Performance Measurement Drives Enterprise Resource Integration

Control Instruments Corporation is a manufacturer of instruments and systems for the detection of hazardous gases and vapors. Our equipment is used in such diverse settings as the Alaskan pipeline, magazine printing presses and submarine generator rooms. In the summer of 1994, we implemented new Enterprise Resource Planning systems and techniques with the help of Management Alchemy. The project included employee training, improvement programs, computer hardware upgrades, and the installation of an Enterprise Resource Planning information system. One year later, with everything up and running, the company has made measurable improvements in productivity and profitability.

In the course of making these improvements, the management and employees of Control Instruments found the truth contained in some simple, but essential business axioms, and came up with a few of their own. This article tells the story of our company's journey on the road to manufacturing excellence.

Goals and Controls or Knowing what to do

If you don't care where you're going, any direction will do, but how will you know you've arrived?

Without clearly defined goals, most organizational efforts become diffused and weak. Cohesion is lost as individuals and departments fight to optimize "their own" efforts at the expense of the whole. Informal, uncontrollable systems of work spring up, turf wars and petty battles erupt, all taking a toll on morale. To make any progress, a few clearly-stated, company-wide goals are needed. And to keep these goals on track, key measures must be taken constantly and reported regularly, so that everyone knows how the company is doing.

We've known about the value of planning and performance reporting for years, because we've worked against a written business plan since 1985. In fact, the success of our strategic planning was one of the reasons Enterprise Resource Planning (ERP) was so attractive to us: steadily growing sales volume was starting to reveal the limitations in our manufacturing operations, and we were having problems keeping up. To keep on our strategic course, we had to marry the strategic and operational elements of the business into a comprehensive plan.

The specific, measurable goals we set for ourselves fell into two categories. First of all, we wanted our customers to be happy, which meant satisfying their expectations regarding price, delivery, and quality. And we wanted to be happy too, which meant satisfying our own profit and Return on Investment (ROI) expectations. After investigating our options, with the help of Dom Luzi of Management Alchemy we selected ERP software to enable us to reach these goals.

The People -Everyone is invited

Sometimes the biggest parties are the best.

We began the ERP project with the premise that our success would be based 75% on people, and 25% on computers. Our first goal was to get everyone involved; the more people actively engaged, the higher the chances of success.

While our business planning takes place largely on the management level, the ERP project reached out to every single employee. Everyone was involved in assessing the situation, setting goals, collecting data and reporting performance.

Initially not everyone participated or came to easy agreements, but that was okay. Martha Baumann, the leader of the project team, relates, “Having a large number of people involved helped, and not just to handle the volume of work. Differing perspectives, even opposing views, actually helped to form group cohesiveness. Because everyone was included in the discussions, and even negative opinions were listened to openly, individuals felt directly involved.” Over time, a core group of motivated team members awakened the interests of the complacent. About 25% of employees were consistently active in the project. Overall, about 75% of the employees were actively involved in implementation and improvement efforts.

We started out giving every company member from 24 to 40 hours of video training, using a guide to MRPII techniques by David W. Buker Inc. & Associates. The video training became the basis of extensive training sessions conducted by Dom Luzi, of Management Alchemy. Mr. Luzi led cross-departmental groups through video review and discussions, organization of the steering committee and project team, and development of an implementation plan.

In committing so much employee time to video training and group discussions, we were worried that it would cripple factory capacity. But the enthusiasm and improvements created during the training easily compensated for the classroom time. We had our highest shipment month in the company’s history at the peak of the training period. The payback to education is immediate.

Stepping Forward

Volunteers rise to the occasion, regardless of management expectations.

The ERP implementation team consisted of non-management employees who met with the president once a week. At first, using non-management employees for the project team seemed a radical approach, but it proved to be highly successful.

As Bill Ennis, Production Manager, explains, "There was an opportunity for those (mostly quiet and unassuming) people to step forward and take action. Every manager was surprised at least once by seeing unexpected performance from one of their people. You just couldn’t tell for sure in advance who would be the one to see it through. We (managers) would’ve missed out if we had relied solely on our own expectations and just assigned tasks." Martha Baumann concurs, "Groups of people who used to fight each other can now work together. During the project they

got insight into each other's jobs and could see what the other person did and how it related to their own job as well as the big picture. "

Sharing the numbers

Most people are naturally suspicious of statistics, except when they produce them themselves.

Our performance measurements required a willingness to provide all employees with access to the computer system. Even though non-financial employees could and did make some beginner's mistakes, collecting, monitoring presenting and acting on the measures was (and still is) everyone's job. It's not a secret process solely in the domain of number-crunchers or Information Technology Specialists aka bit twiddlers.

