PACKAGING WORLD® TACTICAL BRIEF

The Power of Packaging eBook (Tactical Brief) Series: The Importance of Flexibility in Today's Industrial Market

CONTENTS

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Defining Industrial Flexible Manufacturing

Moving from a product-based ideal to a machine- and operational-based philosophy on flexibility.

By John Wenzler, Corporate Industry Development Manager, Omron

Manufacturers typically compete based on distinctive, core or competitive competencies. Among those could be price – or cost – quality, delivery, service or even flexibility. The packaging industry itself, mainly in the past few years, has been trending toward competing in the area of flexibility. Traditionally, this has meant that a packager's major strength is flexibility of a product or the ability to easily make changes to the product itself or flexibility of volume, which is the ability to easily handle shifts in demand.

Today, manufacturing flexibility consists of three components:

1. The flexibility to produce a variety of products using the same machines and to produce the same products on different machines.
2. The flexibility to produce new products on existing machines.
3. The flexibility of machines to accommodate changes in product design.

Trends Driving the Need for Flexibility

There are several factors simultaneously challenging the traditional definition of flexibility.

By Michael Savage, Automation Manager, McRae Integration

The first thing to touch upon is the trend of abrupt changes in market demands that represent new conditions packaging companies have to operate within. There are several factors that are simultaneously contributing to these market changes, including globalization of the economy, market disaggregation or the move from a homogenous market to a more diverse market as well as the increasing demand for endless variations of familiar products.

How are these trends driving the need for flexibility?

Globalization

Globalization has had a tremendous impact on the way packaging companies do business. The market is becoming a group of interconnected suppliers and buyers across continents. For example, raw materials used to make sub-components in Germany and the UK may actually come from Mexico, Africa and India. Those sub-components assembled in Europe are then shipped to the U.S. for final assembly. And the U.S. then distributes the final product to regional warehouses around the world.

Based on this example, globalization means conforming operations and processes to accommodate new and different supply chains. It could mean shifting manufacturing operations to other countries – opening plants to take advantage of lower labor costs or to gain access to desirable markets. It also means being prepared to handle competition from overseas companies – if you have access to their local market; they probably have access to yours.

And for packagers, perhaps the biggest impact is the flexibility to produce accurate packaging for overseas purchasing. Being a part of a truly global market means designing packaging that is suitable for different markets and cultures. It means ensuring physical design, visual graphics, messaging and language conform to regulatory and

logistical requirements for each of your markets.

Globalization is changing the dynamics of flexible manufacturing, from the technologies to the systems and to the communications. For example, it dictates an environment in which production lines are composed of several modular cells. Those cells can be re-organized and re-configured by introducing new devices, machines, functionalities or even by re-configuring the communications network.

Mass Customization

Consumers have seen mass customization coming for many years. For example, printing your own message on M&Ms, custom images on credit cards, adding personal initials to L.L. Bean clothing… and, of course, the campaign that put mass customization at the forefront of production – the Coca Cola 'Share a Coke' campaign.

And with an increasing amount of companies competing in the globalized marketplace, the practice of mass customization, or targeting different mass consumer groups, is at the forefront of operations. It is the recognition that consumers are evolving and demands will vary from consumer to consumer. So as packaging is becoming more sophisticated to ensure the physical design, visual graphics, messaging and language conform to regulatory and logistical requirements for each target market, the machines used to produce packaging are also becoming more sophisticated.

Embracing mass customization happens with stringent planning and

an in-depth understanding of how to utilize its principles to achieve specific operation, especially if you are transitioning from a mass production mindset. When it comes to accommodating practices necessary for mass customization, research, and more importantly experience, has shown the most important consideration is a uniform communications platform within the supply chain. Or more simply put, a necessity for the resources to work both forward and backward in the supply chain to ensure customers' specific needs are met while still maintaining efficient and economic manufacturing practices.

Continued
Trends Driving the Need for Flexibility

SKU Proliferation

Similarly, SKU proliferation has changed the landscape for packaging companies. Competition is driving packaging companies to expand their portfolios to provide a wider array of product choices. All of these choices generate new SKUs which, in turn, drive the need for increased use of automation, distribution networks, warehousing space and transportation logistics.

