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Understanding Lean Manufacturing for Assisting Manufacturers to Improve their Company's Operations

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ABSTRACT

Lean development is one of the practices that illustrate the elimination of costs by the implementation of non-value activities. Tools that combine cell output, overall cost-effectiveness, single-minute dies sharing and smoothing have been commonly used as part of distinct areas of production. Lean production applications have been considerably smaller in the constant process industry. For this investigation reason following are the quantity of industries and sample size short recorded from the Jalna Industrial Area Total No. of industries are taken 10 (Steel Industries). Data have been gathered for the study from primary and secondary sources.

1. Introduction

The steel industry can be regarded, in terms of lean manufacturing, as a good candidate based on the taxonomy established. It allows the development of slimming more desirable because its alternate routing and parallel machines serve a variety of hot mill furnaces, a number of rinsing furnaces and many pickle lines at the end of the production process and the fact that its non-discrete goods are produced discrete relatively quickly or during the middle of the production process. In this sense it is also possible to adjust tools such as kanban pull method, output speeds, and reduction in configuration, TPM, 5S and others.

The taxonomy usually gives us guidance on which facets of a certain business lean. While all strategies may not be simple for all industries to implement, suitable tools for those industries may be defined based on their product and process characteristics and versatility. Industries like metals and textiles are also well suited to lean production. For lean equipment, such as JIT, setup reduction, TPM, and 5S, the metal industry production environment is close to that of steel. In the textile industry, the commodity becomes non-discreet early on, making it ideal for lean processing equipment. For example, reduction in installation and output levels could be modified to shift from one product form to another (gloves, clothing, etc.).

Another sector with a larger degree of equipment versatility is specialty chemicals. The production method is called a workshop system and the machine is arranged in a practical format in which a machine can produce several different items. Cellular production can be adapted in this industry by providing separate cells for various product classes. Each cell should have certain dedicated machines according the goods it can use, so this industry has parallel, dedicated, general purpose or advanced equipment.

With regards to the quantity of raw materials and goods, it has been said earlier that industries with a limited variety of raw materials and a high volume of products, including drinks, will be ideal for others, but not others. It should be pointed out that this would not imply a lean introduction for the process sectors not included in this grouping. Instead, it is important to analyze special Lean tools so as to see which one might effectively apply. The beverage, brewery and paper markets, for example, are businesses with high volume of goods. This inevitably allows the phase to flow continuously; however, cellular re-arrangement will be complicated for these industries. The adoption of the Kanban pull method is also impractical in such a scenario. Furthermore, due to its dedicated facilities, high volume and limited choice of raw materials, the installation reduction may not suit these industries. In such sectors, however, the fact that goods travel constantly raises the need for TPM to ensure high reliability of equipment. Finally, in any industry it can be applied strategies like 5S and visual system.

Industries on the other hand with a wide variety of raw materials and a limited amount of goods may still employ some lean tools for such an area. For example, tools such as reduction of set-up for fast changeover could be used in painting, speciality chemicals and medication industries to reach the production of small lot. Simple use may also be made of instruments like 5S and visual systems.

2. Literature Review

Harsimran Singh Sodhi (2020) The coronavirus has affected the manufacturing sector very hard. Output in every country has been stopped. The new research will provide experts with assistance in restoring the development region

from the delayed effects of coronavirus. The continuing paper and web papers were carefully analyzed in order to determine the global industrial impact of the pestilence crown. Additional findings are investigated by WHO, IMF, World Bank, RBI, and so on. Furthermore, Lean Six Sigma was proposed to rebound from the evil influence of the crown in the automotive industry. The problem induced in the processing industry by Covid was recognized in the present study and the Lean Six Sigma methods and strategies for the equivalent clinical treatment were proposed. The effect of coronavirus has not only become a big challenge for the physical good of humans but also for the financial strength of most countries on the globe as it drives the global economy through an unprecedented financial slowdown. Subsequently, industrial experts are expected to recommend the manufacturing industry's tools and strategies for faster recovery.

Maria del Rocio Quesada Castro, Juan Gregorio Arrieta Posada (2019) The pastry shop sector in the city of Medellin has exceptional monetary and social meaning; most of the organizations, with high informality, low value and production levels, are small. Lean Manufacturing has one of the most common ideal waste removal models, with exceptional trainings benefits for improving the quality and managerial effectiveness in both the business and administrative fields. This thesis explores the degree to which Lean Manufacturing technology is applied in the food industry in miniature and small businesses in Medellin. The organization used to boost current efficiency with symptomatic and later tools with the production boss questionnaire, which included nine strategies or tools and an administration variable which required associations to direct them. The key findings have shown that PokaYoke, the Kaizen and visual manufacturing plants are the excellent Lean practises. Whatever the case, activities for which the sector is regarded as a list must be strengthened: VSM (value age), JIT (production flow) and ADMON (Administration). Associations would raise agreements at least 139, 20 per cent, without increasing the number of members, to increase the degree of efficacy of the region.

