

Seradex White Paper

A Discussion of Issues in the Manufacturing OrderStream

Manufacturing Data - Its accuracy, collection and use

During the past several decades, managers have expended great effort to stay abreast of the latest information technologies (IT). Despite this effort, managers still do not have the accurate, timely, and useful data they need to be effective. Data failures are embarrassing and costly. No industry--communications, financial services, manufacturing, health care or government is immune. The garbage-in, garbage-out syndrome is more pervasive than ever. , even generally tolerant ones, are especially angered by poor quality data that affect them personally (like billing mistakes); the employees who must interact with those customers feel the impact.

There is a natural human tendency to assume that "if it's in the computer, it must be right." This is especially true for people who do not know how the original data was collected. Thus, less experienced users are more easily victimized by bad data.

Can data collection make me money?

Seradex has initiated several broad based programs to determine and eliminate the root causes of poor quality data.

We have found that:

- Many managers are unaware of the quality of data they use. Poor quality is the norm not the exception.

- Most corporations spend enormous amounts of money finding and fixing bad data. Inventory write downs, invoicing errors, improper costing and sales information, incorrectly manufactured products, late shipments and delayed financial reports. Accurate profits every month permits more intelligent management decision-making during the year rather than crisis actions at the end of the year to recover from serious "surprise" write-offs
- Poor quality data sabotages strategy, tactics and operations.

Identify Poor Quality Data

According to a recent survey by ComputerWorld, almost 67% medium and large companies admitted to problems resulting from inaccurate, outdated, or missing data. Companies who are committed to data quality are in a strong position to tackle the problem.

MIS organizations typically spend their time figuring out how to move and store data better and faster without spending any time trying to improve the quality of data.

The timely and accurate acquisition of data is crucial to make informed decisions in ever compressing time horizons.

What data is collected from the floor?

In order to analyze and improve data collection it is useful to review what data is commonly collected from the shop floor. Time and attendance, scheduling, inventory movement, costing and quality information (SPC, ISO900) among others are routinely collected by small and large manufacturers alike.

Typically companies have not integrated any of these systems. This extends collections efforts, duplicates data and is the source of many errors.

Integration is the Key

By establishing a "data collection hub" the collection efforts can be integrated into a single system. The data can then be sliced, diced and shared. As an example in our hypothetical company John spend 8 hours on a lathe working on work order 1.

Typically:

- John fills out a time sheet, which is approved by his supervisor and sent to payroll.
- He records SPC information on a paper form.
- He marks on the Work Order the completed work. This updates the schedule
- An accountant has come into the plant to establish the standard costs for the operation - this is on another paper form which is then entered into a computer.
- John signs a material move ticket which is sent to inventory control and key entered into the computer

Utilizing bar code data collection technology all this information can be completed using 8 or 10 swipes. The information can then be sent

electronically to payroll, costing, scheduling and quality.

We are now dealing with a single database and have much more control over data integrity, flexible reporting etc.

Data Quality

There is no debate, if manufacturing is to be planned and controlled effectively there must be accurate data. There is also no debate that in most companies the data in the key manufacturing records contains a high percentage of errors. Therefore manufacturing cannot be planned and controlled effectively in most companies.

There is also great skepticism that any data quality effort can succeed. It is accepted by many managers without question that achieving a high level of accuracy will involve a massive effort and very high costs. This conclusion is based on the large number of transactions occurring. Such pessimism is understandable.

Couple this pessimism with the lack of quantifiable data of the costs resulting from errors in records and you may conclude that the situation is hopeless and any actions would simply be a waste of time.

We have found that average people can keep good records, it does not cost very much do so and there are large tangible benefits that far exceed the collection costs. The only alternative to accurate data is a continuation of record errors, informal systems and the high costs of operations in a poorly planned and uncontrolled environment.

There are five prerequisites in the development of accurate records:

- High expectations
- Data Ownership clearly assigned
- Measuring accuracy
- Fixing root causes of data errors
- Data Collection Tools

Reviewing each of the five steps required to achieve high levels of record accuracy will soon show convincingly that the out-of-pocket costs can be very small. All of the requirements represent simply sound management and involve very little expenditure of money. Eliminating errors can be done quickly, incur little cost and generate very real savings.

High Expectations

Generating a climate of high expectations means instilling a "zero defects". Errors cannot and will not be tolerated. Attitudes among those who handle important data in manufacturing must be similar to those in medicine, dentistry and commercial flying where accidents and errors are just not acceptable.

