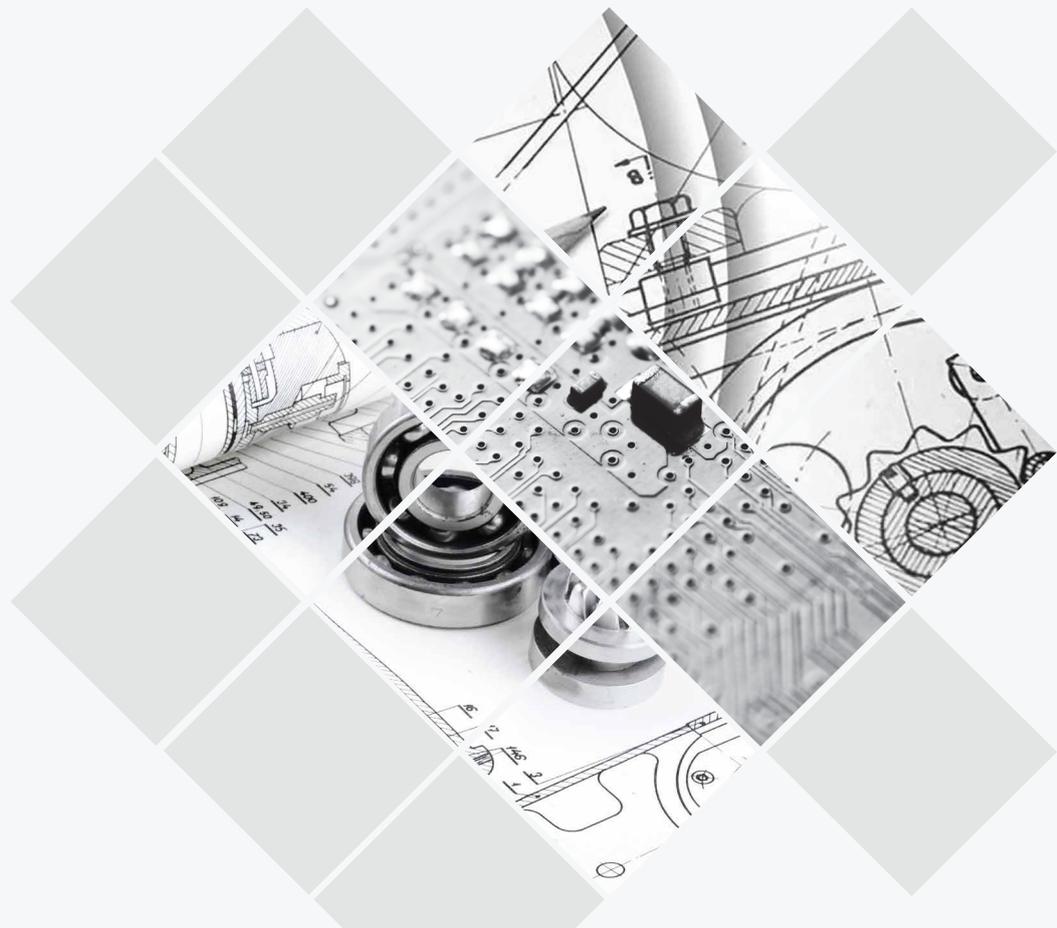


high speed process line: principles and practices for an efficient production system

About nine decades ago, a young and enterprising engineering graduate from Detroit conceived a production technique in the automotive industry.



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Abstract

About nine decades ago, a young and enterprising engineering graduate from Detroit conceived a production technique in the automotive industry.

He adapted a rivet-less chain conveyor widely used in the mining industry to efficiently facilitate movement of automobiles and components. Henry Ford was the first to recognize the potential of this technique that was named after its inventor Jervis B. Webb. At Ford plants, 30 miles of the Webb Conveyor system was installed. This single concept managed to revolutionize the history of mass production.

Today, the assembly line is fundamental to every manufacturing and production plant across the world. Productivity increased, and operational costs and time consumed reduced significantly. However, consumer needs and requirements did not diminish. People want quicker turnaround and flawless results. The need for yet another revolution: the High Speed Process Line was born. This white paper focuses on the constraints of a conventional assembly line and the implementation, advantages and adaptability of the High Speed Process Line.

The Era of Automation

The constant demand for higher productivity necessitated the implementation of optimized production techniques. Assembly lines are a significant part of every production plant or workshop. For example, in the FMCG (Fast Moving Consumer Goods) industry, the process lines begin from the manufacturing process and ends with packaging, labeling and storing.