At this point, packaging companies start asking questions like:

- How do I schedule manufacturing runs for each different type of product?
- How can my plant operations accommodate a pull vs. a push strategy?
- How can we implement changes in technology, systems and communications without those changes becoming obsolete when product lifecycles are already brief?

SKU proliferation, together with competitive pressures, is driving the need for implementing a flexible and dynamic manufacturing environment that maximizes effective capacity, improves process dependability and reduces downtime. Operations need to have the precision and discipline of total automation to enable rapid changeover capabilities and accommodate shorter production runs with the least amount of capacity cost and loss.

Key Components of a Flexible Manufacturing Environment

Companies can no longer consider their plants as the creators of cost and the absorbers of capital – the manufacturing process is now viewed as a critical strategic resource.

By Laura Studwell, Packaging Industry Marketing Manager, Omron

Within the last few decades, the conventional plant has been thrust into a role of which they are unaccustomed. Faced with shrinking markets and fierce competition from overseas, packaging companies can no longer consider their factories as merely the creators of cost and the absorbers of capital. The manufacturing process is now viewed as a critical strategic resource and is the focus of many companies.

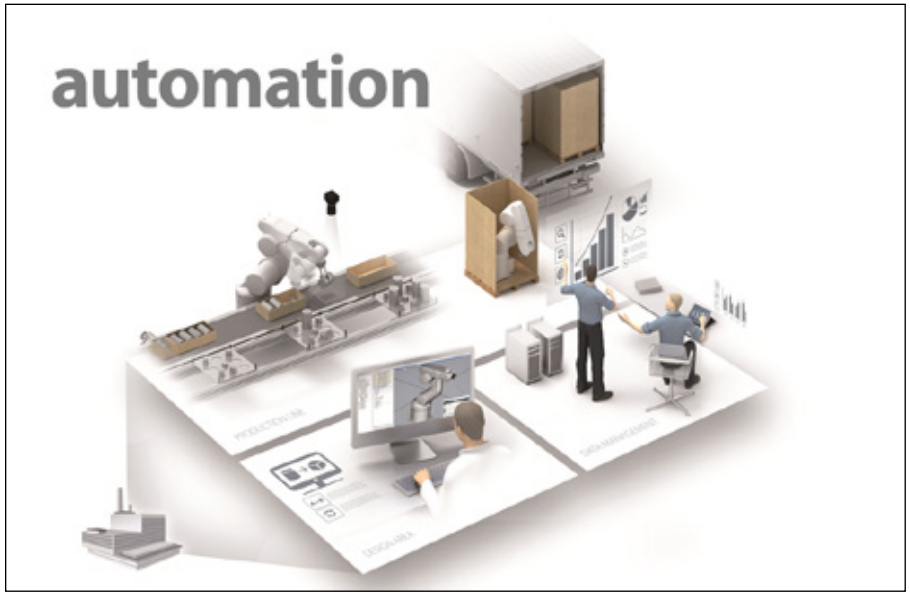
This section will discuss the six key areas that are most widely used to characterize an industrial flexible manufacturing plant.

Automation

In order for packaging companies to compete with low labor cost countries, following a 'don't touch the part' philosophy is recommended. Adhering to this philosophy means committing investment to a fully automated manufacturing plant that can increase throughput and decrease operator intervention. The great thing about automation is that any packager can make the investment – and should – if they want a sustainable, globally competitive business.

Earlier, this tactical brief discussed SKU proliferation, where a product goes through the segmentation process to increase the number of available products in the market. Here is an example of how automation pacifies this trend: A snack foods company has four horizontal flow wrappers to apply the primary packaging and two robots to pick and place mixed variety packs into the secondary packaging, or the carton. The company packages around 125 different product combinations on each horizontal flow wrapper per day, which is about 500 product combinations per day.