Data Ownership

Assigning to individuals responsibility for maintaining accuracy in specific records they work with is fundamental for control of errors. Few job descriptions contain any reference whatsoever to the needs for handling data accurately. Many line manufacturing people refuse to accept responsibility for data integrity because "our job is to make the products, not monkey with paperwork."

However, computers handle wrong numbers as easily as the right numbers. And many decisions and actions are triggered by shop floor data. Inaccurate data triggers the wrong decisions and ultimately some crisis. People in material control, purchasing and scheduling activities

must rely on shop floor data and they cannot validate each piece of information.

Many crises on the factory floor can be traced back to data errors in reporting the wrong quantities, incorrect part numbers or improper orders. There are others, of course, who pay a high price for record errors; principal among these are customers who don't get deliveries when they want and need them and companies which support excess inventories they don't even know they have.

Measuring Data Accuracy

A well-known management principle states that you cannot control what you do not measure and this is especially true of record accuracy. The technique required to do this, cycle counting, has been receiving increasing attention and experiencing new developments. The technique is not limited to on hand inventory balances and has been applied equally effectively to bills of material, customer order files, released purchased and manufacturing orders and other important manufacturing data.

Fixing root causes of data errors

Properly conducted, the identification and elimination of the root causes can improve record accuracy levels remarkably quickly. At the beginning of any program to improve the validity of records many errors will be found and many causes detected. A good manager will identify quickly the vital few causes which affect many records and work on these first.

A key to the success of the whole record accuracy program is establishing a tolerance range within which the record will be considered accurate. This tolerance range, called the "significant error limits," will be

dependent upon an item's value, availability and method of handling and counting. For expensive electric motors, chemicals, machine frame castings, air conditioning units and the like an error of one will be unacceptable; the tolerance range is plus or minus zero.

For mass-produced items measured with counting scales, a range of plus or minus 2% is adequate. For low value packaging materials, fasteners, commercial hardware and similar items a tolerance range of plus or minus 5 % is probably acceptable.

Data Collection Tools

The proper data collection tools minimize activities that people do not do well such as transcription, format changes, data entry, and so forth. The necessary tools for accuracy include bar code readers, EDI, software validation and eliminating duplicate data entry wherever possible.

Key characteristics of data collection tools include:

- (1) Collecting data as efficiently, accurately and be cost effective by avoiding time-consuming keying and rekeying of data.
- (2) Be simple to use require minimal operator training and support
- (3) All manufacturing information, wherever generated, will reside in a single industry standard multi user relational database.

Benefits

To reach world class manufacturing data must be analyzed and acted upon. During this process, data must be shared by the shop floor, engineering, quality control, and management. The faster data is circulated, the sooner it can be acted on.

Scheduling

You will be able to display dynamic information regarding production, idle time, machine downtime, auto mode active, if you need to send a message to a specific machine tool operator, it's no problem.

Time and Attendance

Time cards make accurate cost allocation difficult.

For example, when a worker received a shop order, they are supposed to report the time the product was being worked on. Traditionally employees complete their time cards at the end of the shift. It is almost impossible to accurately record all of their activities that day and this data is frequently inaccurate. Statistics show that the average time card requires 12 minutes of time for the operator to complete and office personnel to enter the information into the payroll system. This amounts to one hour per week or 50 hours per year per employee.

Additional expense is often spent entering this data into job costing or routing data bases.

If we can collect his electronically it will be accurate and we can use the same data to feed not only payroll but costing and scheduling. All this at a cost of only several hundred dollars per employee. The payback on these systems is frequently measured in weeks.

Job, WIP and Inventory Costing

This data is also required for SPC, Scheduling, Job Costing and Inventory. Other data that will be tracked by the system will include:

- No. of Scrap Tickets
- Dollars Scrapped
- No. of High Priority Work Orders

Emergency Breakdowns

Factor	Scheduling	Costing	Payroll	MRP	SPC	ISO9000
Real Time Information	Reduce Cycle Time On line status reports Where is the order? When will it be complete? Instantly communicate schedule changes to entire company	On line WIP	On line Payroll	Real time on hand inventory	Don't make more defective parts waiting for results	Record that a operation was performed
Accuracy	Accurate set up and run times Accurate Routings	Ensure labor and material standards are accurate	Eliminate payroll errors	Accurate BOM's Accurate on hand inventory		
Customers	Improve on time deliveries			Eliminate delays from missing parts		
Audit Trail	Monitor labor productivity against standards	Dollars and reasons for scrap by employee, work center and operation				Lot and serial number tracking
Decision Support - Shop Floor	What should be worked on next					
Supervisors	Reduce unplanned overtime Employee productivity is measured	Eliminate waste	Automate time and attendance			
Management	Accurate real time data for feedback Generate accurate reports on demand Capacity info. for capital budgets Evaluate savings from set up reduction Evaluate plant layouts Analyze labor & equipment efficiency	Pricing Product Mix Customer Profitability Product Design Production Operations improvement priorities				
Reduced data entry time	✓	✓	✓	✓	✓	✓
Eliminate paperwork	✓	✓	✓	✓	✓	✓
Reduced data entry cost	✓	✓	✓	✓	✓	✓
Benefits		Data for Activity Based Costing Machine downtime Monitor yields		Items don't get "lost" in warehouse		view auto cad drawings ensure correct materials are used Engineering change notices

