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Development Working and Challenges of Automation System in Lean Manufacturing

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ABSTRACT

The objective of lean manufacturing is to reduce waste in human exertion, stock, time to market and manufacturing space to end up exceedingly receptive to customer request while delivering quality items in the most effective and prudent way. This methodology fixates on the disposal of waste. Waste might be discovered covered up in policies, systems, process and item plans, and in activities. Waste devours assets however does not increase the value of the item. Then organizations know about cost reductive policies like lean production which has demonstrated observable accomplishment; therefore a few makers will in general pursue such framework. This paper focuses on automation in lean manufacturing it discusses principles of lean manufacturing, lean implementation, constraints in lean implementation, challenges in automation of lean manufacturing, development of automation in lean environment and working of automation and lean together. Automation essentially does not intend to utilize entangled robotized frameworks. There would be numerous other less difficult choices which are progressively helpful to fill in as well as less expensive to buy.

1. Introduction

Manufacturing operations are ceaselessly endeavoring to expand productivity and yield of their operations. They will likely fulfill the customer with the correct item, quality, quantity, and cost in the most limited measure of time. Lean manufacturing is in excess of a cost decrease program or a critical thinking approach. The fundamental thought is that an effective production can be accomplished by a far reaching way to deal with limit wastes. This implies dispensing with abundance production and stock, repetitive development of material, waiting and deferrals, over handling, overabundance specialist movement, and the requirement for modify and redresses. Some portion of lean manufacturing is investigating operations for those parts, procedures or items that include cost

instead of esteem. Each progression of the manufacturing procedure is monitored to decide whether it increases the value of the item. On the off chance that it doesn't include esteem, the procedure could be assigned to a subcontractor or re-appropriating organization so as to concentrate the staff on esteem included operations of its center business.

All manufacturing industry has invested continuous effort for its survival in the current incautious and aggressive economy. So as to deal with the basic circumstance, producers are endeavoring to actualize new and inventive strategies in their manufacturing procedure by making it increasingly compelling and proficient.

In the event that the way toward developing automation isn't proficient and the manufacturing forms were not broke down amid the time, the outcome may not be lean. It will be a grievous circumstance if the wrong innovation was actualized or ill-advised usage of legitimate innovation. In this way, finding the appropriate measure of automation that can be utilized in developing automation ventures is imperative.

2. Lean Manufacturing

Lean manufacturing is a key device that is utilized to reduce waste and to for the most part enhance the effectiveness and competitiveness of numerous organizations and associations. Numerous ventures that have executed lean manufacturing have accomplished enhanced execution after some time. This exposition centers around two medicinal gadget organizations situated in the South of Ireland and their perspectives on the numerous issues associated with executing lean in their separate organizations.

As shown by Womack, Jones, and Roos (1990), the articulation "lean" addresses a structure that utilizes fewer commitments to demand to make comparative yields than those made by a conventional huge scale manufacturing system, while extending the extent of different finished stock for the end customer. The term lean manufacturing is synonymous with different names, for instance, skillful manufacturing, just under the wire manufacturing, synchronous manufacturing, world class manufacturing, and continuous flow.

The upsides of lean manufacturing generally are cutting down costs, higher quality, and shorter lead times. The term lean manufacturing is made to address less human effort in the association, less manufacturing space, less enthusiasm for instruments, less stock ahead of time, and less building hours to develop another thing in less time.

2.1 The Five Principles of Lean Production

Lean thinking depends approach to determine value, line up value making activities in the best structure, lead these exercises without interference at whatever point somebody ask for them, and perform them a more compelling way. This attestation takes us to the five principle of lean thinking: Value, Value Stream, Flow, Pull and perfection.

- **Include Value:** Value is characterized as a "capacity gave to customer at the correct time and at a correct

cost, as built up for each situation by the customer". Value is the basic beginning stage for lean thinking, and must be characterized by a definitive end customer.

