

# **Supply chain management practices and lean production improvement in food and beverage industry**

Research dissertation presented in partial fulfilment of the requirements  
for the degree of  
**MSc in Procurement and supply chain Management**

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## **Candidate Declaration**

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I certify that the dissertation entitled **Supply chain management practices and lean production improvement in food and beverage industry**

submitted for the degree of **MSc in Procurement and supply chain Management** is the result of my own work and that where reference is made to the work of others, due acknowledgment is given.

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## **Abstract**

The paper is focused on the implementation of Artificial Intelligence in Lean Production and Supply Chain Management. Focusing primarily on the fact that there exists a gap between the expected performance from the companies while executing the production process and the actual performance given by them. To cover that gap the research is endeavouring to analyse the impact of implementation of Artificial Intelligence in Lean Production and Supply Chain.

Artificial Intelligence can be the star to hitch the wagon of lean production to. With minimised wastage, abstainment from scrappage, minimised employee costs, adaptability to variation in the voluminous production, producing varied ranges of products the major hinderances and shortcoming of the production line get solved.

Although some are still skeptical about the extend to whether they should implement AI into the core production lines. As uploading company data to the cloud makes the company vulnerable to cybercrimes, technical breakdowns can disrupt and halt the entire production line.

The paper goes about the process by evaluating the option from the mindset of the executives who are responsible for the production and supply line. Qualitative approach is used for collecting data and narrative and disclosure approach is applied for analysis. Thematics is used for coding the data and assigning them with values to obtain desired result.

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## Abbreviations

IOT	Internet of Things
CFA	Carry Forwarding Agent
CRPF	Collaborative, Forecasting, Planning and Replenishment
LSCM	Lean Supply Chain Management
MNC's	Multinational companies
PCA	Principal Component Analysis
RFID	Radio Frequency identification
SCM	Supply Chain Management
SFCS	Sustainable Food Chain Supply
SME's	Small and Medium-Sized Enterprises
SSI	Small Scale Industries
VSM	Value Stream Mapping
FMCG	Fast Moving Consumer Goods
FIFO	First In First Out



# Chapter 1. Introduction

## Overview

This research paper deals in interpreting how supply chain methods and lean process could be applied in food and beverage industries to make the process run efficiently and economically. It also concentrates on understanding the development of supply-chain management in food and beverage production with exceptional reference to the lean manufacturing field. Facing the challenge of feeding the growing population of the world with affecting factors like changing taste and preference of consumers, market fluctuations and sustainability, this is where new supply chain methods can be followed to resolve the vulnerable and resilient issues. The primary research will be done in South India. The economic growth in food and beverage industries is increasing significantly with a total market value of 46 billion U.S dollars in 2020 as per (Statista, 2016). In addition, future technologies and lean methods will also help us manage, handle and process high volumes of data and is ready to cope with ever changing market demands and regulations. Production and manufacturing cycle have a lot of variables to deal with such as raw materials and moving goods, allocating ingredients and the right amount with exact quantity on the desired line keeping in mind the shelf life duration and food safety which is the crucial part in this sector without compromising on the taste and quality of the product. With the internet of things (IOT) movement, there is a gradual increase throughout the industry, more importance is given to sensors and radio frequency identification (RFID) to minimize human interference.

### Supply Chain Method

Supply chain methods deals with new technique to collect, process data and run lines efficiently in food and beverage industries. To keep the stock moving companies are bringing in flow-through sorting system in most of their operations to make tasks like restocking simpler. According to an American author, Brian Shannon, “The complex processes that characterize the food and beverage industry bring an extensive list of challenges, including low profit margins, perishable products, stringent government regulations and changing consumer tastes,”. (schug, 2017)

### Lean Production Method

(Ballard, et al., n.d.) defines Lean Management as the integration of the product design with the entire scope of the production system to the operations performed on the materials and information in that system for greater efficiency in the production process. (Arbós, 2002) conveys that managements who follow lean production are able to attain higher levels of efficiency, competitiveness and flexibility in their production systems. He emphasizes on the inclusion of lean production methods in the service sector. Supporting his theory in the manufacturing sector (Angel Martínez Sánchez, 2001) analyses that the lean production methods can be used to assess the improvements made by the company in their production processes and the identifying the areas inhibiting inefficiency. Apart from efficiency in the production processes lean production also provides sustainable competitive advantage to the companies mentions (Lewis, 2000). Where he describes that lean is no longer an added advantage but a core principle going forward.

### Research Purpose

The aim of this paper, with the prospect of methods such as lean production, is to investigate the effect of lean production methods on enhanced performance of supply chain methods based on food and beverage sector. The research is to establish an early understanding of lean production methods within the sector of food and beverage and its upstream and downstream stakeholders. The food manufacturing industries should find this paper to encourage the management to follow lean production methods in integration with supply chain management in the food and beverage sector.

Furthermore, with the recent global developments due to the pandemic it is crucial that going forward businesses are aware of measures that can provide resistance to the businesses from experiencing a major impact with minimised losses. The research theorises on the concept of integrating and inculcating Artificial Intelligence in the production process as a variable of the lean method.

The objective of this research is to find identify the methods used and improve the process. The below mentioned questions will help us to form a pillar to our research and initiate in providing

comparison between the existing and future robust technologies which will direct us towards sustainable procurement and lean supply chain.

### Research Problem

If companies today want to be market pioneers, they need to focus on their supply chain management components to adapt in the fierce and challenging business environment. (NJOKU & O.U., 2015). The food and beverage industry today are burdened with modern day challenges. Companies are now required have responsible and ethical procurement while maintain low cost labor inputs. In addition to which the product quality has to be maintained and product has to be supplied in edible condition to the suppliers. Along with which the external competition also has to be taken into consideration. Inefficient performance will lead to a bankruptcy. Where the companies failed to use SCM it was seen that there were high levels of inventory which increased the operating costs for the product and increased the break-even point making it difficult to have higher profit margins. (Xu & Makweba, 2009).

With the cut throat competition that now prevails it is now essential for companies to now come up with newer models with higher adaptability to varied circumstances. Process efficiency should be applied on from the procurement stage right until the sale of the product to the customer. This includes minimizing on wastage, maintaining appropriate levels of inventory, increasing the shelf life of the product, lowering the break-even point, optimizing the freight charges.

### Research Questions

Based on the research problem the researcher has identified that the problem pertains to the fact that cost minimisation depends on the company's willingness to do it. To what extend can the company cut back on its quality or should it sell it in tranches of quality or should human intervention be minimised for decreasing labour costs.

Companies need to think on it from a long-term perspective and in terms of innovation. Something that can keep updating itself from the repetitive processes it performs. Incorporating Artificial Intelligence in the chain can be extremely beneficial for the companies.

**Research Question:** To what extent can the application of Artificial Intelligence bring efficiency in Lean Production in Supply Chain Management?

### Significance of the Study

In order to remain the finest, the global food industry should constantly improve their quality methods and productivity. The research paper systematically, collects and critically scrutinize existing lean production and supply chain system in the food industry and aims to understand how to enhance the process. It also seeks to investigate the impact of lean production in minimizing the extra inventory and fulfilling the customer requirements. It will also help us find the predictability gap between the existing technologies used and the future technologies in this industry taking into consideration the problems faced where many of the operations are still painfully manual. Analysing and processing data in a lean way can simplify the whole process and give out details in organised format which can be assessed and reviewed conveniently.