Bakator, Mihalj and Ćoćkalo, Dragan and Vorkapić, Miloš (2018) The use of the ideas, tools and techniques of lean manufacturing for increasing efficiency in the material industry is divorced from this article. The key idea was to review literature extensively in the field of lean factory and textile manufacture and to create a hypothetical non-exclusive model that indicates the chance of increasing productivity. The model depicts a non-exclusive manufacturing framework, including possible ways to handle the increase in productivity using various lean production tools. Lean processing strategy relies on the elimination and elimination of multiple waste types. Of instance, in the article of the production process, efficiency and other metrics should be increased. In this scenario, the change relies on crucial details across the production lines. The details were obtained from the input circle and it is used after an evaluation to decide what changes can be made to boost efficiency and company results in general.

Benjamin Durakovic, Rukiye Demir, Kemal Abat, CelalEmek (2018) Many measures to reduce production costs, including lean manufacture, have been implemented in recent years. The key goals of this programme are to decrease and increase efficiency more. It comes from multiple tools and strategies and can easily blend into expense concentration or cost control procedures. However, the growth of the output quantity and product variety is becoming more acute under market circumstances. Paper thus concentrates on lean trends of execution of output and challenges in the different fields of produce. In some sectors the strengths and failures of lean manufacture implementation are discussed. Lean ideals have been found to be appropriate as a means of upper hand, they are ideal and are essentially advancing towards many sectors. The biggest risk when it comes to adopting lean is the lack of expertise, but the people who communicate with consultants were more effective.

3. Objectives

1. To study the role of lean manufacturing for assisting manufacturers to improve their company’s operations and become more competitive.
2. To investigate how the tools of lean manufacturing can be adapted from the discrete to the continuous manufacturing environment

4. Research Methodology

For overcoming the problem of brake-down of blast furnace we have adopted the Lean principle in which waste like waiting – Idle time is rectified. Due to sudden brake-down of blast furnace complete production process stops. For this Lean manufacturing principle recommends the total preventive maintenance (TPM). In which the maintenance of the furnace is carried out on a predefined schedule. For which the furnace is shut down for a predefined limited period. This shut- down time is less as compared with the sudden brake-down, and maintenance period.

4.1 Research structure

The steel industry should use the programmes of upgrading lean tools in a process office to understand the impacts of Lean Tools in the process division. In order to start, the current ABS status is specified by estimated stream mapping. This is used to classify source waste and then to separate lean instruments to try and decrease this waste. At that moment, the future State delineates a system with its lean resources. A simulation model will be built for ABS to quantify the benefits of lean mapping tools and strategies. A proposed technique for refreshing ABS is developed for these lean resources that cannot be precisely calculated by simulation, and a subjective evaluation of their advantages is presented.

4.2 Tools of data analysis

After the data assortment, arrangement was done; from that point analysis and translation were investigated. Both numerical and measurable tools have been utilized for data analysis. Mean weighted normal techniques and Statistical tests like Chi-Square test, T test, F test, Fisher Test have been utilized any place proper Graphical introduction and diagram and table techniques of insights were used. From that point the conclusions were drawn and recommendations were made. Following are the tests utilized for testing:

- **Chi-Square test:** The Chi-square test is a significant test emblematically composed as X^2. Chi-square is a factual test for inspection analysis. The data set will also conduct a Chi-square test, showing that at any point, 80 percent of cells have a recurrence of 5 or greater, and no cell has a more modest recurrence than 1.0.

$$x^2 = \sum_i \sum_j \frac{(Oij - Eij)^2}{Eij}$$

Fisher Exact Probability Test 2 x 4: The Fisher reliable test for a two-line probability table of four segments, indicating that the entire data set size is no greater than N=10. The test outcomes in two probability assessments: PA and PB.

4.3 Sources of Data

Data have been gathered for the study from primary and secondary sources. A pilot study was directed to check the attainability of the study and likewise to test the suitability of the inquiries remembered for the questionnaire. In view of the contributions from pilot study, minor changes were made to a portion of the inquiries remembered for the questionnaire.