When the company needs to change the recipe, an operator simply touches a button on an HMI, which sends a signal to the machine automation controller and the line adjusts to accommodate the new



parameters – all without human intervention. It is hard to believe that just two years ago this company only packaged 25 different product combinations per day in their entire plant. And with automation, they now package 500 different product combinations per day.

Automation within a plant, a line or a modular group of machines will satisfy demand for greater levels of productivity, safety and functionality. System integrators as well as machine builders are pushing the implementation of automation to help their customers:

- Increase throughput by minimizing the degree of manual operation required.
- Increase operability of machines; for example, through the standardization of parts and processes.
- Accommodate on-the-fly changes to the product or its packaging.

The move from semi-automatic machines to fully-automated solutions means increased levels of automation, such as increasing the numbers of servo-driven actuators, the introduction of machine vision, increased safety controls and even remote monitoring. And the big trend in automation is machine-to-machine communications and software that connect machines on the plant floor to the enterprise level.

Robotics

Robotics is rapidly becoming a staple in the packaging industry due to repeatability, speed, accuracy, flexibility and safety. Robotics make it possible for packaging companies to increase the scale of factory automation. Integration has resulted in higher production rates, improved quality and improved safety – all by reducing the effects of challenging work environments and eliminating the impact of external environmental factors.

How can integrating robotics, into plans for designing a flexible manufacturing plant, impact operations?

1. First of all, they will increase production output rates. Robots can run for long shifts, overnight and during weekends with little supervision. This enables true around-the-clock production runs that will increase output rates. New products can be introduced faster into the production process and changeover time becomes almost negligible. Handling multiple applications on a single production line can be done with minimal disruption to existing processes.
2. Robotics also create a surge in manufacturing flexibility. Accommodating changeover, or switching from one product to another, is simple with robotics. Systems with robotics automation can easily accommodate variations in product, increasing uptime and reducing waste. The incorporation of vision systems to guide robotic function has resulted in an increase in the flexibility of use.
3. The integration of robotics helps reduce waste by performing routine functions to fine tolerance limits. A fully automated packaging line has a coordinated control system, which securely shares data between robots and other critical control points.

Coordinated control systems and continuous monitoring means that virtually every product coming off the line conforms to set tolerance limits, increasing the amount of conforming output. Packaging companies can expect to see greater overall efficiency as the quality of output increases as well as the amount of conforming output.

The bottom line is that robotics, if integrated correctly into plans for a flexible manufacturing plant, can improve operations and offer flexibility to accommodate future changes. Few other industrial automation solutions can have such an impact on brand protection, market share protection and ultimately profitability.

Industrial Communications

At the heart of a flexible manufacturing plant lies reliable, high-performing communications and connectivity networks. The vision for machines that talk to other machines, collect data, then analyze and report on that data can only be realized by robust and flexible communications networks. Communications networks that connect all parts of a manufacturing enterprise, from the plant floor and the corporate office to remote locations.

Safety, protecting both people and processes, is the top priority when developing a network strategy for industrial operations. To achieve fail-safe reliability and redundancy for data transmissions necessary for industrial applications, network components must exceed the requirements for hazardous environments. Secondly, unplanned downtime is not an option. Reaching maximum uptime to ensure smooth and reliable operations starts with preventing communications and connectivity problems. Another high priority is control, or the uninterrupted flow of signals between devices, machines and control systems. This is mandatory in a highly automated environment with little to no margin for error.

The operational benefits at the plant and enterprise levels can be measured in both the short and the long term. In the short term, this means gaining access to real-time data, such as inventory visibility and increased production capacity to improve overall operations, integration with enterprise resource planning (ERP) systems for scheduling, planning, quality tracking and delivery information as well as lower costs for maintenance and administration. In the long term, benefits include faster and less costly plant upgrades and expansions.