Food products can be classified into 2 main types: (1) 'fresh' agriculture products (such as fruits and vegetables) and (2) 'processed' food products (desserts, canned foods and snacks) (Zhanguo Zhu, 2018). Beverages industries can be classified into 2 major types: (1) Alcoholic and (2) Non-Alcoholic, where non-alcoholic can be further categorised into aerated and non-Aerated (361degreeshospitality, 2014). Different categories of food products need to be treated differently. A greater portion of the market is negligent in this certain aspect by which they fail to maximum their gains. It is crucial to expand the scope of the pre-existing horizons to incorporate new ideas of improvement in an innovative manner. With the growing competition it is important to factor in the external influencers to form a practical and enforceable model. Developing a lean production model in co-relation to the supply chain management will create a huge impact on the distribution, storage and transportation methods of the companies. Different products have different shelf lives which has to be the first priority filter for the model. The aim is to recognise and build backed by

Artificial Intelligence that can adapt to the newer times and work at full efficiency and effectiveness.

### Research Objectives

#### **Primary Objective:**

To reach a point of integration of lean production and supply chain management in food and beverage industry.

#### **Secondary Objective:**

To forecast the scope of implementation and necessity of Artificial Intelligence in lean production and supply chain management.

Food and beverage industries are booming and every household depends on them for their daily needs and necessities. They play a prominent role in providing commodities in day to day life. Meeting the needs and taste preferences of the customers are a crucial part in this industry and also matching up to the seasonal preference varying from person to person. Apart from that keeping the store shelves full at all time and layout the optimum usage of the given area is also challenging. Providing optimum priority to not only to reach every single person need but also to make sure all the products sent out are in quality considering the standards of the company and the governing body. Lean practices can be used to obtain maximum productions economically and upgraded supply chain methods can be implemented to reach out on every market shelf in that given period. Running lines efficiently and economically can be a major task for both operations and line managers as quality and standards should match the lean process of the company. Use of new technologies could help the industry to build a better proper framework to comply with the emerging needs of the company.

When the food and beverage sector is analysed in respect to the challenges, they try to resolve it becomes important to built a model integrating practices that can overcome the on-ground problems and help built a concrete base for the business to achieve sustainable growth. The paper focuses on the need of recognising the need of a building an integrated model and therefore

establishes its objective to find a point of integration for concrete basis along with providing scope for future development in the form of Artificial Intelligence.

## Structure of the Study

### Chapter 1. Introduction

A brief understanding about the Lean Production and Supply Chain Management. The existing processes and models followed and their effectiveness. Specifies the aims and objectives of the paper. The main research questions are mentioned to provide the reader a clear estimate about what the paper is going to be.

### Chapter 2. Literature Review

Literature review mentions the previously written research work which directly or indirectly relates to this academic research. It provides precedent for the research to be undertaken and a concrete basis for the researcher to justify the reason for undertaking the research.

### Chapter 3. Research Methodology

This chapter pertains to the data being collected, analysed and concluded. The analysis is used to prove the hypothesis undertaken. It specifies the type of research opted for. The methods and strategies used for collection of data, the type of data that is being used, interpretation of the results generated and the conclusion in respect to the primary and secondary objectives mentioned. It mentions the methodology that is undertaken by the researcher to justify his hypothesis with the support of the data results.

### Chapter 4. Presentation, Discussion and Findings

The analysed data is presented to come to a conclusion on the hypothesis. The rationale behind the conclusion and the results obtained during the research.

### Chapter 5. Concluding Thoughts on the Contribution of this Research, its Limitations and Suggestions for Further Research

This chapter describes the conclusion drawn by the researcher based on the study and key findings.  
The chapter also includes the recommendation proposed by the researcher.

## Chapter 2. Literature Review

### Scope of Supply Chain Management

Since early 80's businesses have been under a tremendous pressure to innovate techniques improve customer services, reduce the cost of product and bring in efficiency in order to get high profits. Organisations had to adopt to new strategies to obtain competitive advantages. Manufacturers have indeed been developing creative approaches to gain and preserve their core competencies while entering a new period of intense global competition. One such concept is Supply Chain Management (SCM), which has received a great deal of attention from both academicians and policymakers over the last decade. (Felix T.S. Chan, 2017). The development of successful SCM has increased the demand for volume, agility, waste management, process monitoring, human use and global scope to achieve competitive advantages. Well-designed supply chain processes can boost significantly productivity and commodity consistency, and consequently improve consumer profit levels. Implementing lean processes through supply chain will reduce duplication and lead times as well as add benefits to clients. Lean supply chain is a modern performance management methodology from which supply chain efficiency can be tracked.

In order to completely understand the scope of supply chain management (Davis, 1993) in his research paper has developed a framework for addressing the uncertainty that hovers on the reliance of suppliers, dependency of the manufacturers, need of transporters and the dynamic of customer demand. It is pivotal to keep the customer satisfaction at the centre of the supply chain management while focusing on reducing the overall costs for the process. One of the key points to remember while designing an effective supply chain is to be able to respond to uncertainty. Supply management operates in a chain and a problem at any given end can disrupt the entire line that is why it is important to be mentally cognizant for the element of surprise.

When supply chain management is discussed from an industrial perspective (Ellram, 1991) describes the advantages and disadvantages of the of it in relation to the vertical integration of the chain along with the obligational contracts. It also highlights the fact that if followed with certain conviction supply chain can be of great help as a competitive advantage, can help avoid hazards and prevent some. Speaking from retrospect (J.Thomas & M.Griffin, 1996) segments supply chain



management into procurement, production and distribution. Due to the increasing global competition companies are now under pressure to develop their supply chain model to adapt to the needs of the customers. This has brought innovation and modern solutions under one umbrella. The remain ahead firms are now forced to reduce their operating costs and improve their customer service.

(SameerKumar & AnvarNigmatullin, 2011) portrays the prime objective of the study is to gain perspective on the performance of a non-perishable product in monopolistic environment. It uses the system dynamics approach to understand the behaviour and relationship of a non-perishable product in the scope of supply chain. Supply chain has been segregated into different components to understand the process in its entirety, to facilitate the study of the critical components. Scope of the study includes modelling to generate multiple scenarios wherein the strategic implementation shall be required along with business decision making. It primarily focuses on 4 different aspects. Food chain supply management issues, changes/uncertainty/trends affecting the demand of food chain supply, demand cycle according to seasons, system dynamics modelling.

### Emergence of Lean Production Methods

Shifting our focus to lean production (MatthiasHolweg, 2007) in his research specifies that lean production has moved the attention of the managers from the accepted mass production norms. It has now become a trade-off between mass production and quality production. It also has significantly impacted the manufacturing and services provided incorporating the two with innovation and tailwind it above and beyond the general high-volume manufacturing environment.

(RachnaShaha & T.Ward, 2007) takes it further ahead and discusses about the confusion and inconsistency in the lean production methods. By identifying a key set of measurements lean production, a linkage can be charted between the lean production process and the manufactured items. Thus, making it possible to decrease inefficiencies in the production process and effectively produce the output.

Furthermore, (Karlsson & Åhlström, 1996) mentions developing a model that has both research and practical application use. When used as a research tool it can be used as a model for understanding the operational lean production processes and the changes in it in-depth. When used as practise tool it can be used for understanding the application of the assumed processes in its practicality. And lastly it can be used as a to keep track of the development and effectiveness of the lean practise model.

Mass researchers have focused on the incorporation of lean production methods from the perspective of a company's performance or a pattern or a technique followed. (Biazzo & Panizzolo, 2000) focuses on the same from the viewpoint of the employees. The various dimensions that should be factored in while the decision is being made since the direct impact is experienced first hand by the employees. It focuses on how the underlying descriptions of lean production do not focus on the ground reality of the adoption on the processes.

### Effective Supply Chain Management

For an effective supply chain strategy in food industry the end goal of the SCM should be kept in the mind that is providing efficient inventory to each member of the supply chain as well as service goals. For this the flow of the information is very vital at each stage of the supply chain to achieve the main goal of the supply chain. Demand forecasting, anticipated lead times and safety stock practices in food industry how information flow at each stage of the supply chain.