Assembly lines

- Minimizes wastage and thereby cost
- Adhere to production specifications to ensure quality
- Improve productivity
- Enhance process replication efforts
- Facilitate maximum safety, and
- Reduce timelines

The Conventional Assembly Line: Challenges Involved

The Conventional Assembly Line does its job perfectly. However, changing customer needs and expectations demand advancements in the field of production or manufacturing. Following a standard process despite changing times may result in a dwindling bottom line. It is always better to shift to an improved assembly line that can produce 'n+10' items per minute over the traditional assembly line that offers only 'n' units/minute.

On several modern assembly lines, most of the machines' parts or the machines by themselves are sourced from Original Equipment Manufacturers

(OEMs). Hence, the end manufacturer is often unaware of the original machine design. Therefore, creating changes in the process line becomes complex. Lack of synchronization is another problem with the conventional assembly line. Traditional assembly lines often lack reliable and quick communication protocols. A periodical review of the assembly line process to determine tasks that require redesigning or adjustments would help in locating and eliminating problem areas. Every such identified task or activity can be redesigned either partially or completely in order to obtain maximum functionality and efficacy.



Changing Customer Perceptions and Requirements

The modern customer is interested in every product in the market, and is aware of competition and what goes into the making of every single product. Thanks to the digital age! Customers today are not just restricted to any specific geography. With the internet revolution, and smaller businesses going online, the customer base has increased manifold. Therefore, there is a greater need to innovate and upgrade.

A business based out of Mexico has customers from as far as the South East Asia. Similarly, several Indian products are in great demand in other countries, especially the United States. High demand contributes to the need for increasing productivity. This is directly responsible for increasing production speed, reducing associated costs for a lucrative bottom line and optimizing value.

High Speed Process Line

Industries are constantly seeking cost-effective solutions to increase productivity. Besides embracing technology, another primary factor to consider is adherence to safety standards. QuEST Global offers an integrated approach of combining advanced technology and efficient product development to result in a solution that the industry benefits from - High Speed Process Line that is intelligent and quick.

One of the pioneering concepts in the country today, High Speed Process Line from QuEST Global, is a

one-of-a-kind solution to revolutionize the conventional assembly line. The origin of the idea stemmed from enduring client relationships of the organization. QuEST approaches the concept with a systematic and watertight process. It offered an organized solution to one of its prestigious FMCG clients that wanted to optimize their battery assembly line process. The methodology began with a feasibility study of the production process at the client location.

Methodology Adopted

QuEST performed the high impact methodology through a series of steps and processes. A group of experts from QuEST studied the existing production line and conducted a feasibility study of the existing machines. This involved a careful study and evaluation of the existing process line, in order to gather information of the series or sequence of operations and holistic mechanisms. Machines installed at the client location may have an age old design, and may have undergone several changes and implementations that may not have been documented. Hence, feasibility study is essential to understand the original design as well as the changes effected thus far.

Usual Problems Encountered During the Study

- Unbalanced workstation loads: Underutilization or overutilization of workstations
- Absence of real time information: Lack of information on the assembly line or machines deployed in the production line
- Lack of line flexibility: Lack of synchronization with changing demand patterns
- A holistic and detailed research helps in identifying machines that require redesigning in order to set up a High Speed Process Line. Redesigning assumes different forms including elimination of insignificant or redundant tasks, combining activities that do not require distinctive treatments and/or simplification of complex tasks. Either or all of these activities are customized in order to offer the most suitable solution. The machines were re-engineered to attain a fully continuous motion design (CAD)
- State-of-the-art CAD tools are used in the redesigning process to provide the most contemporary solutions. The process of re-engineering is facilitated through the use of SolidWorks, state-of-the-art software, which includes powerful and intuitive product development tools to design, validate, communicate and develop product



designs for efficient marketability of a product. 3D CAD models of the proposed design are generated and reviewed through simulation and the results determine the extent of changes required

- Some of the complex Computer Aided Manufacturing (CAM) like Flip CAM and variable lead screw design were generated using SolidWorks Motion Study analysis in lesser time, and increased CAM efficiency compared to conventional method of generating multi-points data and interpolation techniques
- The process of re-engineering is bilateral in nature: both onsite and offshore work activities are performed

to create a final layout design that is subsequently given form and shape at the production site

- Engineering Instructions (EI) on how to assemble the new workstations, and Maintenance Instructions in the form of 3D animation using 3DVIA tools is provided to enhance global product development and limitation of “Know How To” technology, by eliminating language barrier
- Finally, QuEST also deploys experts at the client location for troubleshooting, to complete the cycle efficiently and to utmost satisfaction of the client

Applications in the Real World

A global leader in manufacturing batteries wanted to increase production rate of the existing machines from XXX parts per minute (PPM) to 1.5(XXX) PPM. Range of alkaline batteries was produced in different plants. The battery assembly line comprised different processes at synchronized speeds. Every station within the process line had distinctive purposes, and included sealant, insulator, electrolyte, slurry, crimp, cap, washer, needle and neg cap.

