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TYING INPUTS TO OUTPUTS

WEB BASED ENTERPRISE MANUFACTURING INTELLIGENCE

# Tying Supplier Inputs to Outputs

What you should track, expected benefits and conditions for effective operational performance management

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## I) INTRODUCTION

In today's just-in-time, lean, efficient manufacturing environment, companies continue to search for new means to improve productivity. With six sigma black belt projects, ISO and other programs continuing to yield significant internal results (one estimate states that each black belt project averages \$230k in savings), manufacturers continue to seek new programs and sources of savings.

Could the supply chain provide the ability to yield significant productivity savings?

Of course, the answer is YES.

The problem with attacking the supply chain is determining what information to track and how to measure it, and then being able to tie those measurements to internal productivity yields. In addition, the appropriate supplier relationship environment must be established to make these measurements effective.

So, what are some key supplier measurements, and how can you tie those measurements to real performance measurements? This article attempts to define some of the measurements associated with the supply chain, and their impact on productivity, production yield or other types of real operational metrics. In addition, it establishes the appropriate framework for a strong supplier relationship management program.

## II) DEFINITIONS

This article uses the following definitions to describe this process:

- ❖ Metric – The name of the metric
- ❖ How – What are the elements in producing the metric
- ❖ Where – Where does this information come
- ❖ Effect – What type of effect does improving this metric have on operations

## III) MEASUREMENTS

### A) Logistics Information

Logistics measurements, by definition, have to do with shipping and receiving. The list below shows the types of metrics and their potential effects on factory productivity.

**Table 1 Logistics Information Metrics**

Metric	How	Where	Effect
On Time Delivery	Comparing Advanced Shipment Notification (ASN) to actual delivery date	ASN – From supplier Delivery date – From ERP, SCM or other package	Allows efficient production resource scheduling
Shipping Costs	Total dollars spent on shipping	Total purchase order cost minus cost of goods purchased	Control shipping costs by understanding where resources are spent.

**B) Financial Information**

Transaction measurements are defined as the financial portion of the transaction. These measurements can include a variety of other activities, such as order entry, order processing and overall transaction history.

**Table 2 Financial Information Metrics**

Metric	How	Where	Effect
Total Spend	Sum all of the dollars spent with a particular supplier	ERP system	Potential consolidation and unit price reduction through supplier rationalization
PPV (Purchase Price Variance)	Tracking the actual cost of a good versus the contract price	ERP System	Shows individual theoretical unit cost versus actual unit cost. Allows working with supplier to correct reasons for variance.
Digitization (i.e. paperwork reduction)	The total number of paper documents divided by the total number of documents needed to perform a transaction	ERP system Logistics systems	Reducing paperwork errors can streamline operations by having all information available to the appropriate personnel at all times

**C) Quality Information**

Quality information encompasses a wide variety of measurements that can be used to improve operational productivity and improve overall supplier relationships. While most manufacturers view quality through transactional or logistics information, there are many different measures that can be used to measure quality. Quality metrics can encompass many different aspects of the organization. Once a centralized system is in place, though, these metric have the potential to help achieve real cost reductions and improvements in yield.

The table below describes some of the metrics used to track quality.

**Table 3 Quality Metrics**

Metric	How	Where	Effect
Packaging	Total number of instances where packaging was incorrect	Corrective Action Request system	Improves warehouse productivity, reducing labor and sorting expenses.
Labeling	Total number of instances where labeling was incorrect	Corrective Action Request system	Improves warehouse productivity, reducing labor and sorting expenses.
Corrective Action Requests	Total number of CARs opened against a supplier	Corrective Action Request system	Provides a means to identify consistent supplier problems, and the costs of those problems.
Paperwork Availability	Total number of instances where the appropriate paperwork was not available	Corrective Action Request system	Improves production capacity if all the appropriate paperwork is available when dock receives incoming materials.
Material Quality Variation – Conformance to Specification	Compare incoming material characteristics to stated material specifications	Incoming Certificates of Analysis (COA) and/or test results tied to material specifications.	By knowing that what is received is what is expected, material processes can be optimized.
Supplier Manufacturing Process ( $P_{pk}$ )	Statistical calculation used to determine process performance	Incoming inspection reports tracked over time	Allows manufacturer to tie incoming inputs to productivity outputs

**IV) USING THESE METRICS TO IMPROVE PRODUCTIVITY**

Now that you have determined what to measure, how can productivity gains be found? The answer lies in tying these inputs to productivity outputs.