Demand forecast is generally based on the past sales data and patterns in past. Demand can be affected by customers, popularity, introduction to the new product, promotions. Better demand can be forecasted by using the CRPF (collaborative planning, forecasting and replenishment) system. CRPF system collect the data automatically and doing the below procedures;

- Point out the customer who can predict the future demands (what are their needs in the future and what they expect?)
- Collecting demand forecasts about particular products

- Make a comparison in between these forecasts and their actual forecast
- Helping them improve in future forecasts by exchanging the data (Hill, 2017)

Research has been directed towards the implementation of Supply Chain Management (SCM) in food supply chains from logistical perspective. It is ground work for devising a route for enhanced SCM execution in relation to enhanced Supply Chain performance. Primarily focused on improving the efficiency and increasing the effectiveness of the adopted supply chain methods. Three case studies were undertaken to critically evaluate the respective scenarios. Two aspects were under supervision 1. The sources of uncertainty in the decision-making process. 2. Using simulation and field tests to make verified and tested scenarios. Using these scenarios, models were developed that could be adopted in these situations. Then the previous performance of the scenario was compared to the evaluated and newly adopted SC techniques.

(Shah & Ganji, 2017) Services industry are in a fix of demand uncertainty leading to excessive supply over demand. The paper focuses on the on extra inventory and waste levels in co-relation to lean production. Ways to enhance the performance of service-based industries through the evaluation of a local baked foods supplier. Research is based on a questionnaire survey conducted in three companies, the baked goods manufacturer, the café purchasing the baked goods and the end consumer. Research concludes lack of commitment from the top management, continuous training, therefore inadequate employee engagement measures which are important to be executed for performance enhancement of the organization. Paper is an isolated study of the upstream and downstream implementation of lean production practices. (Lean supply chain management: Empirical research on practices, n.d.)

### [Scope of Lean Supply Chain Management](#)

(Tortorella, et al., 2018) The goal of this paper is to investigate which lean supply chain management (LSCM) practices significantly enhance the efficiency of the supply chain. A survey over a hundred companies had been carried out where lean was being implemented. Data analysis were done in 2 stages, firstly 22 lean supply chain methods have been consolidated into for

bundles. All these practices were entered for principal component analysis (PCA) and data was extracted using varimax rotation. Relationship between factor scores and the five performance indexes were examined. It is assumed that the factor scores for each bundle reflect the strength of efforts of organizations committed to the introduction of LSCM activities. We studied can LSCM practices enhance effectively the output of supply chain. This work reveals two important results. First, there are certain clusters of LSCM practices which can provide efficient supply chain performance enhancements. Second, defining this set of activities according to the success metric intended helps businesses to prioritize their efforts at LSCM. Implications of these findings are of great interest to researchers as well as lean practitioners and are important.

Existing study of (Dora, et al., 2014) illustrates the principles of lean manufacturing methods to food processing industries to increase quality and profitability in operations. The purpose of this article is to examine the position of lean manufacturing practices among European food manufacturing small and medium enterprises (SME's), and their benefits and challenges. A questionnaire to collect the data was developed. The results indicate that deployment of lean manufacturing practices in SMEs that process food is generally low and still evolving. Some lean manufacturing methods, however, are more prevalent than others; e.g., flow, pull and statistical process control are not commonly used by SMEs in the food processing sector, while total efficient maintenance, employee participation and consumer involvement are wider. The main obstacles to adopting lean manufacturing practices faced by food SMEs arise from the unique characteristics of the food industry, such as exceptionally perishable goods, complex packaging, highly unstable raw materials, ingredients and attributed to a lack. However, lack of expertise and capital makes it difficult for food processing small and medium-sized enterprises to embark on the lean journal. The effectiveness of the manufacturing practices significantly depends on the involvement of workers, adequate preparation and the engagement of senior management. It is also vital to recognize the impact of dependent variables on the use of lean principles and its advantages. One of the drawbacks of this research is that it includes only a limited number of European food companies.

## Lean Supply Chain Management – Case Study

(Lehtinen & Torkko, 2011) focuses on the application of lean concept in the food industry for the development of supply chain management. It uses the case of a contract manufacturer for a distributor producing private label products applying the lean production concepts and tools. Lean Production is defined as increased output with the same amount of input, being similar to the concept of mass production with the difference being that lean production ends up with an increased choice for the end consumer (Womack, Jones and Roos, 1990). What lean production majorly focuses on is the chain of processes used in the manufacturing process, to minimise the waste that adds no value to the end user along with the management of the interpersonal work relation of the employees, team and suppliers and most importantly diversion from the traditional approach of mass production. Towards the 90's the approach shifted from 'shop-floor-focus' of waste reduction to value enhancement. This was put in practise by reducing the insignificant activities and focusing on value added features. One of the prominent lean functions is that there should be transparency amongst the participating firms and every peer should be treated as equal. Every participating firm has the right to examine another firm for joint search of waste. Another highlight for the decade was the opinion that a single firm should be a part of upstream and downstream companies to understand the process thoroughly and for better ideas (Womack and Jones, 1994, 1996).

The case study mentioned is of a contract manufacturer for a company specializing in consumer durables. The products are tailor made to the demands of the marketing companies. The objective of case research is to analyse the flow of information in the company in adherence to the flow of information from its demand chain to produce the best output possible. The internal information was evaluated using three different value stream mapping tools which were process activity mapping, demand amplification mapping, supply-chain response mapping. 3 different supply chains were undertaken for evaluation. Supply chain of a Big marketing company wherein inventory is stocked in 4 different stages and Electronic Data Interchange is used for communication. Wholesaler where the retailers purchase in bulk from the wholesalers which in

turn buy it from the contract manufacturers. Wholesalers forecast the demand based on the historical data. Small marketing companies wherein the customer is delivered with the product within 24 hours. This is possible as the contract manufacturer stocks inventory and delivers it.

### Lean Production Strategies

According to (Nallusamy & Dinagaraj, 2015), this paper aims at implementation of value steaming strategy with sustainable development which will help improve the product value and its sustainability, it uses Green lean approach to adopt and implement Value Stream Mapping (VSM). This research paper aims to describe a simple approach called Eco-Value Stream Mapping that incorporates lean and green techniques to minimize waste and reduce environmental impact. The complete green production strategy blends the lean and green methods. This means that all resources and a green product are completely used, from design to product recycling. Concept Build to Order is added. All the systems are organized correctly, so that the consumer gets the product as quickly as possible. Leanness is practiced by disposing of all waste. Several surveys were conducted, and it was clear that there is enormous potential for applying the Lean Green Methodology in small-scale manufacturing to save money and property. The suggestions were equally obtained from all industry sectors for generating electricity by using solar panels in their industry's roofs. The researcher concludes with green lean fabrication development is a continuous process. A little help from the government will also help SSI's for a cleaner production and supply chain.

The adoption of lean production strategies has been widely accepted in the industrial production lines. Focusing on the co-existence of the use of human labor and AI based processes, lean production circles around the constant improvement of the processes alongside the value-added services by avoiding waste. Taking a step ahead in integration with industrial 4.0 the paradigm merges lean production with a smart network of machines, products and the components. It allows the company to form an intelligent company. (BeataMrugalska & K.Wyrwicka, 2017)

## Supply Chain Management Methods

Focuses on the issue of sustainable feeding and the increasing reliance of food industry on the operations research to reach a harmonious point between economic, environmental and social sustainability. Currently available process-oriented food chain reviews provide basis for operational research techniques in sustainable food chain supply (SFCS) but a structured outline of relevant SFCS research were the study topic. Using mathematical modelling techniques, the existing gap had been endeavoured to be eradicated. With the identification of economic, environment and social issues being addressed in accordance to their relevance. Models were segregated on the basis of their relevance and were then used in different scenarios to critically evaluate its correct implementation. It was concluded that the existing models in the SFCS are rather generic and should be narrowed down for precision for adapting a model precisely for SFCS.

