

## AN ANALYTICAL STUDY OF USE OF AN ARTIFICIAL INTELLIGENCE IN INVENTORY MANAGEMENT WITH REFERENCE TO MEDIUM SCALE MANUFACTURING INDUSTRIES IN NASHIK INDUSTRIAL ESTATE

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### ABSTRACT

*Industries are using innovative strategies for maintaining the cost of production at different stages of supply chain management. Today, artificial intelligence is one of the technological advantages widely used by service industries and manufacturing industries. The role of manufacturing management is very important for developing any country for which India is also not an exception. Manufacturing the product in every qualitative aspect itself is a challenge for the developed country and developing and developing countries. Quality management is an important aspect of customer satisfaction. Delivery of customer value through quality management is one crucial aspect for which every firm is trying their level best. Artificial intelligence includes a wide range of machine learning activities that are working with human control. It is one of the helpful tools in manufacturing industries. In this research, the paper researcher would like to focus on one of the important aspects of manufacturing management, i.e., inventory management.*

**Keywords:** Artificial intelligence, inventory management, manufacturing industries Nashik Industrial Estate.

### Introduction

Any manufacturing industry's success depends on various parameters such as cost of production, customer satisfaction, demand and supply of the goods, forecasting of the market trends, etc. Demand and supply are one of the chains in which the satisfaction of the customer is dependent. If a firm has strong qualitative value among the product, then demand the product at an optimum price, possibly very high, it is challenging for the firm to maintain a proper balance between demand and supply. For smooth flow of demand and supply, it is required to maintain optimum production units. Inventory is the core requirement of the production. Inventory is interlinked between the distribution channel and the production house. In a simple context, Inventory is a stock of goods that always facilitate smooth flow of production.

Inventory management includes various ingredients. Therefore following are the crucial ingredients of Inventory:

a. **Raw Material Inventory:** The quality of production is dependent on the raw material. For any business, the optimum balance of raw material is an important one because some industry raw material is easily available, while for some industry it

is a challenge to make available raw material at the proper time.

- b. **WIP or Work In progress:** On raw material, when different processes initiate, it is called work in progress. It is conducted with the help of different machinery, equipment, and workforce. It is an earlier step of finished goods.
- c. **Finished Goods-** After work in progress, the final goods are all galled as finished goods, ready for sale. It may require different value addition activities such as packaging, finishing, labeling, etc. again, these finished goods may store in the warehouse for sale, and according to market demand, and they may be sold in the competition.
- d. **Spare parts components:** generally, processing of raw material is done with the help of machinery. Different value-added material is required at the time of various processing activities, such as spare parts, equipment, lubricants, switches, oil, etc. maintenance is also an important activity in the industry; therefore, proper Inventory is also necessary required in this stage.

Generally, the role of Inventory is important due to the following motives; these are as:

- i. Transaction motive
- ii. Precautionary motive
- iii. Speculative motive

- i. **Transaction motive:** to maintain a proper balance between demand and supply role of Inventory is important. For stable and smooth production, industries are generally needed. Inventory. Different kinds of sales operations are also dependent on supply; therefore, such kinds of transactions become needed in industries.
- ii. **Precautionary Motive:** uncertainty is one of the challenges as well as risks for the industry. Sometimes due to unavoidable incidents such as strikes, lockouts, natural calamities, if the raw material is not available at the proper time, it may create hurdles in the production process; therefore, for such precaution holding of Inventory is very much important.
- iii. **Speculative motive:** price fluctuation is one of the industry's benefits through the sale of goods. Speculation in the raw material price, such as a decrease in the price, may benefit the organization through cost benefits. Therefore such kinds of speculations can give benefit the organization.

In the industry, two important costs effect on inventory process. These are procurement costs and carrying costs. Procurement cost is relevant to the collection of material from various sources. Sources may be near or away; therefore, this research is trying this research to enhance the quality of education.

### Artificial intelligence

Artificial intelligence is an area of computer science that focuses on creating intelligent machines programmed to work and react like we humans. AI computers are designed for learning, planning, and problem-solving. With such methodologies as time series prediction and reinforcement learning that can be applied, AI helps companies predict consumer demand, manage supplier backorders, and optimize inventory stock levels.

### Role of Artificial Intelligence in Inventory control

1. **Forecasting of Demand:** Artificial Intelligence can work efficiently for the

prediction of the demand. It is one of the challenging tasks where it can work more efficiently and easily minimize risk and uncertainty.