- The sealant station received empty cans that made the outer body of the cell
- The neg cap station completed the battery prior to the labeling operation
- A single geared system drove the entire battery line

QuEST modified the existing system, and devised a set of innovative and effective mechanisms that included integrating production workstations, redesigning and updating systems to achieve production rate of 1.5(XXX) PPM.

The concept can be extended to several facets of the FMCG industry in the production of consumer or personal care goods. For example, production of something as simple as a pen is characterized by several stations:

- Loading station, where cartridge is loaded to the process line
- Fitting station, where the point is fitted into the cartridge
- Filling station, where the cartridge is charged with ink
- Gas charging and plug fitting station, where pressure inside the pen is ascertained, air is charged into the cartridge and a plug seals the pen in place
- Sealing station, where a cap secures the gap and is sealed in place before heading towards labeling

The packaging wing also has its own set of distinctive processes and specific workstations. Adopting High Speed Process Line in this case would accelerate productivity.

Derived Advantages

A holistic feasibility study, a sensible re-engineering process of machines, and continuous evaluation and maintenance of the implemented solution can result in numerous advantages.

- Optimized productivity is a proven advantage, since this process implementation from QuEST has resulted in 50% increase in productivity
- Overall set-up costs in the long run have positively impacted the organization’s bottom line by reducing costs by 30%



- Outdated and inefficient technology is replaced by state-of-the-art and efficient technology mechanisms
- Machine ergonomics are enhanced for better functioning and adaptability in the short and long run
- Modularity facilitates production lines to be adaptable for product changes immediately or in the future. The time for transformation from the existing product lines to the new and improved version is considerably shortened. Expensive or time consuming reconfiguration is, hence eliminated
- Rapid processes and increased speed are the by-products of high reliability in the process adopted
- Engineering Instructions (EI) on how to assemble the new workstations and Maintenance Instructions in the form of 3D animation

Alternative Uses and Applications

The success rate observed in several projects executed by QuEST Global has facilitated High Speed Process

Line to be extended to other industries beyond FMCG like automotive.

Conclusion: High Speed Process Line in Production

High Speed Process Line opens a world of benefits to the production plants. QuEST's team of engineers and technical designers create integrated systems to ensure efficacy and efficiency of the process implemented. Modularity, reliability, improved productivity and ergonomic considerations are some of the immediate and lasting advantages of this cost effective High Speed

Process Line. The concept can be adopted by production plants and manufacturing units across industries and geographies.

Henry Ford once declared "Every piece of work in the shop moves." And at QuEST we believe in making the best moves.

Author Profile



Vinay Galimath

Vinay Galimath specializes in design and development of New Products. He is well versed in a number of CAD, PDM and FEM tools including Pro-Engineer, Solid works, Inventor, EPDM, Intralink, PDM works, Ansys Work Bench and Cosmos Xpress.

Vinay has a Bachelor of Engineering in Industrial Engineering and Management from SIT, Tumkur, and a Masters of Technology in Product Design, BMSCE, Bangalore.

Vinay has approximately 10 years of experience at Quest in fields of Industrial, FMCG, Aerospace, Automobile and Process Industries. He is currently the Technical Manager, and in charge of design and validation of high speed cell line. Previously in his career, he has been technical lead for design of various new products like Rope and Chain hoists. Modular Hygienic Pump, Gear Pump, Engine Retarder Break for heavy truck engine. Last but not least, he was a key contributor for design automation of drive and control systems, process equipment, and printing sub systems.

At QuEST, his role includes:

- Meeting the compliance requirements of the technical review process
- Interact with customer regularly for understanding specifications, project scoping and feedback on results and deliverables
- Appraising the technical deliverables by the FMCG team
- Managing the knowledge management repository
- Evaluating and maintaining the competency levels of the FMCG team
 - Identifying the training needs of the team and coordinating the training program. In addition, he is also actively involved in mentoring the new recruits on the job-specific requirements

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About QuEST Global

QuEST Global is a focused global engineering solutions provider with a proven track record of over 17 years serving the product development & production engineering needs of high technology companies. A pioneer in global engineering services, QuEST is a trusted, strategic and long term partner for many Fortune 500 companies in the Aero Engines, Aerospace & Defence, Transportation, Oil & Gas, Power, Healthcare and other high tech industries. The company offers mechanical, electrical, electronics, embedded, engineering software, engineering analytics, manufacturing engineering and supply chain transformative solutions across the complete engineering lifecycle.

QuEST partners with customers to continuously create value through customer-centric culture, continuous improvement mind-set, as well as domain specific engineering capability. Through its local-global model, QuEST provides maximum value engineering interactions locally, along with high quality deliveries at optimal cost from global locations. The company comprises of more than 7,000 passionate engineers of nine different nationalities intent on making a positive impact to the business of world class customers, transforming the way they do engineering.



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