### Literature Gap:

The journal article by Lehtinen Ulla and Torkko Margit on 'The Lean Concept in the Food Industry: A Case Study of Contract a Manufacturer' tells about lean methods and supply chain techniques to make the process more lean, only the manufacturing is given more importance, whereas in this research both lean and supply chain techniques are used for to make the process efficient. (Lehtinen & Torkko, 2011)

The author justifies that lean and agile are different concept and the difference between them faced by practitioners and academics, thus he came up with a new approach called leagile. He also states that lean system only excels in customer service performance but in this research lean will a wide concept and take every process under the food and beverage industries. (Ph.D., 2011)

This article elaborates the technique and tools in supply chain management, it compares lean techniques with supply chain management and Strategic planning. In my article I have taken both lean and supply chain techniques and extended my observation in food and beverage industries considering India. (Lamming, 1996)

The article is focused on research in lean management methods in supply chain. Many studies are concentrated on development of supply and manufacturing, overlooking the lean suppliers, distribution and logistics thereby inhibiting the fast development in the field. It was also identified by the author that practices like strong and effective relationships, value chain analysis and waste reduction are the most acceptable policies for implementation of lean in the supply chain. Previously published work pertains to the adoption of lean production, the research in this paper continues it to infusing the previously established lean production methods along with Artificial Intelligence. It pertains to acknowledging the scope of artificial intelligence in lean production and also addresses its shortcomings.

### Conceptual Framework

With the help of key lean production and supply variables, and correspondingly integration of both the processes the blend of both would be examined to understand the difference between current methods used for supply chain and the lean methods that could be adopted, and whether the application of artificial intelligence would be feasible futuristic scope.

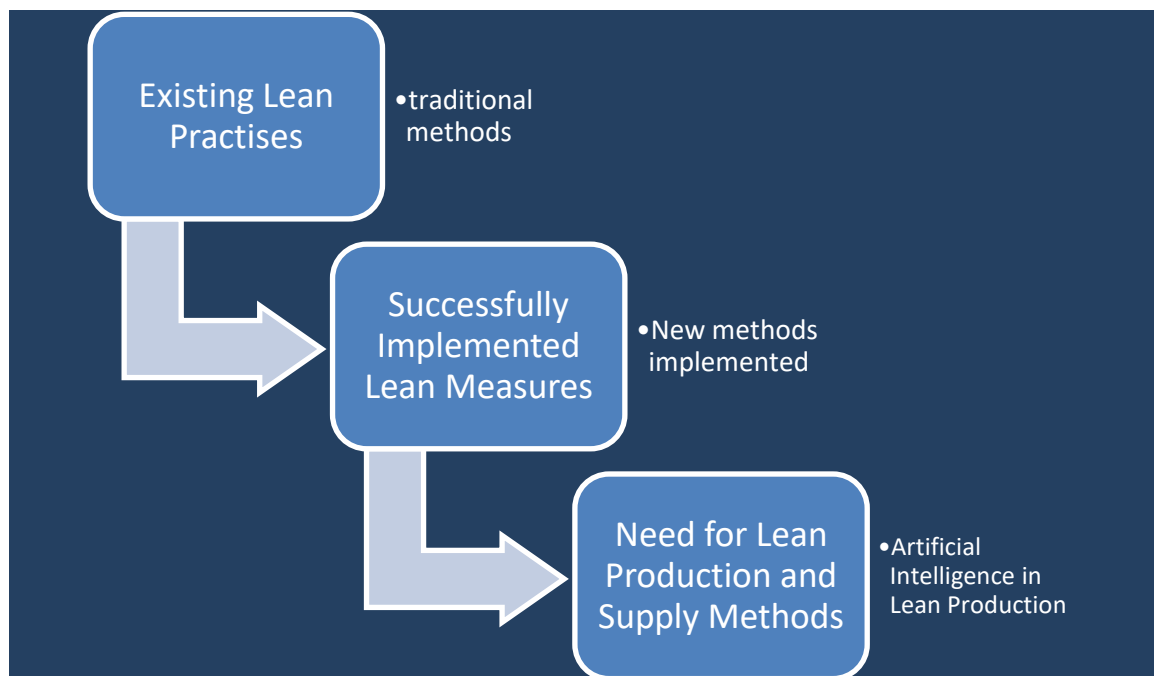


Figure 1: Conceptual Framework



Lean supply chain practices are considered as the core component of the business organization and the variables which are mentioned in the figure 2, play a significant role in influencing the performance of the business organization. This framework is completely theoretical and is constructed to examine the importance of these variables in increasing the efficiency in various business process and departments. If necessary, existing measures and theories would be used from the previous research to measure this theoretical framework. In this framework general variables will be used, there would be no specific distinction in variables such as dependent or independent as this would be done theoretically.

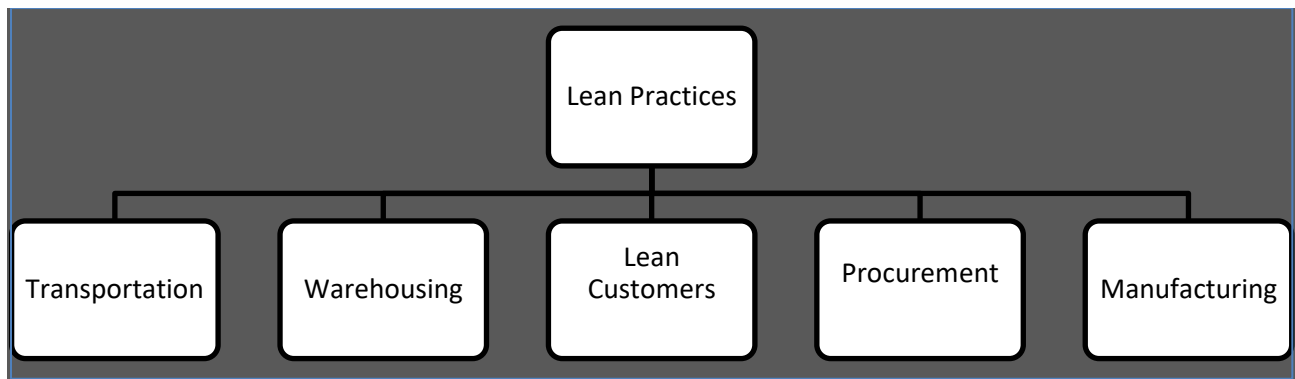


Figure 2: Variables used for analysing.

Above variables which are mentioned in figure 2, would be examined in brief to analyse the differences between the existing lean practices and successfully implemented lean measures in the food and beverage industries. This brief examination of variables would help in understanding the importance of lean measures specially focused on food and beverage industries. This framework will be constructed based on information acquired from the companies which practices lean supply chain methodology and the companies which have successfully implemented the lean measures in their supply chain.

This theoretical framework will be supported by qualitative research in which open-ended questionnaire would be used and to get more precise information semi-structured interview would

be done. Participants for the questionnaire and interview would be the employers of the organization who have agreed to help by providing their valuable information.

