a measure of reliability. It factors both the value of the potential impact of a missed promise with the number of days late of the promise. TDD can be measured for an individual work assignment or the accumulated total TDD of all the work assignments completed by a group over a specific period of time. If the potential damage to the customer is only $10 and the delivery is delayed ten days, then the TDD = $10*10 or 100 Throughput-Dollar-Days. If the potential damage to the customer is $1000 and the delivery is one day late, then the TDD =$1000 *1 or 1000 Throughput-Dollar-Days. If an important product is valued at $4000 and it is delivered on time or before, the TDD = $4000*0 or 0 Throughput-Dollar-Days. A supplier's TDD is the total of the TDD for each item delivered over a period of time (say one month). If two similar organizations were compared doing similar work, the one with the lower TDD would be considered more reliable at meeting their obligations.

TDD is a much more accurate representation of the impact of reliability than Due Date Performance or Missed Sales. (Cox, Boyd, Sullivan, Reid, & Cartier, 2012. Throughput-Dollar-Days.)

Inventory-Dollar-Days (IDD) is a measure of effectiveness (or efficiency) of an organization or a process. IDD considers both the value and the time that inventory (or investment) are involved within the operation. IDD can be measured for an individual work assignment or the accumulation of IDD of all uncompleted work for a group at any point in time. If a process receives materials valued at $100 (generally inventory is considered at Truly Variable Cost or purchase price) and holds that inventory for 20 days, then IDD = $100 * 20 or 2000 Inventory-Dollar-Days. If an expensive item of $4000 has spent two days at the process so far, then IDD = $4000*2 or 8000 Inventory-Dollar-Days for that item. IDD for a process is the total value of the inventory times the days held summed together for all the items that the process has at a particular moment in time. IDD is a snapshot of the quantity, value and time the inventory is held. If two similar organizations were compared doing similar work, the one with the lower IDD would be considered more effective at converting input into output. If Inventory doesn't have an important value, one can use investment as an alternate value. The number of people (value in costs per hour) and other expenses considered as investment in the process can be uses as the 'value' measure in calculating IDD. Inventory-Dollar-Days is a much better representation of process effectiveness than Dollars of Inventory or Average Inventory Turns. While IDD will never be zero, the goal is to lower IDD over time (Cox, Boyd, Sullivan, Reid, & Cartier, 2012. Inventory-Dollar-Days.)

While TDD and IDD were intended to measure the abilities of members in a supply chain (TDD measures reliability of the supplier at delivering to promise, IDD measures the effectiveness of customer at converting Inventory or Investment into sales) in a cooperative environment where the supplier was paid when the final product was sold (Holt & Button, 2000), TDD and IDD can be applied to any process that has inputs and outputs. The process can measure its reliability to promise with TDD and its internal effectiveness with IDD.

The Practical Application of These Principles

In large complex organizations, almost every process is both a customer and a supplier. A process receives materials, assignments or duties from others and provides their processed work to someone else. Any individual process can track its own TDD and IDD as their own local measure of reliability and effectiveness. Any process can determine on their own, "How well are we doing at meeting our obligations to making our overall system better?" This approach is the best way to measure local efficiencies and to be in line with the overall goals of the larger system (see Exhibit 2 for each process row).

Another valuable element of TDD and IDD is that they are additive along a product flow. If there are several processes that work in sequence on an item, the measures can be added together to determine the reliability and effectiveness of the whole system. Consider three processes that work on the same items, one after the other. One can track the TDD through the processes and determine the TDD and IDD of each of the items along the flow AND for each individual process for these items (see Exhibit 2 column values for each item).

Exhibit 2. Throughput-Dollar-Days and Inventory-Dollar-Days for Individual Product Items.

Item #	1455		1446		1447	
	TDD	IDD	TDD	IDD	TDD	IDD
Process 1	0	140	15	200	10	60
Process 2	25	120	40	140	30	35
Process 3	5	70	10	50	0	30
Item Values	30	330	65	390	40	125
System Average	45	282				

Process Values	
TDD	IDD
25	400
95	295
15	150

We see that the processes were usually late with Process 2 being late the most often with a TDD of 95 over the three items. We see that Process 1 held the inventory much longer than processes 2 and 3 with an IDD of 400. The system Reliability as a whole averaged TDD of 45. The system Effectiveness as a whole averaged an IDD of 282. To make improvements in Reliability, management can focus in on the difficulties Process 2 had with Item

#1446 (TDD of 40). To reduce Inventory/Investment or flow time, management should focus on the difficulties Process 1 had with Item #1446 (IDD of 200).