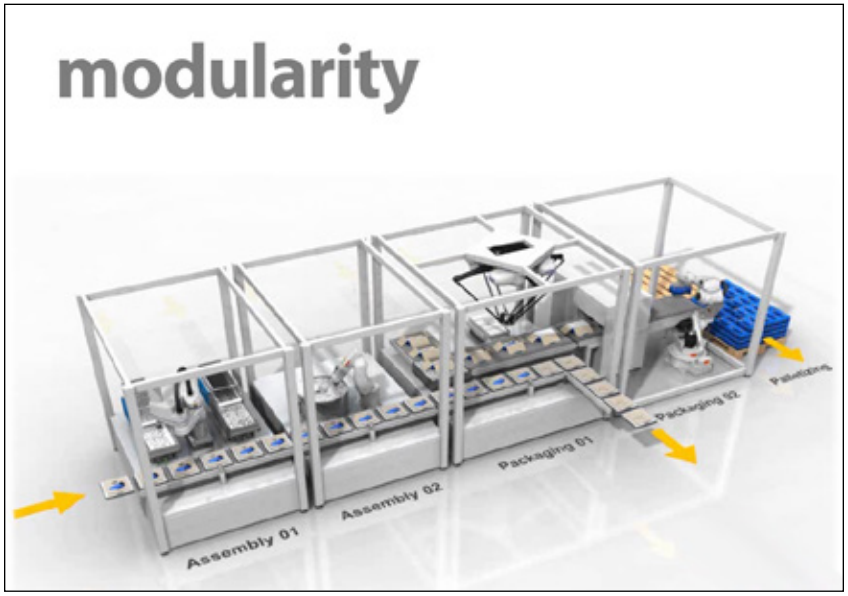
Modularity

Within flexibility is the need for modularity, at the high level, switching out machines when needed. Modularity means automation can easily accommodate variations in product, for example, pulling products from different stations for mixed pallets or variety packs.

When looking at flexibility through modularity, there are three main factors:

- Accommodating changeover
- Handling variations in product and packaging
- Facilitating shorter production runs

To accommodate line flexibility is the idea of smart modularization, meaning a company can modularize a machine with different parts to accommodate different packaging types. With proper attention and engineering, the different parts of a machine can be designed for easier changeover. The easier the changeover, the easier it is to accommodate shorter production runs while staying profitable. Modular design means reducing production costs and improving time to market, rather than constantly designing and creating custom parts. As demand increases for more capable or higher-functionality solutions, machine capabilities will increase as well.



The progression of modularization is going from a single modularized machine into a complete modularized system with multiple modules each performing multiple operations or functions in the application. What makes modularization 'smart' is how the different modules are coordinated with each other, making the entire system easier to setup, or providing automated changeover, or enabling enhanced diagnostics for troubleshooting. For example, when adding an automated filler to a system, how can the time need to synchronize it with the conveyor be minimized? Or if sealing pouches and changing the film material, how can the seal bar temperature by controlled and adjusted automatically? When adding a quality control station that requires vision inspection, how can defects be identified and traced with proper time stamps that match the rest of the machines in the system?

Global Reach

If a company is expanding their reach and becoming a globalized company with facilities around the world, this can mean the number of vendors involved grows at the same time. And what if those vendors have not expanded their reach and even more vendors are needed to meet operational needs to keep a company up and run-

ning? The main difficulty in dealing with multiple local vendors is the amount of time it takes to manage those relationships. Once operations are expanded on a global scale, minimizing vendors to those that operate on a global scale is pertinent.

This minimizes compatibility problems, working with suppliers that have a global reach means obtaining products and components specifically designed to work together, regardless of the geographic area a machine ends up in. This also means gaining access to new features sooner, enhancing compatibility across borders. And running on a single platform means there is an infrastructure in place to deploy new features or applications from the same vendor a lot quicker.

Dealing with global vendors also saves time in the procurement phase. If a company based in the U.S. with a plant in China requests spare parts for a critical control point in their operations, they can be obtained from a local distribution center, eliminating the need to deal with shipping delays, incurring overseas shipping costs

Standardization

Standardization is one of the most powerful tools in a flexible manufacturing environment. It's not just about making everything on each line equal – it's about standardizing certain operational aspects as there are many advantages to doing so.