Table 1 Variables for Lean Production

Key Variables	Things to Examine	Reason for Examining
Procurement	Current procurement strategies and lean procurement strategies.	To understand the advantage of lean procurement
Manufacturing	Examine how lean manufacturing helps in reduction of waste without compromising the quality.	For understanding the difference in manufacturing and lean manufacturing strategies
Warehousing	Processes that could be eliminated with the help of lean manufacturing.	To figure out activities which are absorbing resources but not creating any value.
Transportation	Examining lean strategies used for lean Transportation as a Strategic differentiator.	Excess transportation increases unnecessary cost.
Technologies	To examine how the use of lean technology can help in reducing waste.	Understanding the importance of lean technology in manufacturing process,
Lean Customers	Examine customer needs and interest.	To understand gap between consumer need and the product produced to meet the demand

Table 2 Supply Chain Management variables

<u>Key Variables</u>	<u>Things to Examine</u>	<u>Reason for Examining</u>
Integration	Human Resource working in the manufacturing process need to communicate and collaborate	Improved communication would reduce the errors that cost the company in terms of time and capital. With everyone is working together it is easier to overlook the entire workforce and identify the areas of improvement in the supply chain.
Operations	Day-to-day operations and monitoring the labour force	Major improvements to the supply chain. Maximising the output, optimal working labour hours, efficiency in the process.
Purchasing	Purchase chain of materials, supplies, tools and equipment.	Cognizance about the required raw material, shortage of material, delay in production, overbuy and strain on company's budget.
Distribution	Planned shipping process, Logistics, warehousing of the customer.	

### Conclusion

Research focuses on developing a new integrated model of lean production for supply chain management with the infusion of Artificial Intelligence. Factoring the various variables, the concept is to make the process for supply chain management to be independent of factors that can hamper the overall efficiency of the process.

The variables used define the process at different time stage that enable granularity in the foundation of the model. They are inter-dependent on each other functions that makes the model to be practical and effective.

## Methodology and Research Design

### Overview

From the above literature and considering the literature gaps, my data for the primary research is extracted completely based on qualitative analysis and in the which lean procurement and supply chain directors or managers will answer during the video interview regarding the process they apply to make supply chain leaner, which will be conducted according to the availability and convenience of the participant. An ethically verified questionnaires' will be developed before the interview session. After the interview is complete, questionnaire and the data collected will be sent to the company for the approval and only when the entire reports are approved by the participant or the company the data will be considered in my research. This research will help the company to know their approach to lean methods and to find out ways to make the process leaner.

### Research Philosophy and Approach

The word Paradigm means 'thinking in philosophical way' and was first used by American Philosopher (Thomas Kuhn 1962). It is a sort of pattern which describes and includes worldviews, ideologies and mindsets. This research will follow a constructive approach in which the ontology includes the features of lean manufacturing and its various features considering the aspects of procurement, manufacturing, and technology etc. The qualitative method will be used in relation to the method, having in-depth interviews.

The research is **inductive** and **deductive** type which will be used to identify the theoretical base from previous literatures. The author will carry out inductive approach as the approach of this research is to understand the lean practices in the food and beverages industry. The data analysed will be used to develop a theory which can be used further. It is a bottom up process where the theory is based on empirical data. The data analysed will be used to evaluate the test cases in the food and beverage industry.

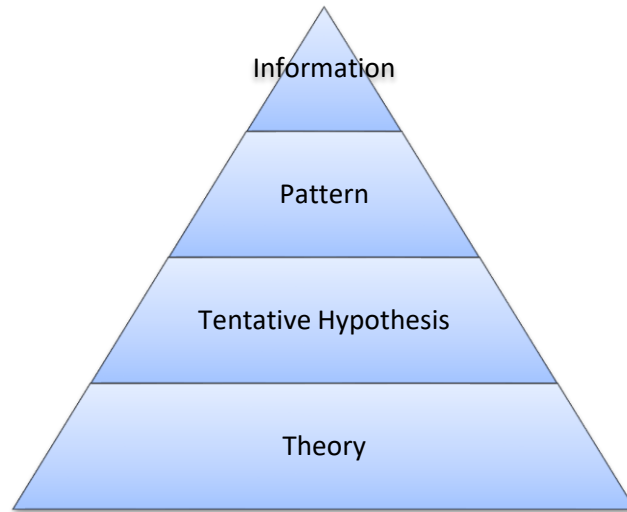


Figure 3 Deductive Research

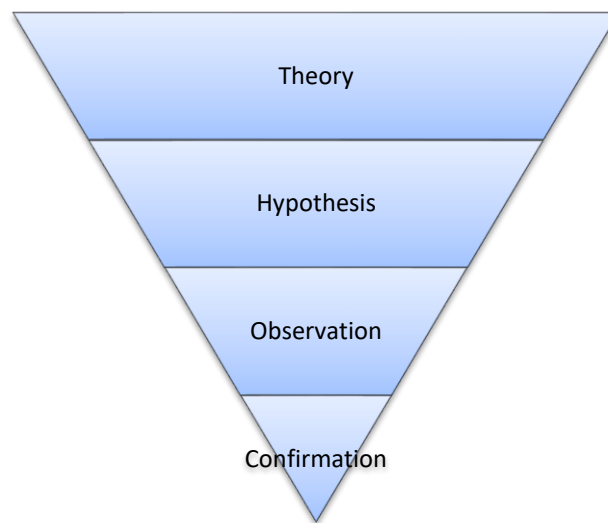


Figure 4 Inductive Research

This research will be defined from only **qualitative approach** as to find in-depth analysis of the lean practices. The research will require unbiased respondents those who are currently working in the respective fields. The research tests the competence to cope up the technicality and advancements that may hamper the productivity of supply chain. The base of the qualitative research will aid to understand the perception of different sample to identify the research questions and induce the theory.

**Interpretive approach** will be followed in this research, previous literatures will be used to identify the feasibility in food production and beverage industry. This research will pin-point the key areas in food and beverage industry, by the use of interviews and evaluate the viable approaches in the industry. The Epistemology will be intended to interpret the theories that will be used to identify means of actions in procurement, lean practices etc.



Figure 5 Action Research Cycle

**Descriptive research** approach primarily aims to describe the phenomenon undertaken to its fullest with its underlying characteristics. As the name suggests the researcher is required to describe the what of the research question rather than the how and why. When undertaking descriptive approach, the data to be evaluated is often collected qualitatively but is analysed in a quantitative manner. For instance, data pertaining to statistics, averages, percentages, etc. It involves naturalistic data and is an attempt by the researcher to study the language, learning and teaching without any external factor acting as a catalyst to the process.

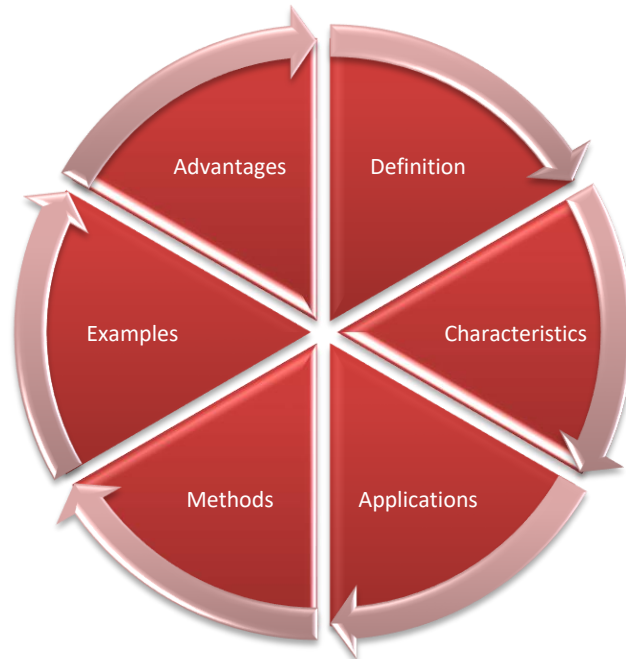


Figure 6 Descriptive research cycle

Descriptive approach was chosen primarily due to the fact that the qualitative approach undertaken in the form of interviews will further be bifurcated into segments for evaluation. The data will be fragmented into statistical form for a true and fair picture of underlying conditions which can further be used in the paper to conclude their objectives. Qualitative and descriptive approach are independent approaches but can be used in a cluster of combination to complement each other.