2. **Reduce wastages and increase profit:** Artificial intelligence can work more efficiently and effectively in the management of Inventory at various levels such as raw material, work in progress, finished stock management.
3. **Effective check on Human activities:** Artificial intelligence can work more effectively and efficiently so that manual or human errors can be minimized. To control manual activities, artificial intelligence can work more effectively.
4. **Effective utilization of the Inventory:** AI creates a mechanism of effective planning, coordination, organization, and direction for the Inventory; therefore, effective utilization of the Inventory can be possible.

### Literature Review

1. Rupa Dash, Mark McMurtrey, et al., (2019) Use of AI has transformed the manufacturing sector, from virtual assistants to advanced robotics, has enabled the manufacturing companies to produce more with fewer errors to adept demand. Using AI helped them in rapid growth as they can shorten development cycles, improve engineering efficiency, prevent faults, increase safety by automating risky activities, reduce inventory costs with better supply and demand planning, and increase revenue with better sales lead identification and price optimization, etc.
2. Tom Jose V reported that Inventory management is the integrated functioning of an organization dealing with the supply of materials and allied activities to achieve the maximum co-ordination and optimum expenditure on materials. Inventory control is the most important inventory management function, and it forms the nerve center in any inventory management organization. An Inventory Management System is an essential element in an organization. It is comprised of a series of

processes, which provide an assessment of the organization's inventory. For example, we consider the inventories in a company that makes washing machines in all these analyses.

3. Tereza Sustrova (2016) The constructed model of an artificial neural network can be used for further order cycle optimization. The future order amount can be planned based on predicted demand, and thus the inventory management can be improved as a part of supply chain management. The article presents artificial neural networks as very useful and bringing many opportunities for further research.
4. Lawrence Imeokparia (2013), inventory management approaches imply that customers are frequently waiting for stock to fulfill their requirements through inventory postponement, and in turn puts added pressure on the third-party logistics provider who faces these inventory management issues directly with the customers. The implications of this can be negative feedback and negative customer relationships, as opposed to positive customer relationships if the inventory management approach adopted a level of inventory speculation, where forecasting would increase the inventory and would be more likely be available to fulfill the customer's requirements.
5. Ndlala Phindile and Mbohwa Charles concluded that The paper reveals that employing inventory control comes with a big price. There are many problems that an organization needs to attend to. Ineffective inventory control is the main problem. Furthermore, companies in developing countries do not use the basic inventory control techniques. In many cases means the ROP is always related to the extent of working capital available. Companies in developing countries tend to order a massive quantity of stock subject to the amount of working capital available.
6. Serhii Zhukov, (2015) Economic Production Quantity model (EPQ) determines the quantity a company or retailer should order to minimize the total inventory costs by balancing the inventory holding cost and average fixed ordering cost. E.W. Taft developed the EPQ model in 1918. This method is an extension of the EOQ model. The classical economic production quantity model (EPQ) has been widely used. Numerous research efforts have been undertaken to extend the basic EPQ model by releasing various assumptions or adding new so that the model conforms more closely to real-world situations. Recently, re-work activities have attracted considerable attention because of the reduction of natural resources and the rise in raw materials' cost.
7. Obiri-Yeboah Hanson, David Ackah & Makafui R. Agboyi (2015) Efficient inventory control can be done by introducing different measures to prevent the company from incurring unnecessary losses made by different departments. Measures can be put in place, for example, stock-taking, which is the accounting of stock at every end of the month, to record the lost and available stock, etc. The company should set up strict rules for procurement officers and store managers to follow during purchasing and storing of material to avoid loss. Therefore, an organization needs to have a sound, effective and well-coordinated inventory management system because the business environment is rapidly changing, highly competitive, and drastically affects its performance.

### Research Methodology

For this research work researcher has used the following research methodology:

### Objectives of the study

1. To study the role of inventory management systems in the manufacturing industries.
2. To study the need and role of artificial intelligence in the medium scale industries of Nashik industrial estate.
3. To study Impact of artificial intelligence on the overall productivity and performance of the organization.

### The hypothesis of the study

**H01:** Artificial Intelligence cannot have a Significant Impact on the overall performance of an organization.

**Ha1:**Artificial Intelligence has a significant impact on the overall performance of an organization.

**H02:**Artificial Intelligence cannot have a Significant Impact on the productivity of an organization.

**Ha2:** Artificial Intelligence has a Significant Impact on productivity and organization

### Sources of Data Collection

For this research work researcher had collected data through primary as well as secondary sources. These sources are as follows:

#### Primary sources

The researcher has collected data by using the following sources :

1. Discussion
2. Observations
3. Interview
4. Questionnaire

#### Secondary sources

1. Websites
2. Journals
3. Books

**Types of Research Design:** for this research purpose researcher is used exploratory and descriptive research design.

**Sample size:** 60 respondents

**Sampling technique:** simple random sampling

**Statistical Test:** The researcher has used the ANOVA test for testing of hypothesis.

#### Scope of the study

Maintaining the cost of production is one of the greatest challenges for every industry in today's competition. Industries are using innovative strategies for maintaining the cost of production. Today, artificial intelligence is one of the technological advantages widely used by service industries and manufacturing industries. This research paper researcher wants to study the scope for artificial intelligence in the medium scale manufacturing industries of Nashik industrial estate.