5. Data Analysis

➢ Lean technique is helpful for improving the material flow & identifying bottleneck on the production line

Chi-square formula for testing:

Table 1: Lean technique is helpful for improving the material flow & identifying bottle neck

Organization/ Attributes/Respondent	Steel industry N=10 Respondent=30
Yes	26
No	4
Total	30

Source:-Primary Data (Questionnaire)

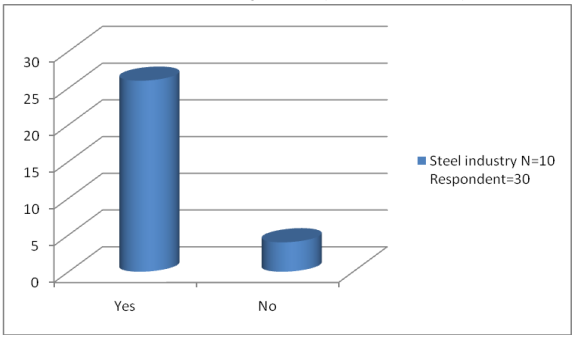

Figure 1: Lean technique is helpful for improving the material flow & identifying bottle neck

Table 2: Chi-square test

Organization/Attribute/ Respondent	Steel industry	Total
Yes	26/30*30	26
No	4/30*30	4
Total	30	30

Table 3: Chi-square test

Observed (O)	Expected (E)	O-E	$(O-E)^2$	$(O-E)^2/E$
26	17.6	8.4	70.5	4.005
04	2.4	1.6	2.56	1.066
				$\sum(O-E)^2/E=6.071$

(R-1) (C-1) = Degree of Freedom
(2-1) (4-1) = (1) (3) =3
Thus
X^2 Cal = 6.071
X^2 0.05 =5.83 at 3degree of freedom

In this manner X^2 Cal is a lot higher than table value of X^2 and therefore Lean technique supportive for improving the material stream and recognizing bottleneck on the production line.

Fisher Exact Probability Test:

Notwithstanding Chi-square Test, Fisher exact test is additionally applied to get precise outcomes. As a portion of frequencies' are under five subsequently Fisher exact test likewise applied for testing.

Table 4: Fisher Exact test

	C_1	Total
R_1	26	26
R_2	4	4
Totals	30	30

PA= 0.01105 (Probability per definition A)
PB= 0.01105 (Probability per definition B)

In this manner the determined values are under 0.05 thus Lean techniques accommodating for improving the material stream and distinguishing bottleneck on the production line.

➢ Lean thinking focusing on continuous improvement through elimination of all sorts of waste, both operational & organizational

Chi-square formula for testing:

Table 5: Lean thinking focusing on continuous improvement through elimination of all sorts of waste

Organization/ Attributes /Respondent	Steel industry N=10 Respondent=30
Yes	29
No	1
Total	30

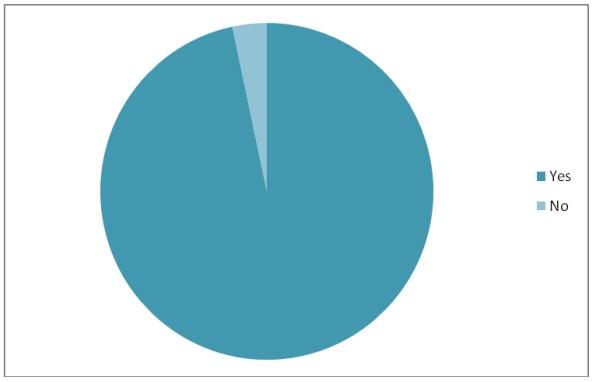

Figure 2: Lean thinking focusing on continuous improvement through elimination of all sorts of waste

- **Expected Frequency:**

Table 6: Chi-square test

Organization/Attribute/ Respondent	Steel industry	Total
Yes	29/30*30	29
No	01/30*30	01
Total	30	30

Table 7: Chi-square test

Observed (O)	Expected (E)	O-E	$(O-E)^2$	$(O-E)^2/E$
29	24.2	4.8	23.04	0.952
1	5.8	-4.8	23.04	3.972
				$\sum(O-E)^2/E=4.924$

(R-1) (C-1) = Degree of Freedom

(2-1) (4-1) = (1) (3) =3
Thus X^2 Cal = 4.924
X^2 0.05 =5.83 at 3degree of freedom

Subsequently X^2 Cal is a lot higher than table value of X^2 and therefore Lean thoroughly considering zeroing in on continuous improvement disposal of a wide range of waste, both operational and organizational.

- **Fisher Exact Probability Test:**

Notwithstanding Chi-square Test, Fisher exact test is likewise applied to get precise outcomes. As a portion of frequencies' are under five henceforth Fisher exact test additionally applied for testing.

6. Conclusion

As per the majority of respondents lean techniques are useful for improving the material stream and recognizing bottlenecks on the production line. As indicated by the greater part of respondents lean techniques are useful for lessening labor time for the association. As per a large portion of respondents lean speculation centers around consistent improvement through disposal of such a waste. As indicated by a large portion of respondents appraisal agenda is a successful device for lean evaluation. As indicated by most of the respondents lean technique is helpful in any association. Decreased such a waste, improve quality, diminished bottleneck on production line, decreased process duration and smooth material stream are the kinds of benefits detailed from association by utilizing lean tools and techniques.

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