- **Value Stream:** The value stream is characterized in Lean Thinking as the arrangement of all the "particular exercises required to configuration, arrange, and give a particular item, from idea to dispatch, request to conveyance, and crude materials under the control of the customer". To make a value stream, portray the end result for an item at each progression in its production, from configuration to request to crude material to conveyance define a value stream as being "all the actions (both value added and non-value added) currently required to bring a product through the main flows essential to every product:

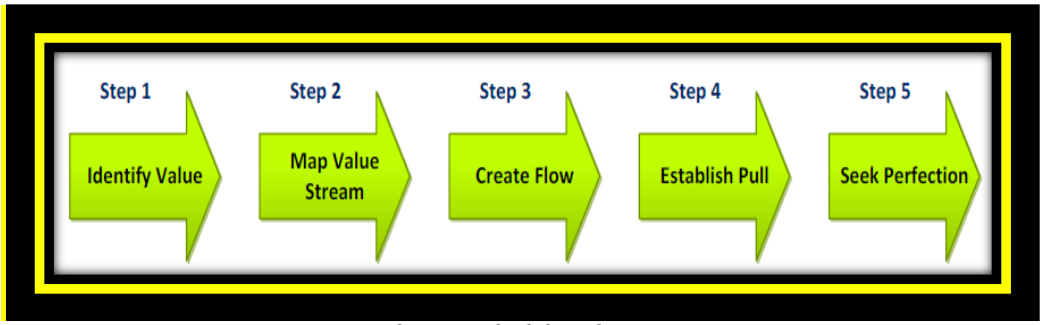

Figure 1 Principles of Lean

- **Production Flow:** Flow is characterized as the "dynamic accomplishment of errands along the value stream so an item continues from configuration to dispatch, request to conveyance and crude materials under the control of the customer without any stoppages, scrap or reverses". This makes an interpretation of as a mandate to relinquish the conventional cluster and-line method of thinking that appears to be realistic to most. Approaches to cultivate stream incorporate empowering speedy changes of devices in manufacturing, and also rightsizing machines and finding consecutive advances nearby each other.
- **Pull System:** The fourth lean principle of pull is characterized as a "system of falling production and conveyance guidelines from downstream to upstream in which nothing is created by the upstream provider until the point that the downstream customer flags a need". This is conversely with pushing products through a system, which is inert to the customer and results in superfluous stock development.
- **Perfection:** The fifth and last lean principle is perfection, characterized as the "total disposal of waste with the goal that all exercises along a value stream make value". This principle makes the quest for lean an endless process, as there will dependably be exercises that are viewed as waste in the value stream and the entire end of waste is all the more a coveted end-express that a genuinely achievable objective.

The final lean production principle is continuous improvement meaning that perfection is the only goal throughout the production lifecycle. Continuous improvement involves operators helping to solve problems in order to improve the manufacturing process and to become a more learning organization by criticizing every aspect of the production lifecycle.

2.2 Lean Implementation

Lean management implementation can give product separation and help the undertaking to work with fewer hazards in the chose market. Lean management might be seen as an approach to reduce costs in an organization, or as an approach to build customer satisfaction. Lean management likewise speaks to a manufacturing rationality prompting shorter cycle times and disposal of misfortunes.

To gauge the degree to which firms are occupied with lean management, an operational measure is required. Lean production in such a way, which will cross over any barrier between the varying philosophical and practice/tools points of view By consolidating such a conceptualization, this examination is additionally mindful of the qualification between the vital dimension (i.e. lean thinking) and operational dimension (i.e. lean production) and in this way its corresponding nature. Creators distinguished 10 factors in their investigation, which comprises of three factors that are provider related, one is customer related, and six are inside related.

The key components for effective implementation of institutionalization in lean management are operations, time, tools, and embellishments. The principle of consistent stream guarantees stable work processes which limit stops, waste, products of low quality, and redundant advances. The draw principle requires the demand dispatch by the customer so as to exchange request in reverse from the last gathering to the crude material distribution centers, which creates every one of the solicitations as they are required. The principle of ceaseless enhancement suggests consistent inclination to fulfill customer needs and enhance the manufacturing procedure without imperfections

2.3 Constraining Factors in Lean Implementation

The implementation of lean manufacturing procedures inside associations is seen to draw enormous challenges. Albeit lean manufacturing has perceptible advantages; its implementation in the association experiences a few challenges. Just 10 percent of organizations have lean manufacturing philosophy legitimately established. In addition,

it is trusted that under 10 percent of the general organizations still can't seem to achieve effective lean implementation inside their premises.