The end market for machine builders ranges from multinational corporations that demand a standard machine globally - to local companies with varied requirements from one supplier to the next, depending on the country. However, the packaging industry is undergoing consolidation, with retailers taking a large share of the CPG market. This has been enhanced by a number of acquisitions in the pharma industry – which has resulted in additional consolidation.

Many packaging companies have adopted a policy of standardized machinery used in plants regardless of region. For example, machines used in plants in Canada are essentially the same as ones used in plants in Italy. End users state there are a number of advantages to standardization, detailing:

- Economies of scale where packagers can demand a lower price and rationalize purchasing activities
- Ease of troubleshooting and maintenance such as allowing for a remote expert to support local engineers
- And consistent achievement of standards, such as safety, on a global scale

Key Advantages of Operating in a Flexible Manufacturing Environment

Here we focus on what packaging companies can gain from operating in a flexible environment.

By Adriana Zimbardo, Director of Sales and Marketing, ZimaPack

When considering ways to increase efficiency and decrease costs, chances are flexible manufacturing is in the future. It provides a numbers of benefits which will be covered in this section.

Achieving a highly automated manufacturing process with computerized monitoring and management of quality and production

An estimated 80% of managers still use Microsoft Excel to manage auditing and compliance on production lines. This method does not allow for the type of decision making that is necessary to compete in a complex, interconnected and fast-paced marketplace.

Computerized monitoring systems are used to provide the right information so you can make decisions in real time, such as those that will impact or improve production output. They can even be used to manage operational risks, such as damage to machines, unplanned downtime and less than expected production rates. Highly automated production focuses on the process and finds success through the highly-controlled, standardized and continuous processing technology that exists from computerized monitoring.

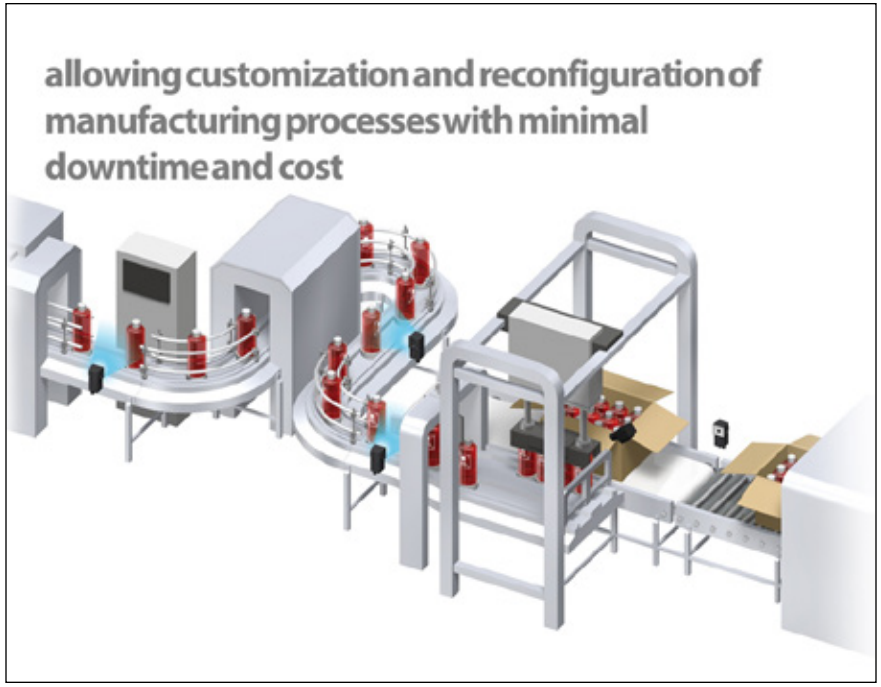
Note: Processes are called automated when they perform their operations with a reduced level of human participation compared with the corresponding manual process. And in some highly automated manufacturing processes, there is virtually no human participation.

Making manufacturing operations readily scalable for different levels of output

There are four components that can contribute to increasing scalability, all four of which need to work together to make operations truly able to handle different levels of output. The first component is scalability of production, which relates to the percent of production cost that is directly dependent on the number of manufactured units. Scalability is often achieved by automating production. The simplest example is to cast a plastic bottle instead of forming it by hand. Scalability can also be created by minimizing distribution costs for each manufactured unit. While a product may be scalable in production, a company may still incur significant sales, distribution, adaptation and installation costs. These costs reduce the product's total scalability.