### Research Strategy

The gathering of data and its analysis would be both inductive and deductive in relation to the progress of the conducted research. This would in turn lead to a compilation of thesis and lay out a pattern to be acknowledged. Concluding the research paper would be in co-relation to the response of the interviewees, the interpretation of the researcher, deducing the entire paper to sum up the answer to the aimed question and its contribution to literary world or cause for change. (Creswell & Poth, 2018)



Selection of a qualitative approach can be baffling. The onerous responsibility of choosing the correct method that can justify the research undertaken and seek correct and relevant answers to the questions asked.

While undertaking a qualitative approach to the sampling, data collection and analysis the underlying approach is emergent in nature. As and when the research progresses the data being evaluated throws light on the key understandings and the research work is adjusted to the newer discoveries. (Ang, 2014)

In relation to the research paper, the aimed objective is to understand the supply chain management and procurement in the food and beverage industry. The processes involved, deal directly with human efficiency and effectiveness. To understand the supply chain is to understand the thinking process of the manager behind the entire execution and the objective of the executive body.

Homosapien's are dynamic in nature and volatile in behaviour. To gauge their rationale, emerges the need for interaction involving personal opinions, facts and perspectives. The responses are personal opinions and can be biased or skewed, which has been taken into consideration while deciding on the sample group selection. A wider base for group sampling mitigates the risk of results being influenced by personal factors. Since the ratio of an individual response influencing the overall results diminishes with the increased sample size.

The paper primarily focuses on data collection through interviews, as an approach to qualitative research. Based on qualitative approach, the collected data will be evaluated on a holistic approach considering the information previously recorded through historical data, interviews of the individuals and interpretation of the same by previously conducted research. Interviews conducted would be primarily of the individuals who overlook supply chain and distribution process in their specific roles. Qualitative approach has been adopted due to the lack of complete and fair quantitative data. Supply and distribution chain of the food and beverage industry is being tested holistically for its competence to cope up with the technological advancements and for the loopholes that hamper the productivity of the supply chain.

## Collection of Primary Data

### Sources

The research is based upon qualitative assessment under which interviews will be conducted and based on the responses recorded. For which the respondents being interviewed form the sampling set for the assessment. For the purpose of sampling it is essential to choose personnel with relevant experience in the field to provide appropriate answers to the questions with enough reason. It is crucial to be extremely cautious while deciding on the respondents as it influences the validity and reliability of the research.

The respondents were presented with a set of 10 questions pertaining to

- The existing lean methods of production how effective are they?
- With the pandemic in picture what were the prominent changes that were made to the lines of production?
- What was the learning outcome out of the entire process?
- Do you see artificial intelligence being a part of the lean production model in the near future?

The interviews were conducted over phone calls and were recorded and the verbatim is attached in the appendix for reader reference. The primary objective of the primary data collection is to gather information from different perspectives and to find a new lean method that can be implemented in the supply chain. Ideas can be for the segments of production, wastage, supply chain, procurement, inventory management.

### Access and research ethics issues

Attention to the ethical issues has been increasingly acknowledged not due to the ethical reasoning and rationale but since they are being expressed as an integral part of the research work. The ethical authenticity of the paper should not only pertain to the research methods but also to the pre-determined research goal, in the questions asked to interviewees, the validity and relevance of the topic to the cause, and lastly critical assessment of the conceptual framework adopted. (Maxwell, 2013)

Practising ethical norms while conducting the research is pivotal to maintain the integrity of the data. There should be voluntary participation by the interviewees and the responses should not be coerced or skewed in any form. The questions asked should not be in violation to the moral code of conduct and should not negatively impact the reputation of the interviewee. Critical evaluation of the historical data should be strictly professional and discreet. Any personal underlying grudge should not neglect the rationality behind the undertaken study.

### Collection of Secondary Data

Secondary analysis can be a viable method for analysis when used in a correct manner for being used in the systematic procedure of analysis. It provides us with an illustrative research application by using the secondary data analysis. (Johnston, 2017)

It mainly includes the data that is being collected by the government for public records, public and private institutions for research and by educational institutions for academic purposes. For instance consensus, institutional journals, academic publications.

### Approach to Data Analysis

The research is based on qualitative analysis. The initiation is to find basic patterns or observations that can be used. The collected data is cross referenced with the research questions that were initially formed. The data is coded or indexed, where the researcher endeavours to identify broad

concepts in order to classify the data into concepts, behaviour and phrases assigns codes to the data. After the data has been coded the data is then divided into themes trying to find the most common answers to the questions asked. This helps in identifying patterns which can then be used to answer the research question.

To analyse the data narrative and discourse analysis has been used.

**Narrative analysis:** As mentioned in the research strategy the research is primarily focused on the qualitative data analysis and relies on the information deduced from the responses received from the respondents in the interviews taken. The application can be classified under narrative analysis as this method uses interviews of respondents, the narration of varied instances or observations from different circumstances to analyse the content.

**Discourse analysis:** Discourse analysis is similar to narrative analysis as it uses the discussion between the respondent and the interviewer. The difference being that discourse analysis approach is slightly more towards the social convention of the respondent and the interviewer. It also takes into account the daily activities of the respondent and includes that information in the analysis.

## Conclusion

The research methodology includes a blend of narrative and discourse analysis. Primarily based on the primary data collection executed through the interviews conducted. The interviewees were industry practitioners enabling them to render opinions and answers relevant to the research questions. This concludes that the method adopted is the correct approach to seek answers to primary and secondary research questions. The approach of qualitative analysis proves to be appropriate since lean production and supply chain are human oriented processes.

## Research Design

Research Design is the basis used to construct the structure of the research that is being undertaken. It clearly outlines the process and proclivities required to be executed for an in-depth analysis of the central question. (Schwartz-Shea & Yanow, 2012)

Considering the nature of the research topic undertaken, it was decided that qualitative approach is an appropriate choice. It is a descriptive study, consisting of the primary data collection in relation to the historical data available. Evaluating the data based on their relevance and analysis forming a part of the conclusion.

Qualitative approach initiates with assumptions and theoretical interpretations that state a problem in relation to the individuals or groups pertaining to a social problem, question or inquisition. The method of approach should be progressive in nature to adapt, to the suitability of the nature of the respondent, sensitivity of the individual to the requested answers and the place of study. (Creswell & Poth, 2018)

## Methods Used

### Interviews

Interviews are based on interactive observations. While conducting an interview an interviewer is deducing the translucent comments and responses of the interviewee into comprehensible statements that can form basis for the conclusion of his theory.

The researcher should be well aware of the questions that need to be answered in order to establish the required findings and proceed in a formal line of questioning. It is crucial that the researcher proceeds with rationality and understands that the degree of formality in the interview depends on the responses received, degree of openness and flexibility and the tolerance for ambiguity. (Schwartz-Shea & Yanow, 2012)

There are multiple factors and parameters that should be considered pre commencement of the interview. Setting these constraints, the researcher restricts himself from deviating from the pre-determined required range of questions.

- Qualify whether the respondent is eligible under the sample size undertaken.
- Determine whether the respondent classifies under an existing sub-class or a new sub-class has to be introduced to the sample group.
- Response transcript has to be verbatim for true and fair analysis of the responses.
- Questions should be in relation to the end objective and should build up the case for conclusion.
- Pre-set the classification parameters of the responses for evaluation, so that you're aware what kind of response is required. (Mitchell & Jolley, 2013)

Contrary to quantitative approach, qualitative approach cannot be standard set of deductions and inductions. Every qualitative research undertaken is customised to the research objective undertaken. It does not consist of a pre-determined initiating point or a final step, it is an interconnected process through the different design components. Thus, you can't simply borrow or develop a standard set design and implement it. A customised design has to be built which has to be constructed and deconstructed over the course of time. (Maxwell, 2013)

In context with the above-mentioned points the following set of questions will be asked during the interview. The questions have been formed by keeping the key objectives of the research in the centre of attention.