There are different reasons noted as the hindrances of fruitful lean implementation inside associations. Most of the times, these reasons go on undetected or remain belittled. The operational exercises inside manufacturing associations are as a general rule, particular. Therefore, connecting the reasons for these issues to their correct impacts turns out to be exceptionally mind boggling. The following are a portion of the variables that are accepted to deter the implementation of lean manufacturing and ought to be viewed as right off the bat in the lean strategies selection and implementation within organizations.

a. Cost of lean implementation

The principal essential point with respect to implementation of lean procedures is that lean production can't just be added to the current organization and be relied upon to work legitimately. There is a requirement for change in structure, propensities, execution assessment framework and by and large, change in the organization, to have the capacity to adjust to lean. Lean techniques are actualized to make the manufacturing procedure productive. Be that as it may, this regularly brings at least one undesired circumstances

- ✓ Need to submit additional implementation cost
- ✓ Investment in manufacturing and get together offices
- ✓ Changed maintenance and increased cost of part management
- ✓ Increased risk to quality

b. Lean implementation time

The progress procedure to lean is a difficult and time-consuming task. Makers are worried that executing lean methodologies is costly and tedious. Bachamada (1999) expressed that time might be required to be kept at any rate for the fruitful operation of lean. He ordered the lean implementation time in different stages, for example, arranging time, planning time, framework advancement time, preparing time, and production start up time. It is likewise expressed that the time between the underlying arranging and implementation went from six to seventy months, with a normal of 22 months for the general lean venture implementation. For the arranging phase of the undertaking the normal time taken by the organizations was around five months, running somewhere in the range of one and thirteen months. For the structure organize the normal and range was generally equivalent to for the arranging stage. For the framework advancement organize, normal time was around four months.

c. Misapplication of lean tools

Because of the aggressive idea of the present manufacturing market condition, most administrators have selected to receive the lean manufacturing idea in a surge. As indicated by ongoing studies, 75% of organizations at present utilize some kind of process enhancement system. Diverse territories of industry don't have a similar dimension of system implementation and similar techniques to pursue Hence, to accomplish effective implementation and consequent appropriation of the lean manufacturing idea, a mix of components must be encouraged simultaneously. These incorporate an early comprehension of the lean principles and their operational exercises and the effect of these principles inside any organization.

d. Employee involvement

Lean is regularly said to flop in implementation despites its present fame. This is something that lean shares for all intents and purpose with other management frameworks and organizational changes all the more by and large, where considers report disappointment rates of up to 70 percent. With respect to lean, proof demonstrates that disappointment might be established in constrained implementation encounter, a propensity to come back to old schedules, low management duty, absence of training and education, poor linkage between lean activities and overall strategy, etcetera.

e. Complexity of implementing lean tools

One trouble with lean manufacturing is that the unpredictability of the new methodology sets aside a long opportunity to execute completely. On the off chance that chiefs utilize just a couple of the essential lean tools to distinguish deficiencies, which is a handy solution approach, the genuine potential for emotional and persistent enhancement is normally lost. The essential inquiry most organizations wishing to embrace productivity enhancement activities confront is whether activities ought to be received successively or simultaneously. Studies have appeared most occasions, organizations focus on a particular paradigm in isolation.

f. Sustainable lean implementation

One obvious explanation behind lean manufacturing failure in organizations is absence of supportability of lean implementation endeavors. Basic achievement factors (management and initiative, organizational societies, objectives and destinations, critical thinking, skills, consistent enhancement, money related abilities, execution measure, change, instruction and plan) to actualize lean systems. They proposed three implementation stages (readiness, plan and implementation) yet neglected to set up a deliberate approach by which makers could recognize wastes; assess existing execution; evacuate those wastes; recalculate the execution and utilize maintainable lean tools for consistent enhancements.

3. Automation From Lean Perspective

Automation is an increasingly clear idea, however still one that has developed throughout the years. At its center, automation is just about the capacity to robotize different assignments in production. These can be small things, as basically moving a thing down a transport line automatically, to extensive things, similar to machines that total complex gathering done in the past by hand.

The vast majority of the adjustments in how automation is seen, or the potential outcomes it's been credited with at different occasions, are essentially an aftereffect of the truth of innovation in that day and age. Fifty to 70 years prior, a machine having the capacity to detect when a receptacle was full and proceeding onward to fill the following one may have

been progressive. Nowadays, whole production lines keep running with little to realize human inclusion is a genuinely normal reality.