When it comes to scalability, there is a grey area – which is scalability created by the interactions between people. This occurs when the value of using a product, and thereby the willingness to pay for it, is related to how many others will also use the product. This happens when the customer contributes to requirement specifications,

customization and deliverance. And the final component to making production readily scalable lies within a company's infrastructure. This is where growth in the number of customers makes it possible to increase the payback from investments already made in infrastructure. When packaging companies acquire new customers, they increase the returns from the investments they made in automation or MES systems.



Allowing customization and reconfiguration of manufacturing processes with minimal downtime and cost

Producing custom products, using automation to reconfigure machines and processes, with minimal downtime and cost is also an advantage of operating in a flexible environment. And in that environment, if it is truly flexible, the entire production process can be changed with a simple touch on a pre-programmed HMI. This allows for accommodation of variances in product, variances in packaging – such as size, shape, color… and even on the labels to account for different geographic demands – or even differences in what retailers want to see on their shelves. Where this becomes even more of an advantage is when automation helps companies perform these tasks with minimal downtime during changeovers and when the precision and accuracy of automation can produce less scrap and waste, both of which contribute to lower costs, which in turn, mitigate any challenges to profit.

Providing management with detailed and timely data about the manufacturing process

Imagine the impact of instant access to management reports so quality managers can concentrate on analysis and decision making rather than system maintenance… or being able to compare sites consistently and immediately in order to take action to improve business performance… and having a fully-integrated and automated

Course 1 - Primary Types of Packaging (Overview)
In this course, the principle packaging mediums will be introduced including paper (corrugated, paperboard, folding cartons and labels), glass, metal and plastics (extrusion blow, injection, injection blow moulding and flexible packaging). The basic manufacturing processes, common terminology used and typical applications for each process will be discussed.

Course 2 - Sustainable Packaging & Optimization
This course addresses sustainable packaging design including circular economy concepts, life cycle thinking and design for recycling. The optimization component provides a more holistic approach and encompasses the entire packaging value chain. 4 sessions highlight case studies and provide a 12-step approach to setting up an effective packaging optimization program.

Course 3 - Branding & Graphic Design
Identify the elements of graphic/structural design and how market research can evaluate their effect on the success of a new product. Discussion includes areas such as structural and graphic design, demographics, psychographics and consumer appeal, motivational messages and the point of difference, brand names and trade dress and color, material, shape, graphic art and typography.

Course 4 - Printing Processes & Value Added Enhancements
The 3 principle printing processes used in packaging (flexography, lithography and gravure) will be detailed. Concepts such as printing plates or image carriers, offset vs. direct printing and plate material for each process will be discussed as well as the new technology of digital printing, and less common processes such as screen, hot stamp and pad printing methods. Finally, the advantages and disadvantages of the 3 printing processes will be summarized.

Course 5 - Corrugated: Printing, Box Design, Properties & Regulations
The box production process and the 3 principle printing processes will be described as well as their typical applications. Corrugated properties, flute sizes, construction and Edge Crush Test (ECT) will be introduced as well as the typical applications for each situation. Carrier rules, regulations and class stamps will be explained as well as the role ECT now plays in shipping regulations.

Course 6 - Folding Cartons, Paper & Paperboard
Folding cartons: Coverage includes production sequence, common classifications, design considerations, typical folding designs, variations of tube styles and the internal supports and their applications.
Paper & paperboard: Coverage includes manufacturing options, physical properties, paper treatments as well as grading, measuring and testing.

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Key Advantages of Operating in a Flexible Manufacturing Environment

system up and running in days rather than months. Imagine all this as part of one integrated systems that is accessible at any time.

Especially with companies trying to compete on a global scale, there is a necessity for manufacturing intelligence and benchmarking, where managers can access key performance indicators (KPIs) and analytics at their fingertips, anytime, anywhere, in any language. And even at smaller companies, there is a growing desire to monitor the plant floor, understand part flows, planned versus actual performance, run programs and access paperless information.