By determining which factors relate to improved productivity allows a manufacturer to set the production parameters in order to optimize manufacturing.

For instance, in chocolate manufacturing, there are many factors which make the chocolate have the appropriate taste and consistency. These factors include raw material consistency, heating and mixing capabilities. Through design of experiments and looking at the many variables, a six sigma black belt can apply statistical methods to determine which raw material and process settings produce the best, creamiest chocolate. On the other hand, by understanding which variables contribute to lumpy, inconsistent chocolate, the manufacturer can work to eliminate situations in which those conditions arise.

By tying these inputs to outputs, a manufacturer can determine how to optimize productivity, reducing costs and improving productivity measurements.

The benefits from performing these functions can be staggering. The following are just a few of those examples:

- ❖ An automotive manufacturer reduced its defects over all suppliers from 2,000 to 700 parts per million over one year by updating supplier ratings continuously and managing supplier corrective actions on its supplier portal.
- ❖ An electronics manufacturer reduced the average time to implement corrective actions at a supplier from 10 days to 3 days by using e-mail notification and online status tracking. Another firm reduced the average time from 30 days to 10.
- ❖ An Aerospace and Defense (A&D) manufacturer reduced its incoming receiving backlog by 83% over a one-year period by catching certification documentation problems at the time of shipment.
- ❖ An A&D manufacturer improved its data integrity for quality tracking from 50% to 92% overnight by installing a system that forced data collection at the time a quality problem was detected.

## V) ELEMENTS OF GOOD SUPPLIER RELATIONSHIP MANAGEMENT

### A) Introduction

After determining what to measure, there are several other steps that must be taken to assure a successful supplier based productivity plan.

Begin with the basic elemental building blocks of any good relationship; trust, openness, factual representations, mutual concern for one another's best interests, and common or shared goals, and apply them to your supplier relationships. Chances are, that your organization fails in at least one and possibly all of these critical elements.

The chances are that high level relationships share many if not all of the following characteristics:

- ❖ Common Language
- ❖ Open and consistent communication
- ❖ Trust, sharing, and open attitude
- ❖ Predictable behavior
- ❖ Truth
- ❖ Willingness to hold each other accountable for commitments and improvement

You can imagine that if you could actively engage in all of these components of a relationship, whether it be with a supplier or with an individual, you would have gone beyond a good relationship and entered the rarefied world of GREAT relationships.

## **B) Common Language**

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The first part of a great relationship comes from having a common language in which to communicate. From the company's standpoint, it means receiving all of its information in a common format from their supplier community, and being able to use the information to make data based decisions.

For instance, a company that makes molded plastic parts must know that the common chemicals it purchases from all of its vendors have the same critical elements, or at least know those specifications before mixing the batches. By having this information in advance of the supplier's material arrival, the company can adjust their processes to make the most consistent product based on those specifications. If suppliers do not send the same information about the materials they ship, how can a company make consistent products? Even if the materials are within the specification, each lot may be on opposite sides of the specification (one supplier high and the other supplier at the mean), which may affect the final outcome of the manufactured product.

So, how do you get this information painlessly and in a common language before the materials arrive? More importantly, if the information does arrive ahead of time, is there a way to use it to be able to make decisions? When implementing a system to perform these tasks, make sure that your processes systematically help you stay ahead of your suppliers. Just as there are many shades of gray, there are many different levels of electronic communication. A common language here means having one common set of measurements, one master data repository, and various slave systems feeding data into the same collection point so that data can be aggregated, trended, analyzed, and acted upon in a proactive manner, rather than waiting for a crisis or a problem to prompt a mad dash search to try to accumulate and translate data into a meaningful message.