The most important contribution of using TDD and IDD is the visibility it provides to senior management. TDD and IDD identify both the temporary bottlenecks in the organization (the causes for TDD) and the systemic bottlenecks (highlighted in IDD). Senior management can now clearly see where to focus its limited improvement capability to provide the best overall improvement for the organization. TDD and IDD give an aerial view of the congestion in the flow of work through the system. And, TDD and IDD defend the plight of the local manager dealing with work overload and resource shortages.

The computation of TDD and IDD can happen at any level; from individual's desks to the department as a whole. And, it is easy for any local group to do either on their own or in concert with other groups.

A sample of spreadsheet for tracking TDD and IDD in the workflow of a single organization is available at: http://private.wsu.edu/~engrmgmt/holt/em530/KeepingPromises3Charts.xlsx (Holt, 2013). (See Exhibit 3.) In this simple example, the single organization doesn't have a Throughput measure for the work they do. So, the TDD term has been renamed Value-Late-Days (VLD). In some organizations, the Throughput may be difficult to determine or assign to an obligation. However, most people can assign a value to the work they perform. If a Throughput is not defined for a work task, then a local entity can set an arbitrary value on its work and achieve similar results. (If the larger organization wants to track TDD and IDD along the flow through many local entities, then a fixed value or throughput per work item can be assigned for each of the work items.)

Exhibit 3. Spreadsheet of Value-Late-Days and Value-Inventory-Days.

	A	B	C	D	E	F	G
1	**Getting Things Done**			jholt@wsu.edu	Today-->	28-Feb-13	Current Report
2	(Add your own times, type, Throughtput Value, Recvd, Due, Cplt. Change F1 to "today()")					VLD	58
3			Value of			VID	284
4	**Item**	**Type**	**Work Load**	**Rcvd Date**	**Due Date**	**Completed**	**Days Late**
5	Franklin	Letter	10	1/5/2013	1/22/2013	1/24/2013	2
6	Bill	Exam	2	1/6/2013	1/22/2013	1/26/2013	4
7	Evens	Invoice	3	1/6/2013	2/1/2013	1/31/2013	0
8	Anderson	Claim	5	1/7/2013	1/25/2013	1/29/2013	4
9	Obermeyer	Insurance	6	1/7/2013	1/31/2013	2/1/2013	1
10	Benson	X-Ray	1	1/8/2013	1/23/2013	1/24/2013	1
11	Adams	Letter	2	1/10/2013	1/28/2013	1/31/2013	3
12	Baker	Letter	2	1/14/2013	2/12/2013	2/18/2013	6
13	Calvin	Design	18	1/14/2013	2/11/2013	2/12/2013	1
14	Dogwood	Planting	3	1/14/2013	2/12/2013	2/11/2013	0
15	Evanston	Wyoming	10	1/16/2013	2/4/2013	2/7/2013	3
16	Foster	Letter	2	1/20/2013	2/5/2013	2/11/2013	6
17	Graham	Claim	5	1/21/2013	2/19/2013	2/23/2013	4
18	Holt	Contract	3	1/22/2013	1/26/2013	1/25/2013	0