#### Limitation of the study

The researcher has collected by using primary data such as questionnaires, discussion, and

observation. Some of the respondents were not easily shared information due to secrecy. The researcher also had collected secondary data that are lacking the primary touch of the information. With this, both limited researchers tried to collect the maximum database for this research study.

### V. Data Analysis and Interpretation

**Table 1: Need of Artificial Intelligence**

| Sr.No | Particulars | Number |
|-------|-------------|--------|
| 1     | Yes         | 38     |
| 2     | No          | 14     |
| 3     | Can't say   | 08     |
|       | Total       | 60     |

Analysis and Interpretation: Above table shows need of artificial intelligence in manufacturing industries. 64% respondents are agreed with need of artificial intelligence, 23% are not agreed and 13% became neutral. Therefore it is clear that maximum respondents are agreed with this need of artificial intelligence in manufacturing industries.

**Table 2: At which level it is useful**

| Sr.No | Particular     | Number |
|-------|----------------|--------|
| 1     | Raw material   | 7      |
| 2     | WIP            | 29     |
| 3     | Finished Goods | 02     |
|       | Total          | 38     |

Analysis and Interpretation: from the above table it is clear that 76% respondents said that artificial intelligence can be useful at Work in Progress, 19% said that procurement of Raw material and 5% said that finished goods.

**Table 3: Whether it can increase roductivity of an organization**

| Sr.No | Particulars | Number |
|-------|-------------|--------|
| 1     | Agreed      | 38     |
| 2     | Not agreed  | 14     |
| 3     | Can't say   | 08     |
|       | Total       | 60     |

Analysis and Interpretation: The above table indicate role of inventory in increasing productivity. 64% respondents agreed with increasing productivity, 23% not agreed and 13% became neutral. Maximum respondents

are agreed with artificial intelligence can increase productivity of an organization.

**Table 4: Impact of Artificial Intelligence on overall performance of an organization**

| Sr.No | Particulars                 | Yes | No |
|-------|-----------------------------|-----|----|
| 1     | Increase productivity       | 38  | 22 |
| 2     | Smooth functioning          | 35  | 25 |
| 3     | Saving of time              | 45  | 15 |
| 4     | Decrease cost of production | 43  | 07 |

Analysis and Interpretation: From the above table it is clear that artificial intelligence can have positive impact on saving of time, decrease cost of production, increase productivity and smooth functioning of the manufacturing processes.

**Table 5: Effect on employment:**

| Sr.No | Particulars | Number |
|-------|-------------|--------|
| 1     | Agreed      | 45     |
| 2     | Not agreed  | 08     |
| 3     | Can't say   | 07     |
|       | Total       | 60     |

Analysis and Interpretation: from the table and pie-chart it is clear that 75% respondents are agreed with artificial intelligence can effect on employment.75% respondents agreed with this while 13% are not agreed with this.

**Table 6: Need of the training for implementation of AI**

| Sr.No | Particulars | Number |
|-------|-------------|--------|
| 1     | Yes         | 47     |
| 2     | No          | 08     |
| 3     | Can't say   | 05     |
|       | Total       | 60     |

Analysis and Interpretation: from the above table it is clear that 78% respondents said that it is need for the training of the artificial intelligence, 14% said not required while 8% cant not said anything. Therefore it is clear that maximum respondents said that need of the training is essential for implementation of the Artificial intelligence.

**Testing of Hypothesis**

**Hypothesis-1**

H<sub>0</sub>1: Artificial Intelligence cannot have significant impact on overall performance of an organization.

Ha1: Artificial Intelligence is having significant impact on overall performance of an organization.