Truly, automation has been utilized in mid 1960's with ergonomics reasons. Working in troublesome circumstance and lifting heavy parts are two instances of this. A short time later, businesses consider automation intend to enhance quality, execution and effectiveness. Automation is frequently viewed as the principle answer for enhance proficiency in manufacturing. Thusly it turned into a key innovation in manufacturing ventures. As per Granlund (2012) embraced from Groover (2008), automation advantages can be introduced as pursue: work productivity, reduce work cost, moderate the impacts of work deficiencies, reduce or dispose of routine manual and administrative assignments, enhance laborer wellbeing, enhance product quality, reduce lead time, achieve forms that is impossible physically and maintain a strategic distance from the surprising expense of not computerizing.

Western organizations routinely use innovation like automation as mean to fabricate manufacturing forcefulness. Automation is for the most part segregated into two characterizations; motorization and computerization. Automation predominantly relates to the physical stream of products, and computerization insinuates the stream of information. In perspective of producer's inclination, conveyed by Frohm (2008), automation has the going with essential focal points: upgrading working condition, potential results for extended volume limit, better thing exacerbation managing, conveying with in any event agents, change of benefit, cost cuts, and improved quality.

Figure 2 Automation in lean manufacturing

Regardless of what has been referenced previously, a few organizations that are intrigued to pursue lean manufacturing trust that more automation brings greater unpredictability and even has negate with lean principals. A few organizations and extraordinarily SMED's have absence of sure to manage automation issues and automation offices. Subsequently, they are profoundly reliant on their automation providers and integrators. They additionally observe automation with high starting bed, hard to keep up and furthermore with confused interface. In light of past investigations some automation challenges that may come to lean condition are recorded as pursue: high venture cost, product and process adaption and customization for the automatic manufacturing, robot programming adjustment for new product, human-Cell interface , human-Machine Interfaces, installation complexity, training of operators and personnel, quality issue and the capacity to identify absconded products, upkeep, space occupation, perception, skill issue and supply issue. A portion of these components can be rethought as complexity. Hedelined and Jackson (2011) have proposed three systems:

- The improvement and implementation of maintenance strategies
- Standardize the arrangements in each plant.
- Reduce the apparent complexity of system for operators.

3.1 Challenges In Automation

Executing automation in organizations would incorporate various fragments and may cause a couple of issues. Now and again it is serene striving for organizations to execute automation with high innovation mainly in light of the way that organizations have absence of certainty. The examination involved furthermore of separating the central obstacles to monetarily legitimizes the endeavor, and conveyed reasons not to place resources into robot automation Jackson et al., (2011):

a) Low and unbound volumes (56% everything being equal)
b) Short life-cycles, thing collection and costs to rethink the structure (38% everything being equal)
c) Reluctance in placing resources into bleeding edge innovation and the need to rely upon external specialists (31% all things considered)
d) Costs related to the need of versatility and re-configurability (24% all things considered)
e) Problems regarding the treatment of breakdowns and support (16% everything being equal)

4. Development Of Automation In Lean Environment

Organizations tend to take after cost saving policies, for instance, lean manufacturing. Furthermore, extraordinary forceful situation and issues, for instance, high work cost, quality issue and ergonomics goad organizations to progress toward increasingly raised measures of automation inside their business domain. Consequently, it is asked with respect to whether ordinary robot automation accomplices to the guidelines and practices of lean. As such, with an explicit ultimate objective to answer the request, the articulation "Lean Automation" has risen nowadays in mechanical condition. "Lean automation is a technique which applies the proper proportion of automation to a given endeavor. It stresses generous, reliable parts and cutoff points exorbitantly perplexed courses of action". In particular, the organizations utilized automation in a lean production condition to achieve: snappier thing headway; cut down stock dimensions; a rearranged operations organization process; extended stock turnover rates improved yield quality. Asks about exhibit a couple of organizations that are charmed to take after lean manufacturing believe that more automation brings more noteworthy unpredictability and even has renounced with lean measures. A couple of organizations have nonattendance of beyond any doubt to oversee automation issues and automation workplaces. Therefore, they are significantly subject to their automation suppliers and integrators. They in like manner watch automation with high starting bed, hard to keep up and besides with befuddled interface. In light of past examinations some automation challenges that may come to lean condition are recorded as take after: high theory cost, thing and process adaption and customization for the modified manufacturing, robot programming alteration for new thing, human-cell interface , human-machine Interfaces, foundation multifaceted design, getting ready of overseers and work constrain, quality issue and the ability to recognize betrayed things, upkeep, space occupation, recognition, capability issue and supply issue. A portion of these segments can be revamped as unpredictability; For instance, issues concerning human interface with cell and robots, upkeep, observation, etc. An outline dealt with by Hedelind and Jackson (2011) reveals that directors every now and again indicate that they don't for the most part observe what is happening inside a robotized cell anyway they see it like a "black-box". As a proposal to oversee multifaceted nature in production, Hedelined and Jackson