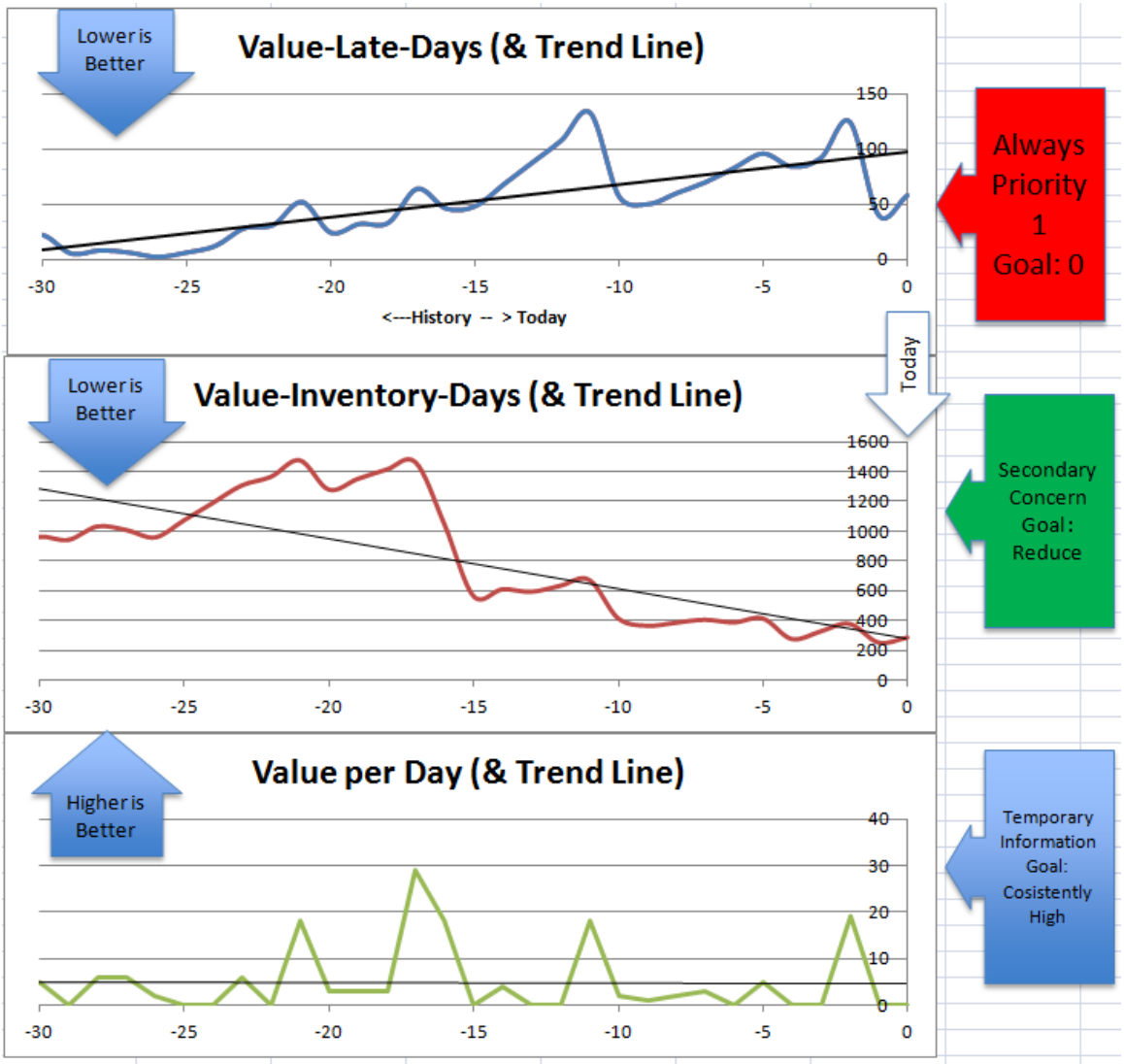
On the sample spreadsheet, the time that work assignments were received, their due date and the completion date is recorded. For work that is late or was completed late, the days late times the value of the work is calculated and added together to report the Value-Late-Days (VLD) for the reporting period (for the previous 30 days in this spreadsheet).

For each uncompleted item on the work list, the Time and Value are multiplied together and a daily snapshot is taken of the sum of all the task values and their times within the entity. This is called Value-Inventory-Days (VID).

Both Value-Late-Days (VLD is the same as TDD when the entity uses Value instead of Throughput) and Value-Inventory-Days (VID is the same as IDD when the entity uses Value instead of Truly Variable Costs for the Inventory) are plotted over the last 30 days to show the changes in the VLD and VID values with the trend line (see

Exhibit 4). A third plot of Value per Day (Same at Throughput per Day) produced by the entity is included but is only of local interest (like measuring a "personal best" level of performance).

Exhibit 4. Tracking Plot of Value-Late-Days and Value-Inventory-Days over time.



What we see in Exhibit 4 is the organization suffering with many late tasks (the Primary Measure) and Value Late Dates trending upwards until just the last few days. We also see that there is a significant decline in the time it takes to get things done (the Secondary Measure) with an improvement in Value-Inventory-Days from about 1400 VID to around 300 VID. It appears this organization is improving over time (VID going down) but is suffering from some short term overload (VLD was high).

Conclusions

In complex organizations where the workload varies, using TDD and IDD (or VLD and VID) measures can quickly evaluate the areas that need help and the times when management must throttle back the work released to their limited resources. Simple spreadsheets can track the individual entities values. A data record can track the flow of individual products.