Accessing detailed and timely data about the manufacturing process is an advantage because today's data collection and monitoring solution have the capability to help management see, analyze and quickly act upon time sensitive data coming off the plant floor.

Enabling manufacturers to coordinate their work processes with those of their suppliers to maximize efficiency and minimize costs

Most companies that operate within a flexible environment have the resources to drive improvements throughout the supply chain. Companies that have successfully learned to build a stronger network successfully drive out time, cost and defects from their processes. These companies make suppliers an extension of their businesses by implementing electronic communications processes with even the least technically sophisticated suppliers, coordinating plans and schedules based on supplier constraints and monitoring supplier actions at the order level.

Considerations Impacting Implementation

This section contains a few factors worth considering before moving into full implementation mode.

By Mike Kuhlow, Electrical Engineering Manager, Algus Packaging

Making the important decision to move to a flexible manufacturing environment is a huge undertaking and the rewards for doing so will also be huge. But before going into full implementation mode, it is worth considering a few factors which will help determine the feasibility of implementation and whether this move is right for future operations and business goals.

Intensive Planning

To prepare for the changeover to an industrial flexible manufacturing environment, substantial work is necessary regarding detailed design, preparation, project planning, scheduling and plans for ongoing maintenance and improvements. The planning process can take months to years depending on the level of adaptation needed.

Upfront Investment

As with any other major project, there is an upfront investment and the payback is not immediate. Purchasing or adapting machines to be more flexible, integrating industrial communications networks as well as monitoring and reporting software can cost a company millions of dollars and the payback can stretch into several years depending on how well you utilize the systems in your new environment. Many companies use overall equipment effectiveness, or OEE, which is an industry accepted method of monitoring utilization.

Change in Culture

Any time a company moves to implement a project of this scale, push-back is inevitable. When operators hear the word automation, they can sometimes hear 'we can do more with less.' Flexible manufacturing environments typically require comparatively fewer people with broader skills to run them. Training, or perhaps re-skilling, has been found to be the most important key to the success of the new environment, which is also a major investment for the company.

Complexity

An industrial flexible manufacturing environment is quite complex and intricate between new technologies, systems and communications. It requires more skilled labor and more expansive technological expertise. There is also an extensive network of hardware and software that must work seamlessly and consistently together.

Strategies for Successful Implementation

A solid strategy is the key to success; keep these things at the forefront when making decisions.

By Wayne Marsh, General Manager/President – Automation Technologies, Chicago Electric

What is a good strategy for successful implementation? Here are a few things to keep at the forefront when making that decision to move full steam ahead.

Business Process Reengineering

Business process reengineering involves the redesign, not design, of core business processes to achieve dramatic improvements in cycle times and quality. For example, business process reengineering reduces costs and cycle times by eliminating unproductive activities and the operators who perform them. Reorganization by teams decreases the need for management layers, accelerates information flows and eliminates the errors and rework caused by multiple handoffs. Business process reengineering improves quality by reducing the fragmentation of work and establishing clear ownership of processes. Operators gain responsibility for their output and can measure their performance based on prompt feedback.

In business process reengineering, companies start with a blank slate and rethink existing processes to deliver more value to their customers. They typically adopt a new value system that places increased emphasis on customer needs. Companies reduce organizational layers and eliminate unproductive activities in two key areas. First, they redesign functional organizations into cross-functional teams. Second, they use technology to improve data dissemination and decision making.

Business process reengineering is a change initiative that contains multiple steps. Executives need to:

1. Refocus company values on customer needs
2. Redesign core processes, often using information technology to enable improvements
3. Reorganize a business into cross-functional teams with end-to-end responsibility for a process
4. Rethink basic organizational and people issues
5. Improve business processes across the organization

Process Reorganization

And a subset of business process reengineering is process reorganization, of which the goal is to improve performance substantially on key processes that affect customers and related stakeholders. This is accomplished by analyzing existing processes and feedback from those processes, automating processes to help them become more efficient and monitoring processes on a cyclical basis. Feedback is always returned at every step and consistently needs to be analyzed, while at the same time monitoring the process with efficiencies or inefficiencies. It helps an organization by:

1. Reducing costs and cycle times by eliminating unproductive, non-value adding and inefficient activities. Reorganization decreases the number of unnecessary interactions, accelerates information

flows and eliminates the errors and reworks.