MRP

Companies are installing a very expensive and very powerful MRP II system, but the whole system could collapse under its own weight.

They also wanted their newly implemented MRP II program to be class A certified. This required inventory accuracy to be 95% or better, consistently.

The process of taking the annual inventory count costs the company in production downtime lost productivity. Usually worksheets are manually filled out and sent to the accounting department, which would begin a week-long project of reconciliation.

The material transfer reports, which comprised a paper shuffle that plant-floor workers had to perform each time they needed materials, used to take a total of 20 labor-hours each day. The bar code system can automatically track each transfer, including location and time. As a result, the need for such reports has been eliminated.

Because the accounting department doesn't have to depend on scribbled notes from the shipping clerk, errors are down. And since the labels are printed automatically, the shipping labels look more professional than the previous handwritten ones. But it has to be considered an important benefit. Reduction in many operating expenses including extra set-ups, the use of substitute materials and alternate operations, air freight for urgently needed materials and a surprising number of additional expenses which are incurred when it is found at the last moment that material thought to be available was really not on hand.

SPC

SPC software is an essential tool that helps companies meet tight tolerance and minimize errors and scrapped parts. Currently SPC is rarely integrated with other data collection applications.

The benefits of running SPC software on a network include:

- Reinforces work team cooperation & eliminate paper
- Instant color charts and control limits on line give immediate process feedback and allows running within tighter parameters and reduce scrap
- Allow E-Mail between the operator and the supervisor such as alert messages for a violation of a control limit.
- Extensive history of operating capabilities for different variables, such as machines, tooling, operators, and process techniques can be established.
- Automated gauging, analysis, and reporting of quality control information.
- Assists ISO 9000 certification through accurate communication of required procedures to each work center.
- Reduce cycle time by reducing delays for QC data to be processed and approved.

Batch vs. Real Time

This is an argument that has been waged in accounting for a decade. In real time data collected automatically updates the data base. While this is conceptually appealing there is an opportunity for incorrect data to pollute the data base. In some cases where status data is collected like SPC measurements, machine stoppage etc. real time display is beneficial.

In a batch process transactions are first stored in temporary file. After

an approval/editing step by a manager or supervisor and the creation of an audit trail a final "update" to the real data base takes place. For transactional type data - hours worked against a job, scrap tickets etc. an extra validation step is warranted.

Reporting

Many different reports are generated by the system. Defect reports are closely scrutinized. These can be generated by employee, work order, part, operation, or defect code and can be presented in a summary format such as the total number for each defect code, or a detail format that lists all pertinent information about each defect. Quality, on-time delivery, and cost data are now being compiled and monitored by teams. This information is charted to demonstrate continual improvement. Reports are also generated based on time and attendance, labor, and WIP data.

Security

To prevent catastrophes, operators should only have login access to SPC data for read/write purposes and no delete capability.

Only allow operators access to the workstations they will be using, and running a regularly scheduled automatic or manual backup program.

Infrastructure Benefits

Once the infrastructure for automatic data collection has been installed many other capabilities emerge.

Drawing Files

Files from popular CAD programs could be called up on the floor and examined.

- Ensure that a part is never produced to an out of date drawing again
- Eliminate or reduce paper drawing files

- Assist with ISO requirements that operators are aware of latest revisions
- Allow operators to attach comments to a drawing suggesting improvements or tips for other operators.

DNC - the communication between CAM and CNC machines is enhanced. CNC machines have very limited memory. This is a holdover from the days when programs were fed to CNC via paper tape and large amount of RAM was not required.

- All walking back and forth between CAM and machine tool should be eliminated the operator should never have to leave the machine for any programming issue.
- Display multiple parts programs and be able to edit and transfer any of the files to any of the machines while the machine is running.
- If the operator makes changes the network file will be instantly updated.

E-Mail

By giving everyone access to E-mail the teamwork process is enhanced. Simple questions can be easily answered without operators leaving machines, without holding as many meetings and by getting engineering, management and supervisors exposed to more feedback and information.

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