Initially, volunteers gathered and posted performance measures right in the work centers. These rough cut numbers proved valuable, even if sometimes a bit inaccurate; they got everyone thinking about the job instead of just doing it the same old way. It fostered a sense of ownership in the process, while individuals came up with improvements that often surprised their managers.

Martha Baumann relates, "Prior to this project only a very small handful of the people on the floor—shipping and receiving, the stock clerk, and the floor supervisor—had access to, or reason to use, the computer system. Now almost everyone uses the ERP system on a regular basis. For the most part they do the transactions themselves. It improves timeliness and helps give people an understanding of what's going on."

As we "cut over" each new software module for a particular function, the related performance measures were performed by the ERP system, making them painless to collect.

There is synergy between motivation and measures

The generally intangible ingredients for success-like innovation, cooperation, and perseverance-show up as improvements in the reported measures; this feedback fuels the effort toward further improvement.

When we got everyone together at the start of the project, some people were more enthusiastic than others. But we noticed a big change when the hard numbers started to go up on the walls. People responded positively to the feedback. The group that had been working from the start got a big boost when they saw the results. Some of the "wait-and-see" people jumped into the effort then. Reporting the measures made progress visible, and this visibility inspired people, which led to continued progress.

It can’t be done. Or can it?

Limiting beliefs are self-fulfilling prophecies.

Some of the limiting beliefs we came up against were deeply entrenched in our old way of doing things. Yet, we forged ahead with a willingness to take a chance that our old ideas were wrong. Today, it would be difficult to find anyone in the group who would claim to have held these ideas. Here’s a small sample of what we overcame:

- *“We’re not ready for ERP / MRP II.”*

This sounded too much like the “I’ll start Monday” promise made by people needing to diet or exercise. Inertia can provide some pretty reasonable arguments for delaying action. Luckily we quickly learned that there were immediate benefits to beginning the program. For example, we immediately gained greater clarity about operations following our first MRP run. Which we did within the first two weeks of our effort.

- *“If we reduce inventory, we’ll increase shortages and never be able to deliver.”*

It seemed logical to think that lower inventory would create havoc on delivery, but the Interactive software gave us a quick, clear view into inventory that enabled us to reduce shortages while reducing active inventory over 50% in one year. A team comprised of Engineering, Purchasing, and Manufacturing people now use the shortage reports to prevent and correct for overdue purchase orders.

- *“Building more frequently in smaller lots is inefficient.”*

We were choking the floor by launching work orders in quantities above demand levels purely out of the “bigger is better” perception. By cutting our lot sizes, we freed up capacity and material for actual demand, and ended up with greater efficiency in every work center.

- *“If we are to expand, we’ll need more people and floor space”*

We brought as much outplant work as possible back in-house to get our quality and engineering revisions under control and to reduce our lead times and lot sizes. After an initial struggle, we ended up without additional personnel and with a 50% increase in the volume of shipments.

- *“You have to exaggerate the forecast to compensate for poor completion rates.”*

Sales and Manufacturing learned to trust each other. Rather than trying to overload the schedule to make up for expected shortfalls in output, the sales people learned that production could adapt to new priorities and changing demands by putting material and capacity to use where it was most needed. This resulted in higher completion rates and improved delivery performance.

- *“Running a formal ECO system is too complicated”*

A formal Engineering Change Order system was thought to be too burdensome, but it was our informal system that was killing us. Our informal system had no way to combine related changes, and the current manufacturing revision level was not always clear. Revising subassemblies to the latest revision level was a huge headache. There was a blizzard of paperwork—over 2500 folders per year—and a lot of confusion. Using the built in ECO software with integrated Bills of Material, Inventory and Shop Floor Controls modules, really helped. Changes to related subcomponents are all properly synchronized. Combined with reductions in lead times and lot sizes, the ECO software has eliminated the problem of obsolete WIP. We have reduced the number of ECOs to less than 200 coordinated changes over the past year; this low number makes it possible to review each change in a meeting of cross-departmental representatives.

Success is getting it done on time

Sooner or later, almost everyone gets to the goal. The successful make sure they get there on time. To be meaningful, goals must have specific deadlines. To stay on course, frequent position checks are necessary.

Prior to implementation of the resource planning system, each department manager spent the two weeks after month-end gathering data and assembling a report. Because the data was assembled manually, mistakes were common. The time wasted in preparing reports was terrible. And to add insult to injury, by the time the report was finished the data ended up being old and not very useful.

We found that the best way to reach goals on time was to monitor our daily progress. We were sailing for the new world, and we quickly learned that we needed to check our “compass” every day. We couldn’t afford to wait a month or even a week to find out what was happening. Our old computer system was incapable of quickly providing the information we needed, and this led us to hardware and software changes.