2. Improving quality and speed by reducing the fragmentation, isolation or repetition of work and establishing clear ownership of each process and activities. Process owners gain responsibility for their output and can measure their performance based on prompt feedback.

However, many organizations put the focus of business process reengineering on IT and process redesign techniques. In fact, there are other complex issues such as human, organizational, cultural and political influences. Just a word of caution, one of the main reasons for failure is the neglect of the human element. Resistance to change acts as a major barrier to successful implementation.

Organizational Cooperation

Major changes to business processes have a direct effect on job roles and workplace culture. Change often involves multiple areas within a company so it is important to get support from all affected departments. Through the involvement of selected department members, the organization can gain valuable input; a step which promotes cooperation and acceptance by all segments of a company.

Getting enterprise wide commitment involves the following: top management sponsorship, bottom-up buy-in from process users, dedicated project teams and budget allocation for the total solution with measures to demonstrate value. Before any project can be implemented successfully, there must be a commitment to the project by the management of the organization and strong leadership must be provided. Reengineering efforts can by no means be exercised without a company-wide commitment to the goals. However, top management commitment is imperative for success. Top management must recognize the need for change, develop a complete understanding of what is going on and plan how to achieve it.

Convincing every affected group within the organization of the need for change is a key step in successfully implementation. By informing all affected groups at every stage, and emphasizing the

positive end results of the reengineering process, it is possible to minimize resistance to change and increase the odds for success. Ultimate success depends on the strong, consistent, and continuous involvement of all departmental levels within the organization. It also depends on the people who do it and how well they can be motivated to be creative and to apply their knowledge.

Supply Chain Practices

Improving operational processes within the supply chain can lead to greater competitive advantage. The first step to refining the supply chain is to understand where improvements can make a significant difference in performance. Map the current and desired future state of the supply chain, evaluate current roles and responsibilities, review data to prioritize the path forward and identify areas for improved performance.

Keep in mind that every company has its own unique supply chain needs and challenges and individualization is an important part of manufacturing efficiency and productivity. However, when processes become too complex or do not realize the same return it may be time to reengineer the entire process cycle.

Determine how to design and reengineer the supply chain so that the maximum benefit can be gained. Whether looking for ways to cut costs, speed products to market, improve customer service or strengthen the balance sheet, it's all about streamlining the supply chain to keep a competitive advantage.

1. Keep the distribution network sleek and streamlined to gain efficiencies, improve customer service and better utilize assets and capital.
2. Get insights into optimal logistics design, reengineering and supply chain management.
3. Gain leading-edge industrial communications and information systems.
4. Constantly monitor productivity through new benchmarking processes.

Continuous Improvement

When it comes to implementing an industrial flexible manufacturing environment, ongoing, continuous improvement should be regarded as an improvement strategy that enables a company to make the move from traditional functional orientation to one that aligns with strategic business processes.

It is essential that the automation infrastructure provides performance measurements to support continuous improvement. It will need to efficiently capture appropriate data and allow access to appropriate individuals, at every step of the process, and encourage constant evaluation of results. The use of a feedback mechanism that provides for and facilitates resolutions of problems and issues is imperative and will also contribute to a continuous risk assessment and

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Strategies for Successful Implementation

evaluation, which are needed throughout the implementation process to deal with any risks at their initial state and to ensure success of the implementation.

Anticipating and planning for risk handling is important for effectively dealing with any type of risk, when it first occurs and as early as possible, in the implementation process. Companies planning to implement an industrial flexible manufacturing environment must take into consideration pre-determined factors of measurement in order to ensure their efforts are comprehensive, well-implemented and have minimum chance of failure.