For instance, having the supplier's material characteristics in a fax before the materials arrive may seem good. While faxing the information is in a common "digital" format, it is essentially a piece of paper, and requires additional work to turn it into data that can be used to make decisions. Paper based data is not useful for predicting trends and behavior unless it is charted and trended. That typically only happens after a problem emerges, since it is difficult to accumulate and assimilate data into one cohesive and comprehensive picture.

Another method may have the material characteristics sent in a spreadsheet. This will put the data in a format that can be input into SPC programs, and easily compared to specifications as well as other supplier's results.

Having all suppliers' lot level material characteristics in a common knowledgebase is the ultimate solution. The difference between a spreadsheet and a common repository is that all of the data will be in one place, and quick comparisons can be made between suppliers, plants and materials to see trends and their effects on incoming processes, as

opposed to spending time and other resources to be able to make these decisions. Using the Internet to collect this data and placing into the common system is the fastest and easiest way to complete this task.

The data is speaking to you every day and in every way. Are you listening? Can you understand the predictive messages it is screaming out to you, or will you learn this language when it is too late and you are trying to explain to the world why you just didn't see the disruption or the disaster coming and being the Supply Chain's very own poster child for the Kenneth Lay Enron defense mantra, "I didn't know it was going on".

### C) Open And Consistent Communication

Simply put: a steady flow of communication in an open and non-defensive posture will unearth problems and mis-understandings early. The earlier a problem is caught, the less costly it is to remedy the problem before it festers and worsens and draws others into the fray. Many studies have shown the benefits to addressing a problem early. A paper given at a American Society for Quality Customer-Supplier Division conference in 2002 quantified these costs. The standard state of quality, assuming everything goes well, has a basic cost of 1X per lot. X is the amount of money used to perform basic testing, product qualification, manage regulatory paperwork, etc, for a material that meets the specification, has the right paperwork and does not require any additional manipulation. If the material is found to be non-compliant, it costs approximately 3X per lot. Non-compliance can be anything from materials not meeting the specifications to missing paperwork to late shipping. Finally containment costs of managing a product recall start at 5X per lot, and only go up. These costs include everything from product recalls to loss of brand equity.

It is imperative to be able to identify problems early, and then quickly put into action processes to contain and limit the risk associated with those problems.

If you measure it, or even have them measure it and report it to you, the supplier knows it is important, and will pay attention to it and improve it. However, don't settle for single discrete data points. Capture the entire trend. The Six Sigma methodology of DMAIC (Define, Measure, Analyze, Improve, and Control) defines this process. You can't do this in an isolated vacuum, and you can't do it on a single data point. Force yourself to read the messages you are already getting, and probably dead-filing one document at a time. String those documents together in one comprehensive sentence, and you may be getting "HELP" signals that can avert a disruption or even a tragedy.

Having a digital solution may speed the process of problem identification and management. For instance, in the material specification case previously mentioned, having the information digitally shortens the process of finding trends, and therefore, catching problems.

As an example, a manufacturer was noticing a trend in their incoming material characteristics. While the materials that the supplier was shipping were within the manufacturer's specifications, the SPC calculations showed that the supplier's processes were drifting out of control. The manufacturer immediately stopped all shipments and had the supplier look into the issue. It turned out that their processes were drifting, and that the supplier was in jeopardy of producing materials that would have adversely affected the manufacturer's products down the road. The containment costs were relatively minor, but the costs that were prevented were tremendous.

The lesson is that the speed in which this happened was over a 24- hour period. The manufacturer used a variety of software tools and communication mediums to stop the shipments from the suppliers before the infected materials entered the manufacturing processes.

### **D) Trust, Sharing And An Open Attitude**

Treat the supply chain teammates with the appropriate sharing, trust, and openness. Do some introspection about the supply chain. Do all of your suppliers know what are your current specifications and revision levels? Do they know your design goals? What about your cost objectives? Do they know how they have performed from your perspective over the last quarter? Last year? How they compare to others in your chain? How they can be more impactful? What are your quality standards and audit expectations? Do they know you have chosen to differentiate yourself in the market by cost? By innovation? By customer intimacy? Do they know how they should behave differently as a result?