1. What are the existing lean tools, training and techniques applied in the production process, to enhance the overall productivity and efficiency and reach optimal production?
2. What is the process for executing a new lean method?
3. What factors would you consider before choosing a new lean option method
4. Have you ever witnessed the adoption of a lean production process from another organization? In your opinion how effective was the implementation of the new strategy?
5. Have you encountered a situation where a new idea was not adopted just because it belonged to a specific person? How does that impact the company?

6. What was your instantaneous reaction to the pandemic? What was your priority line of focus on lean production or minimizing the losses?
7. What were the improvised strategies adopted for the pandemic?
8. What is the learning outcome from the pandemic? What strategies and policies are the companies to adopt for such uncertain and unseen circumstances?
9. According to you how popular is the adoption of lean strategy in small scale industries and how effective are their methods?
10. Have you ever witnessed a strategy whose adoption has been unfruitful or disastrous for the supply chain?

The interview conversation shall be recorded and assorted for reference and proof. The transmission of data shall be through skype calls and in person interviews conducted by the researcher. The verbatim of the interviews conducted shall be attached in the appendix.

The subject of the research is bounded by the territorial boundaries of India. All the interviews shall be conducted within the state and uploaded along with the paper for future reference.

### Research Problems

Lean is the most frequently used approach to maximize the output and minimize waste. Initially it was only used in manufacturing and automotive industries but recently this has been adopted in every sector from healthcare to small scale industries. Need for new methods and techniques are very important as every organisations or sector doesn't have the same structure to work on. Supply chain needs techniques which can be implemented with less capital and training to teammates. Every organisation has put some or the other lean method to work on, some have implemented it directly whereas the other has made slight changes to the existing methods depending on the line or product or the services which the organisation is providing. Very little information is being found on the internet regarding the recent changes or small changes which the organisation on its own makes to fit in its supply chain. Lean on its own is a huge concept, breaking it down according to the needs and importance at the right moment helps organisations fix problems of waste and boost immunity.

Recent pandemic has hit the supply chain industry. Moving ahead it's the decision of the supply chain team if they still want to keep the lean concept in their supply chain or just run the supply chain keeping in mind the profit. Development of a plan to control the losses during this period and to plan on a strategy that will help the organisation to get through the uncertain future problems. Pervious lean methods have also been used during this pandemic.

### Research Hypothesis

Research Hypothesis is used for the primary research aim.

Hypothesis	Criteria
Artificial Intelligence is the means through which the lean production and supply chain management can be brought at a point of convergence and the extension of the same model can be used to enhance the overall efficiency and effectiveness of the processes	Based on the themes assigned to the coded data extracted from the qualitative primary data collected from the interviews conducted.



## Presentation and Discussion of Findings

### Overview

Based on the findings from the interview taken of the respondents from the FMCG industry working in the food and beverage industry extracts have been taken from the verbatim. Based on the extract's codes have assigned to the important points pertaining to the primary and secondary research questions. The codes assigned are then used to generate themes to dissect the information for analysis into smaller segments for clear and precise results.

### Findings

EXTRACT	CODE
Subject 1: Eliminate waste, Just in Time. Hands on site experience. Cost and effectiveness in a long run is considered. Capex and employee training are the major impact on the product cost and processing time and should be pre-planned. AI should be executed in granularity Long term goal of the central body had to kept in mind so that the external business environment can be predicted and deviations from the assumed path can be rectified for using the resources properly	Prospective strategies Just in Time technique Granular attention Enhanced Product Process Efficiency Resource planning
Subject 2: Good understanding to evaluate and solve the problem with existing resources. A steep dip was expected in the numbers due to the pandemic.	Problem solving technique Decision making skills.

<p>Do not overproduce nor overstock the goods produced.</p> <p>Learn from neighbour's mistakes and prepare yourself.</p> <p>Minimum knowledge over lean and other methods.</p>	
<p>Subject 3: We follow a set of guidelines from our company's framework.</p> <p>A corporate development team is set which follows global organisations strategy is followed and key responsible people plan and take up the decision and move forward.</p> <p>Previously ideas and plans were open to alteration only for the executives.</p> <p>It depends on the company's law to extent are they agreeing it implement and give the right to AI to manage their supply chain</p>	<p>Company rules and guidelines</p> <p>Follow framework</p>
<p>Subject 4: Use of AI for QR codes instead of printing menu.</p> <p>AI along with data analytics can be our future.</p> <p>Supply chain needs to be incorporated with AI.</p> <p>This will help us track everything down to a single hub.</p> <p>Incorporation of Artificial Intelligence is required for improving the efficiency in the process and minimising the human intervention.</p>	<p>Data analytics and Artificial Intelligence.</p>
<p>Subject 5: Focus on their inventory turnover.</p> <p>Shelf life of the product has to be increased for improving the sales and controlling the inventory to reduce the wastage.</p>	<p>Inventory Control</p> <p>Shelf Life</p>

<p>Subject 6:</p> <p>Combination of work between the executives and the employees.</p> <p>Training should be done from managers to on ground employees and on timely fashion the implementation process is done.</p> <p>No employees were laid off but were moved to other plants.</p> <p>Simple terms like reducing waste, value and appreciation for the work of employees is used.</p> <p>It is essential to give human interference in a process that is people oriented.</p>	<p>Equal distribution of work at all levels</p> <p>AI along with human interaction</p> <p>Labour retainment</p>
<p>Subject 7:</p> <p>Employee network is used to bring on board new vendors leveraging the employee relation for a better price.</p> <p>Adopted a strategy of CFA (Carry Forwarding Agent).</p> <p>Includes checking on the stock and expired items and finding a lean way to scrap it.</p> <p>Running extra lines did help to utilize the stored raw materials.</p> <p>Products expected to be in demand were produced in greater quantities and goods with sales lag were produced to a minimum.</p> <p>Developed strategies for different verticals, high end products were laid off and mid-range were produced in higher quantities to reach the optimum.</p>	<p>Innovation in supply strategy</p> <p>Positive adoption of lean production methods</p> <p>Evaluation.</p> <p>Optimum utilization of Resources.</p>
<p>Subject 8: Minimising the losses as the priority.</p>	<p>Cost Minimization</p>

<p>Cutting down the losses.</p> <p>Instant reaction was to control the losses.</p> <p>Reducing the losses were set as a priority.</p>	
<p>Subject 9: Government being proactive in spreading awareness about the importance of Information flow from authority was incorrect.</p>	<p>Information Inflow through the government</p>
<p>Subject 10: The goal here is profit and is achieved either but increasing the volume or decreasing the quality of raw materials.</p>	<p>Cutting corners in production process</p>

CODES	THEME
<p>Prospective strategies</p> <p>Just in Time technique</p> <p>Granular attention</p> <p>Enhanced Product Process Efficiency</p> <p>Inventory Control</p> <p>Cost Minimization</p> <p>Optimum utilization of Resources</p>	<p>Efficiency in Lean Production</p>
<p>Shelf Life</p> <p>Follow framework</p> <p>Innovation in supply strategy</p>	<p>Developed Supply Chain</p>
<p>Company rules and guidelines</p> <p>Problem solving technique</p> <p>Positive adoption of lean production methods</p> <p>AI along with human interaction</p>	<p>Integration of Lean Production into Supply Chain</p>
<p>Cutting corners in production process</p> <p>Information Inflow through the government</p> <p>Equal distribution of work at all levels</p> <p>Labour retainment</p>	<p>Role of Artificial Intelligence in newer strategies</p>

Theme explanation:

Efficiency in Lean Production:

Prospective strategies:

In any business it is quintessential to have a proposed strategy. Business run on estimates, processes and technology. To integrate the three, it is important that the expected future outcome is already available with the manufacturer. Otherwise with a standard benchmark it would not be possible to measure the performance on a time period basis. With the pre-determined strategies, it becomes possible to plan in advance the requirements and avoid the wastages. For instance, when the demand for the next quarter has been anticipated in advance the procurement department will place a purchase based on the estimates in addition to the buffer stock material. This strategy allows the manufacturer to avoid wastage, save on the warehousing cost, avoid excess illiquid inventory, keep the cash flows in balance. All of which was possible only because the demand for the next quarter was anticipated based on the historical which proved to be cost-effective. This creates efficiency not only in the procurement department but also in the production department. With pre-planned processes it becomes possible to train the employees accordingly for the requirements. To know the labor force required for the production or informs the management that the process is heavily labor centric and innovation has to be adopted to for minimizing the employee costs and creating sustainable margins.