Today, our system automatically collects the data and produces reports in minutes, with just a few keystrokes. In the weekly Sales and Operations Planning meeting, it takes about an hour or two for representatives from each department to report against goals, discuss issues and make adjustments to plans. At our monthly management meeting, we quickly and accurately report performance against the business plan, project the coming months, and make adjustments to keep on track.

On the Road to Plain Vanilla

A few thoughts about a favorite flavor.

When it came time to select software, we initially thought we would have to customize the modules to suit “our special needs.” This belief came was based on our earlier experiences with software that came with unfulfilled promises and required extensive modifications. We soon realized that what we really needed was a software package that came “in plain vanilla” as a completely integrated solution to all aspects of operations, including purchasing, manufacturing,

engineering, service, sales and finance. We were prepared to sacrifice the tailoring of the package to each user's perceived needs, rather than to accept the risks that come with a lot of modifications.

Most importantly, we needed to run a two-tiered master schedule (with product configuration), as well as a closed-loop system based upon percent performance to plan. We had been unable to obtain these two features with our old system, despite significant, and costly, custom programming efforts.

Adapting some of our methods to the software, instead of rewriting it, even led to improvements in our operating methods. Since the system we selected was very well-conceived and completely integrated, it was a natural fit with the manufacturing management techniques we were striving to implement.

The Manager of Production, Bill Ennis, found a virtue in the use of a "plain vanilla" non-customized package: "We sometimes found ourselves stalled in mapping out our existing processes prior to implementing new software modules. Eventually we realized that these particular processes were often too convoluted to map sensibly. They were the remnants of old manual systems that had been converted into a customized computer ('We're special, remember?')."

Ennis adds, "We made progress by reviewing each of the software modules in a pilot program. We used the structure and the transactions of each module as a template for our new processes. This method was so successful that we were willing to simply start from scratch where needed, rather than to convert existing processes."

In the end, we realized that being able to customize easily can be a disadvantage. Customizing makes it too easy to convert poor work methods onto a computer and run the same old way. In the end, what modifications we did make to the module were not very significant. We were not as unique as we thought.

Implementation

Family Feud

To build or not to build, that is the question.

"Balancing demand by family"

Control Instruments produces a wide variety of industrial sensors, controllers and monitors that customers "mix and match" in many different options and configurations. These components are integrated into a final sales order that is completely assembled, checked out, calibrated and stability tested in the factory prior to shipment.

Many of our products have unpredictable customer demand. We sometimes obtain a single large order that can represent several months' worth of typical production rates for one of our product lines. At others times we can receive a single unit order for a unique combination.

We knew that success depended on creating manufacturing strategies for all of our products. We began by assigning every item to a product family. Once the families were defined, the Marketing and Sales department worked with Production to establish the delivery requirements for products in each line, based on marketplace expectations. We then set up inventory levels for finished and raw material by family.

The software then automatically maintained all transactions, and allowed us to take measures, by product family This increased organization let us see problems that were BIG, rather than just annoying. We learned to see the problems brought on by pushing too much material onto the floor, and were able to increase efficiency. When things got too tight, we were easily able to change the schedule to build to actual demand and prevent work on unneeded goods from clogging the floor.

Baby Pictures

To really see the kids grow up, take snapshots now and then.

As a result of organizing our plans and measures by family, we got our "baby pictures"—the first comprehensive, detailed look at operations. As the operation improved, it was gratifying to see these pictures change. Some snapshots we really enjoy:

- *Inventory Dollars by Family*
- *Inventory Turns by Family*
- *ROI by Family*
- *Work-In-Progress Valuation*

At the start, our aggregate inventory stood near $1.5 million, and our inventory was turning at about 2.0 times. We did not clearly know what parts in our inventory were obsolete or slow moving. We had attacked the problem of inventory turns without success for a number of years. Worse yet, it was all we could do to prevent inventory growth from outpacing sales growth.

Eventually we learned that a functioning master schedule with good input from sales and production and purchasing was the key to shrinking inventory. We couldn't make progress until all areas impacting inventory were addressed. This included engineering. Because our bills of material were structured as engineering bills, not production bills, our cycle times were extremely long. There were cases where work-in-progress was obsoleting in place.

Report Cards

Good grades don't require much explanation.

“Percent performance to plan”

Our weekly sales and operations planning meeting has become the mechanism for closed-loop control of operations. Every week we measure and report on:

- Sales bookings performance to business plan, current month and year-to-date
- Sales forecast against business plan, three month projection
- Shipments performance to business plan, current month and year-to-date
- Shipments projection against business plan, next three months
- Production plan against sales forecast, three month projection
- Capacity by work center, three month projection
- Work center performance
    - Completions
    - Late
    - Short
    - Rescheduled
    - Inventory accuracy
    - Released capacity
- Weekly performance to master schedule by product family
- Weekly purchase price and work order cost deviations
- Weekly purchases, receipts, bookings, and shipments by family
- Weekly review of master schedule by family

The weekly meeting was also an informal barometer for our status as a team. In the beginning, the meeting seemed endless, upsetting, almost counterproductive. There were countless crisises to address, and arguments and fault-finding. Over time this meeting has become short and sweet, almost pleasant. It took simultaneous efforts on many different fronts to bring this about.