An open knowledge-base to allow free flowing and real-time communication and data sharing leads to new epiphanies, new innovation, focused performance and the best chance of collectively behaving as one integrated well oiled machine who must embark on continuous improvement or risk getting behind the competition.

### **E) Predictable Behavior**

Like individuals, corporations have distinct personalities or cultures that are predictable and provide clues and insight into how they will behave in pressure circumstances and almost always these collective behaviors have un-intended consequences.

Does your company manage to the quarterly pressures of Wall Street earnings expectations? Do they have a long -term strategic view of the market and insist upon quality above all else? You have to use data to pick up the clues as Sherlock Holmes might do. Your company is also sending signals to your supply chain partners about it's own beliefs and behaviors despite whatever is written on the lobby wall stating the Mission, Vision, Values, and Quality policy.

For example, if your company is a slave to the quarterly earnings and stock prices, you probably find yourself in a chaotic reactive fire-fighting mode at the end of each quarter. Your sales team is out making big discount deals with your distributors in the last day or two of the month. Once you signal this, you have trained your channel to wait until the very last minute to place orders at big discounts. You are then in the un-enviable position of having to produce two month's worth of production in the last two days of the quarter. Your schedules are fluid and your quality standards are relaxed. Everything is an inefficient rush and you know this is crazy, but you can't show your corporate officers what this is costing you in time, money, rework, returns, field service, and even recalls or brand erosion.

With only anecdotal evidence, your protestations fall on deaf ears. By being anecdotal, you are also signaling to your suppliers that the marginal product they may want to dump now has a home in your production line, so long as they become the hero and ship it to you during the last two days of the month or quarter.

With a comprehensive and integrated knowledgebase tying your supply chain in with facts, you can show the trends and the costs and the behavior of each participant in the chain. You can tie cause and effect together to show that those quarterly rush orders are costing an extra 10 points in margin from the distributor discounts, supplier performance erodes causing rejects, poorer incoming and first pass yields, field failures and returns tracked by the lot, and even analyze trends from different parts of the world or regions or notice patterns by line item by temperature or humidity or cycle times having adverse effects on your yields.

Remember DATA is the antidote to anecdotal.

## **F) The Truth, Holding One Another Accountable and Continuous Improvement**

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In this data driven supplier relationship, you will each be dealing with the plain old unadulterated truth; rather than debating with anecdotal evidences and perceptions. You will hold one another accountable for top grade performance. You, on the quality of your documentation and expectations and your suppliers, on their responsiveness, creativity, root cause analytical ability, yields, costs and just about everything that can be measured. Instead of being in the same old co-dependent relationships that are holding each of you back from being world class, you will have no choice but to journey together toward continuous improvement, higher degrees of success and performance, and winning the war for market position that ultimately determines your wealth , longevity, and success.

Several papers indicate a number of benefits realized by digitizing supplier processes. Giving suppliers real-time Internet participation in quality processes can reduce defects, non-conformance/corrective action cycle time, and COPQ by up to 67%.

Reducing the cycle time for notification and correction eliminates additional shipments of bad parts. Suppliers realize their responsiveness is being tracked and implement corrective actions faster. The systems documented the cost of poor quality, so manufacturers could charge back suppliers for extra indirect labor related to quality problems.

### **G) Conclusion**

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The digital age has provided us with many opportunities to improve our relationships with our suppliers. We now have the opportunity to take greater advantage of the communication tools out there to move away from small steps to leap frog jumps in supplier relationships. By digitizing processes, sharing information, and moving from anecdotal to data based decisions, the whole supply chain benefits from improved products, streamlined processes and overall healthier supplier/customer relationship.

## **VI) ABOUT THE AUTHOR**

Dan Creinin is a degreed industrial engineer from the University of Illinois. Mr. Creinin has extensive startup experience, having worked for a variety of software, hardware and consulting companies. Having spent his entire career in technology marketing, Mr. Creinin's current responsibilities include all marketing activities for EMNS' GSQA Web Based Enterprise Manufacturing Intelligence software. Mr. Creinin is currently the Vice Chair of Marketing for ASQ's Customer-Supplier Division.

Mr. Creinin is also a lifetime Chicago Cubs fan, and is trying to tie cause and effect to their continuous losing streak.

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