"FACTORY GROWTH" A CONCEPTUAL IDEA

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SYNOPSIS

The present trends in factory management are aimed at developing a unified plant - control system for directing the activities of interconnected manufacturing cells of robots and N C machines. This is expected to pave the way for totally automated factories. Total automation does not mean a factory without people, but rather one automated to the fullest practical extent.

Most factory management system will be made up of human workers and managers teamed with robots and machine tools. The robot is the first step in a larger concept, whether it be called CIM, FIM or FOF. A well planned well executed automation system is a key that can unlock the doors to increased productivity and quality. The make up of these systems goes beyond just hardware and software to "thoughtware" Inherent but overlooked aspects of automation such as vendor quality, management philosophies, training and technological advances can transform a simple robot application into a successful automation system.

The future of Industrial growth will depend on the ability to integrate robots in to existing or planned system. The robot is for many, the first image that appears when the word 'automation' is mentioned. The robot, in actually, is just another step in our quest for automation it is the first step into a larger concept, that of the managing the factory in the 21st century.

What is a robot?

Apart from aesthetic view, the increasing need of higher accuracy and life of products has pushed the Industries towards automation. Decrease in labour cost, higher rate of production, opera tional safety absence of production interruption owing to labour unrest & similar factors helped in promoting the concept of automatic factory. Robot is one such discovery which not only replaces human from respective jobs like loading, unloading or operating machine but also from the accident prone and hazardous places.

According to Robot Institute of America (R I A)

"A robot is a reprogrammable multifunctional manipulator designed to more materials, parts, tools or specialized devices through variable programmed motions for the performance of a variety of tasks".

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This is a satisfactory, all encompassing definition for physical devices that are programmed to perform specified funtion in today's island of automation for our purpose though, a robot can be better defined as :

".....a reprogrammable manipulator that possess some degree of intelligence to allow it to interact with its environment".

Many companies introduce standalone robotics into islands of automation as a means to automate a process in the factory. What normally happens, though is the factory becomes a series of these island of automation, surrounded by a sea of labour-intensive activities. Why does this happen? Primarily it is from improper planning and introduction of factory of the future elements in a piecemeal fashion. The key for success in the factory of future concept is a computer integrated manufacturing plan a CIMPLAN.

FOF & CIM

The factory of the future is a 'concept' of how our factories will be organnized & operated. It is a concept for increasing manufacturing competence. CIM (Computer integrated manufacturing) is a process or methodology that is the key to making the factory of the future occur. CIM is a global concept that includes more than the regulation processes that are found in the normal factory, CIM is

"....the logical organization of individual engineering, production & marketing/support function into a computer integrated business system. Functional areas of the enterprise such as design, analysis, planning, purchasing, cost accounting, inventory control, distribution, quality control, payroll, etc. are integrated through the computer with the factory floor functions such as material handling management and direct monitor and control of all process operations".

The common view of the future factory, as shown in fig. 1. shows every research, design and production area networked and linked in real time to a common data-base. The advantages to this approach include :

1) Reduction in cost from the elimination of duplicated efforts.
2) Standardized manufacturing and test procedures.
3) Improvements in engineering manufacturing productivity and product quality.

C.I.M. is a technology that uses controls, sensors, computers and computer networks for the complete control of the manufacturing process. An essential component of this process is the automated testing equipment (A.T.E.) To show the interrelations of these components, the architecture of CIM is shown in fig.1. It consists of five levels.

1) factory
2) center
3) cell
4) station
5) Process

The lowest level is the process. It is the only level without some form of computer control. It is the level of the actual machine without an imbedded computer. Each of the other levels is a computer network, consisting of a computer, a translator to a superior network (except for the factory level in some cases), one or more translators to inferior networks (except for the station level) and one or more interfaces to the processes. Translators to a network at the same level, whether or not they are subordinate to the same network, are not permitted.

Integrated manufacturing exists today in non-traditional manufacturing business. Every business manufacturers an end product, it may be a service or just good will.

A major airline is computer integration in action. Schedules are made, planes, pilots and demands are matched for efficiency and flexibility. Food is prepared and integrated into the planes configuration. The plane is monitored through the airways and to the end airport gate. All aspects of the business, nation-wide and internationally are monitored and controlled in an integrated fashion. This is just touching the tip of the icebery.

Objectives of CIM

The objective of computer Integrated Manufacturing is to develop a cohesive digital database that 'merges' the function of manufacturing, design and business itself. A sampling of specific objectives include :

* achieving an E.O.Q.
* being able to produce any of a range of products at any time at a predictable cost.
* achieving one inventory turn each working day
* Just in time material management
* CAD/CAM (Computer Aided Engineering) interaction not just interface.
* Total process control
* Increase productivity
* Improved quality
* Good return on investment.

Elements of FOF & CIM

As stated above the robot is just onne component in the quest for the factory of the future. There are hardware & software aspect to the concept of FOF & that make up CIM.