**Table 7: Testing of H1**

| Sr.No | Particulars                 | Yes | No |
|-------|-----------------------------|-----|----|
| 1     | Increase productivity       | 38  | 22 |
| 2     | Smooth functioning          | 35  | 25 |
| 3     | Saving of time              | 45  | 15 |
| 4     | Decrease cost of production | 43  | 07 |

**Table 8: ANOVA H1**

| Anova: Single Factor |          |     |          |          |          |          |
|----------------------|----------|-----|----------|----------|----------|----------|
| SUMMARY              |          |     |          |          |          |          |
| Groups               | Count    | Sum | Average  | Variance |          |          |
| 38                   | 3        | 123 | 41       | 28       |          |          |
| 22                   | 3        | 47  | 15.66667 | 81.33333 |          |          |
| ANOVA                |          |     |          |          |          |          |
| Source of Variation  | SS       | df  | MS       | F        | P-value  | F crit   |
| Between Groups       | 962.6667 | 1   | 962.6667 | 17.60976 | 0.013736 | 7.708647 |
| Within Groups        | 218.6667 | 4   | 54.66667 |          |          |          |
| Total                | 1181.333 | 5   |          |          |          |          |

Analysis and Interpretation: From the above tables it is clear that p-value is less than 0.05. F value table value at 5% level of significance is 9.013 and calculated value is 17.60. Therefore it is clear that  $F_{table\ Value} < F_{calculated\ value}$  hence we reject null hypothesis and accepted alternative hypothesis i.e Artificial Intelligence is having significant impact on overall performance of an organization.

**Hypothesis-2**

H<sub>0</sub>2: Artificial Intelligence cannot have significant impact on productivity of an organization.

Ha2: Artificial Intelligence is having significant impact on productivity an organization

**Table 9: Testing of H2**

| Sr.No | Particulars | Number |
|-------|-------------|--------|
| 1     | Agreed      | 38     |
| 2     | Not agreed  | 14     |
| 3     | Can't say   | 08     |
|       | Total       | 60     |

**Table 10: Chi-square for H2**

| Sr.No | Particulars | Observed Value(O) | Expected Value (E) | O-E | (O-E) <sup>2</sup> | (O-E) <sup>2</sup> /E |
|-------|-------------|-------------------|--------------------|-----|--------------------|-----------------------|
| 1     | Agreed      | 38                | 20                 | 18  | 324                | 16.2                  |
| 2     | Not agreed  | 14                | 20                 | -6  | 36                 | 1.8                   |
| 3     | Can't say   | 8                 | 20                 | -12 | 144                | 7.2                   |
|       | Total       | 60                |                    |     |                    | 25.2                  |

Analysis and Interpretation: from the above table of hypothesis testing it is that Chi-square  $Table\ Value < chi-square\ calculated\ value$ . Chi square table value is at 5% level of significance & one degree of freedom is 5.99 and calculated value is 25.2. Therefore it is clear that null hypothesis is rejected and alternative hypothesis is accepted i.e. Artificial Intelligence is having significant impact on productivity an organization.

**Findings, Conclusion, and suggestions of the study**

**Findings of the study**

Most of the respondents agree with artificial intelligence as the need for today's competitive environment, especially inventory management. Work in progress is an important inventory management level where artificial intelligence can play an important role. Artificial intelligence can play an important role in an organization's overall performance, such as increasing productivity, smooth functioning, and saving time and cost. It is also found that the use of artificial intelligence can effect on decreasing employment. Training is an essential need for the effective

implementation of artificial intelligence in medium scale manufacturing industries.

**Conclusions**

Every sector is facing the problem of maintaining the cost of production at every level of production. Competition is increasing at every level of inventory management. Inventory includes raw material inventory, work in progress, and finished goods inventory. This study researcher would like to conclude that artificial intelligence can play an important role in cost reduction through effective inventory management.

From this study, it is clear that artificial intelligence is the need of today's competition. Artificial intelligence can be more effective at work in progress inventory. Industries should understand the role of AI to increase productivity, smooth functioning, and reduction in time and saving of cost. Training of Artificial intelligence is need of the today's competition.

**The Conclusion from hypothesis testing**

The researcher has used the ANOVA test for testing the hypothesis-I. It is clear from the respondent's opinion that artificial intelligence

can play a vital role in the increased overall performance of the organization.

For testing hypothesis-II researcher has used the Chi-square test. From this test, it is clear that artificial intelligence can play an important role in increasing the organization's productivity.

### Suggestions

1. Industries should understand the importance & need for artificial intelligence.
2. Industries should increase awareness of Artificial Intelligence in their organizational premises and to all stakeholders.
3. Implementation of AI is one of the costlier propositions so that industries should search for better alternative sources from the Indian or overseas market of Artificial intelligence model with the optimum cost to be affordable for medium scale industries.
4. The industry should undertake research and development activities to develop better AI systems according to their need for preferred job activities.
5. Training is one of the important and essential needs for the effective implementation of Artificial intelligence.

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