- The enhancement and implementation of upkeep systems. Mean productive help (TPM) has been recognized as a strategies for improving upkeep execution
- Standardize the arrangements in each plant. This prompts less additional parts. It also diminishes the prerequisite for a wide combination of exceptional planning and authority in different specific courses of action.
- At the moment that organizations develop their own automation courses of action, this can without a doubt be kept up by the production engineers themselves
- Reduce the clear unpredictability of system for overseers. For example, develop a UI with the ability to sort and show the information that is really expected to manage the operation. This system assembles information from various parts of structure and introductions them in sensible way.

5. Working Of Lean And Automation Together

As production has progressed throughout the years, the procedures and innovation we have readily available to enhance the speed and productivity of the things we do have expanded ten times. From one perspective, another and more profound comprehension of lead times and how different components of production influence each other have prompted a superior comprehension of how we can dispense with pointless materials and time from the production procedure. On the other, innovation permits us, presently like never before, to hand off the work in production to robots and machines for hands-off creation.

This two dimensional way to deal with higher proficiency can be generally part into two noteworthy classes: Lean or potentially Six Sigma procedure and automation. Now and again, these two thoughts have butted heads throughout the years, however actually they can really co-operate great couple. In this blog entry, I need to separate how the meanings of both Lean and automation in the workplace have advanced throughout the years, and after that discussion about how they coincide in a workplace, distinguish contrasts between the two, and so forth.

At the point when these issues are acted like "Lean versus Automation," it's anything but difficult to accept they're normally at chances. While this can now and again be valid, and we'll get to it later on, it unquestionably isn't in every case genuine, and the two thoughts can frequently really go connected at the hip. As a rule, this implies automation serves a component of Lean; how about we investigate how that may really look.

Probably the most widely recognized waste sorts that individuals connect with Lean are time, materials, and, by augmentation, cash. When introducing a machine or robotized framework to fill a roll recently possessed by an individual, you're likely hitting on one, two, or three of these. Here are a couple of explicit manners by which automation may play into Lean objectives:

- **No Need for Training**
- **Defect Rate Reduction**
- **Better Precision:**

Clearly, a major preferred standpoint can be the replacement of an ongoing cost (utilizing somebody to complete an undertaking for quite a while) with a forthright one that satisfies after some time (a possibly costly machine or framework establishment). As a rule, be that as it may, automation doesn't need to mean lost positions, yet a moving of consideration. For instance, computerized assignments may free up laborers to work in new divisions, or to practice their imaginative and inventive muscles recently. Probably the most energizing and innovative organizations on the planet are known for having what may appear excessively relaxation centered grounds for their laborers to invest their energy; you may be shocked by what or who conveys the following huge plan to your organization.

6. Conclusion

Executing automation has focal points and weights. Especially executing automation in lean environment gives off an impression of being trying. This can be because of diverse quality of modernized structures, high starting cost and nonattendance of flexibility. Remembering the ultimate objective to have the ability to overcome these troubles and makes automation inside lean environment adequately, following centers can be considered as end to meet automation capability in lean environment:

i. Holistic see toward automation
ii. Clear methodology and whole deal see toward automation
iii. Stability in process and methodology
iv. Flexibility of game plans and contraptions
v. Appropriate dimension of organizational capacity
vi. Appropriate sort of automation arrangements

It is constantly imperative to ask what is should have been computerized and how it ought to be finished. Automation essentially does not intend to utilize entangled robotized frameworks. There would be numerous other less difficult choices which are progressively helpful to fill in as well as less expensive to buy. Besides, relies upon the organizations circumstance, it is conceivable to create gear inside which will assist the organization with increasing interior ability too.

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