The basic hardware and software elements that go into making up the conncept of FOF are :

* Computer
* CAD/CAM/CAE
* Controls
* Information processing
* Smartprocess
* Group Technology
* Automated guided vehicle system
* Robots

These elements are known to most. The thoughtware concept has been present but for the most part not been considered. What is 'thoughtware? Thoughtware, collectively are those elements of the system, which are a combination of management and technology that make up the inherent, qualitative aspect of any business. Some call it common sense. It goes beyond that though. For the most part, the elements that made up thoughtware are intangible and subjective in nature. They include such items as :

* Job satisfaction
* On-demand production capability
* Stability of employment

* Effective use of the process
* Flexibility
* Quality of life improvement.
* Reduced stress
* Improved product quality
* Faster response time under relationship and many more.

Thoughtware is really the process of analyzing the entire manufacturing environment and considering all aspects, not just those that are tangible and can have direct costs applied to them. The point is that automation will touch much more than just those on the factory floor. It will affect everyone within the business itself and those who interact with the business, both the customer and the vendor.

Characteristics of a CIM

Managers of future factories will be faced with the problem of indentifying viable marketplaces, quickly developing new products and delivering new, high quality products at a low cost. The factory of the future implemented with CIM can be characterized by three significant and complimenting factors.

1) It is efficiently integrated and continuous. It is efficient in that no more resources are utilized than necessary, and integrated in that all segments are tied together so that material moves in a smooth continuous manner with little if any work in process.
2) It is flexible and economical in the face of change, with reprogrammability to do a variety of operations at the same rate and more importantly, with the same production equipment. Robots are becoming the most economical flexible factory workers.
3) It is effectively organised to do the right thing with maximum productivity. Build the right product, with the right material, at the right time, with the proper resources at the right price, this is classical marketing.

What will be the attributes of the manager who will be successful in implementing the C.I.M. system?

1) Participative
2) **Technical oriented** will have to understand the potential benefits of specific technologies, relate that need to operational requirements and understand the attributes of an organization that can make it happen.
3) **Goal oriented** Must be capable of establishing long range plans with a modular implementation sequence of events that can be carried out by himself or his replacement.
4) **Non-traditional** Must have the ability to identify the needs of the particular business and organize to meet those needs. Must also be capable of establishing measurement system that relative to the particular business goals.

Automation is an Evolutionary Process

Planning and implementation of Integrated manufacturing requires a long term commitment by management. The plan emanates from the top and evolves from the bottom. There has been a race to develop the necessary technology, the race in near completion. Now a new race is beginning, a race to implement this developing and still changing and improving technology. A plan must

be put into place now. These that wait until this or that part of the new technolo gy for automation has stabilized will be waiting foreever. Imple mentation must start now but with respect to the overall CIMPLAN that has emanated from the management level of the business.

As was stated at the beginning robots are only one part of a larger automation concept. This is where manny are starting, with robots. The mistake some make is not to follow or even have a plan so what technology is procured today can be integrated with the technology that will be available tomorrow.

Robot application implementation can be broken down into three phases. They are

- Application planning (pre-work)

- Installation and start-up

- continued operation.

Any automation project would follow the same three phases. Of the three application or project planning is the most important. One common element in any application planning programme is to get the total view of everything that is to occur both up-stream and down stream from the application and how they would be integrated or merged together. Integral to this planning is safety planning and risk analysis for each of the three operating modes of any automated cell. This becomes even more important in an integrated factory. The three modes are :

- Automatic or normal

- Programming or teaching

- Maintenance

Integrated automation evolves. As it does, it forces manufacturers to regain control, of their factory floor. As it evolves, management learns how well the factory can run and can take steps to maintain that level of excellence. A base line can be established for assessing future automation.

Summary :

The concept of factory Automation is comparatively new. F.A. is made possible with the extensive use of computer Integrated manufacturing (CIM). A FMS is installed as an island of automation, for carrying out only some operations on a component and some components in a product without considering the philosophy behind FMS. i.e. turning manufacturing into a process, may prove to be an economic diaster. In such a case the real benefits of FMS i.e. getting whole products (not just some of the parts) to the market faster and in greater variety, is not achieved.

The Inntegration of the various funtions of an organisation like engineering & Design, Product Engineering, Manufacturing and Business functions to work in close and effective unison through a unified network of computer control is termed as Computer Integrated Manufacturing (CIM) & is the key for the efficient operation of an organisation.

Robots are just one part of automation. All aspects of integrated manufacturing, if properly applied, can have a pervasive & profound effect on today's business from product design through production to product and customer support. Because all the various components become interrelated no one part can be evaluated on its own merits but rather on how it relates to the whole. The creation, storage analysis, transmission, and modification of data (processing of data) becomes the core to all manufacturing operations.

Each of the manufacturing systems like CNC machine, FINS, CIM has its advantages and short comings. A critical evaluation is to be made before selecting a particular types of manufacturing system is an organisation.

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