Little Rascals

Unless they’re looked after, WIP “Orphans” can be real troublemakers.

At the beginning of our investigations, we collected the equivalent of an entire week’s worth of production in various states of nonconformance from hiding places throughout the floor. All of it was aged anywhere from a few weeks to a few months. None of it had showed up on the old system. Most of this material ended up as scrap. Even items that at one time could have been completed or repaired were now obsolete.

We found a cure in a formal Material Review Board (MRB) system integrated with the Shop Floor Control and Inventory. Nonconforming goods are given a disposition quickly, and those to be repaired are immediately put out on work order. Most of the nonconforming goods can be repaired back into the flow within a few hours, so we don’t have to accelerate the schedule to

replace the “disappearing” items. By looking at failure rate statistics captured during MRB transactions, we found a relatively small number of items were responsible for a disproportionate number of defects, and could concentrate on improving these items. This helped cut our gross reject rate in half.

Good Housekeeping

Passing the white glove test

Rejects aside, we could also see WIP filling racks and bins throughout the floor. This was diverting labor and material from other desperately needed goods, causing shortages and delays. In some cases, the material was turning obsolete before it could be completed.

After the “orphaned” goods had been removed from the floor and dispositioned, the stock room reorganized, and work centers given formal stock locations, we began to reorganize the work centers. We “phantomized” sub-assemblies in the bills of material to maintain the engineering structure, but built finished goods using less work orders in smaller lots with shorter lead times. When lead times were reduced, pools of material that had been all over the floor began to dry up. As it did, we took down the racks, cabinets, benches and boxes that had been informal storage areas and threw out.

For example, the timeliness and accuracy of material transactions was poor: this caused shortages, overdue work orders, inventory inaccuracy, expensive spot buys, and late deliveries. We measured inventory accuracy in each work center using a 10 to 20 part audit system, with daily counts. We trained everyone to make their own transactions as they moved material. We relocated stock to the floor to reduce the number of moves, (the software nicely supports a multi-bin inventory system). Reducing inventory helped - there was less of it to keep track of, and more space in the stockroom.

Using the integrated costing modules, we now identify and correct deviations in purchase prices and work order costs every week.

Conclusions or at least the next starting point!

You Can Put Away The Antacid

Now that the family is pulling together, dinner time is a pleasure.

The results of this project have been overwhelmingly positive. The hard work of implementation is behind us, and we are continuing to use the same formula to gain further improvements. Now that working methods are in place and we have a routine that we can follow, we are finding that further progress takes less effort. Here are a few examples of improvements in the hard numbers:

- Inventory has been reduced by 50% in dollars and in floor space in the first year. Currently dollars are at 25% of what they were if we exclude obsolete and slow moving

parts (Some of the Legacy left to us by our Legacy Systems) and floor space has been reduced by 75%.

- Inventory turns have doubled from 2 to 4 in the first year. We are turning our most common families 8 times and on our way up!
- Productivity increased about 50% in terms of Sales per Employee.
- WIP was cut in half in the first year. We have reduced this by an additional 35% since the implementation.
- Delivery performance has increased from 70% to 90% on-time to promise. Our promises to Customers are now measured to the day not the month or week.
- Work order completion rates average 98.5% on a monthly basis.
- Delivery on large order spikes improved dramatically. In some product lines, we handled orders equal to a 6 months-rate of production within 12 weeks ARO, without missing a delivery. Not a single employee would have believed this possible a year ago.
- Our latest physical on the new system required only 10 people one and a half days to count, and 3 people one day to rectify and adjust (compared to the prior physical, which took 30 employees two full days - 60 man-days - to find and count everything, and 5 people one full day to rectify and adjust).

In addition to the hard numbers, we've made other, less tangible but equally valuable improvements. The performance measures offer feedback that everyone can see, and this has immeasurable motivation value. Another reward is seeing our sales and production staffs working together, balancing the master schedule to forecast and actual demand in a confident, cooperative manner. Getting those "natural antagonists" together was made possible by the clarity of our computer reports. Performance measurement, adaptive information technology and a company-wide commitment to change have driven true enterprise resource planning and integration. Dom Luzi of Management Alchemy provided us invaluable assistance keeping us from taking any of our problems and successes too seriously and moving in a useful, positive direction. Two Years after this article was written we had a serious downturn in business. Were it not for the techniques and attitudes that Dom taught us we would not be in business today!

This is a case study written by Christopher Schaeffer President of Control Instruments Corporation about a join project with Management Alchemy.