Just in Time technique:

Just in Time Technique is of East Asian Origin and particularly focuses on the raw material procurement part. The technique emphasis on the concept of manufacturing on demand only. It circles around the fact that the raw material ordered to manufacture a product should only be placed if a purchase order for the product has been received. It helps control the warehousing cost for storing the excess inventory, prevents the loss to born in event of subdued demand and avoids the cost of recycling the unsold products.

Granular attention:

Lean Production primarily is the most efficient way that a production process can be executed. It involves minimum wastage, timely manufacturing of goods, avoiding the production of defective goods, maintaining the product quality. This entire process includes utmost attention on the part of the manufacturer. Since these processes help curb the expenses and improve the topline number by controlling the operating costs, they are crucial to the production process. Lean production when applied optimally can be of great use to control and curb the expenses of manufacturing.

#### Enhanced Product Process Efficiency:

The efficiency of any process can be used to define its future anticipated growth. Consequently, with the increased product efficiency we can expect better product quality at the same cost in the minimum time. The point can't be stressed enough that product is the core focus of the entire business model and should be at the center of all attention. If the product is able to create a niche segment of its own it is possible to achieve voluminous growth in the long term. Along with that creates customer trust in the product. But this is only possible if the product available is of superior quality at a lower price and is supplied to the areas where the product is in demand. To make all of this possible the company has to start at the input process of production. Enhancing and improvising on strategies from there leads to a better finished product.

#### Inventory Control:

Role of inventory controller is a crucial part in the warehousing, organizing stock in First in First Out (FIFO) method, storage and stacking and so on. Proper inventory records and expiry must be recorded. Health safety rules and guidelines must also be followed in the premises. Damaged and expired good must be stored away from good stock. Regular checks for leaks and pest invasion must be checked. Based on reports from the inventory controller production lines will be scheduled, and miscommunication or wrong documentation can cause overstocking or complete dissolution of buffer stock. Inspecting and organizing stock according to the product type and will help the storekeeper to segregate goods when a new order is being placed. Along with the use of AI all the steps can be done in no time reducing time and increasing the efficiency.

#### Cost Minimization

The primary aim of every organization is to minimize the cost. Lean methods can be implemented to reach this goal. Waste minimization, optimum utilization of resources, well organized production line, proper checks on the shelf life of the finished goods and raw materials. Allocation of tasks with regard to the positions. Low scrappage, optimal inventory levels, demand supply equilibrium.

### Optimum utilization of Resources

Resources and raw materials when used to their optimum can reduce waste and add to the productivity in the production lines. AI can be used to get the optimum levels from the input, when dealing with irregular shapes for creating dye prints AI can help minimize the wastage by optimally using the resources available. Here resources in a wider sense is the knowledge or training received. Using every available resource for building the team or will eventually help build the organization. Analytics can track and send out important notes happening around the globe in the similar sector to have a forward planning or brief idea about the issue.

### Developed Supply Chain

#### Shelf Life

Shelf Life is the period of time for a product starting from the input for production right until the product can be used. FMCG mainly concentrates on the shelf life. Everything from raw material to finished goods fall into this, thus having a proper account of the shelf life is very important. As shelf life starts from the date of manufacturing, storing it in the warehouse or producing it huge quantities without a proper distribution plan in mind will be disastrous. Loss of shelf life in the warehouse will directly cost the organization from its profits as retailers need at least 80% shelf life and wholesalers such as Dmart And Metro need at least 60% shelf life when the goods are being received. Every combined effort from production, quality team, sales, and supply chain are needed to achieve this. Failure to perform from any of these departments can cause a lag creating the complete process to come to a halt and reducing the shelf life of the finished goods or raw materials. Mostly when the shelf life reduces to 30 % or below, marketing team comes up techniques such as offers or promotion to clear the stock. Failure to clear this will cause huge

losses. 2 major losses faced when companies are the cost of scrapping the product and the second one is the complete loss of producing the item. Expired stock in FMCG needs huge amount to be scrapped as the product needs to be brought back to the plant or a trusted agent who can scarp the item. Movement of any expired goods in the market can bring about a whole new set of problems to the company. Thus, proper coordination between the respective team responsible for the shelf life must be good. Developed and a well-organized supply chain can help us achieve this in an efficient way. Tracking the product and procedure is a must for a smooth run of supply chain. Timely delivery of the product in good condition is a must. Products must to deliver according to customer deliver order. Any damaged or tampered goods must be picked up from the vendor at timely intervals. Interstate transport rules and regulations must to followed and proper documents must to send along with the transit, any error in this can call for a delay.

#### Follow framework

Frameworks help set in the standards for the process. Framework can be used to standardize the process used for completing the manufacturing process and can have an extended application to the supply and distribution chain. Integrating standardization and AI will lead to a smooth process without any glitches. The outcome can be controlled with minimum human intervention. Surely, the extent to which AI is to be incorporated is in the hands of the management. But if used to its potential AI can separate the emotion from the business processes and create room for better quality products at lower costs.

#### Innovation in supply strategy

Manufacturing a product only completes half of the process. The second half of the work is to make it reach the customers in a timely fashion in a proper condition. With the market being flooded with variety and range of products the supply chain of a company should be strong enough to build its network amongst the retailers, wholesalers and distributors to make sure that their product is in the market with a good reputation. When talking about innovation in supply chain it pertains to adopting new much simpler methods to cater to the customers. For instance, if supplying to a wholesaler, automated purchase orders, hassle free paper free work, delivery at doorstep, additional discounts or bulk discounts can prove to be incentives for them to choose your product.



## Integration of Lean Production into Supply Chain

### Company rules and guidelines

Before initiating any process or implementing any strategy it is crucial to be well versed with the company's policies and regulations. Companies have their set of guidelines to be followed before implementing anything new. Policies formed in the guidelines do delay the process of implanting advanced methods along with constraints of capital input.

### Problem solving technique

AI can take over the procurement in near future, but it is important for us to think to what extent will the company give rights to manage their business. Finding the problem is always crucial, once the problem is being studied all the factors that can be put into it for problem solving is brought in. Existing techniques are being used with some improvising to it or a new method is will be put out. These techniques help the organization with quick and right outcomes to any issues as such.

### Positive adoption of lean production methods

Methods like Kaizen look for innovative improvements in their employees with evolution. Employees have the right to bring in small improvements. And team up to improve and increase team performance. 5S method is also widely used among organizations, were in 5S stands for Sort, set-in-order, shine, standardize, sustain. Sorting the work area and removing all the unwanted things. Set-in-order stands for organizing all the inventory or items in their respective place to reduce waste of motion. Shine as the words explains to keep the area clean and tidy. Whereas standardize means to standardize everything in the work environment. Sustain is to maintain the order which has been setup by all the four S's.

### AI along with human interaction

As of now AI need human touch to it to make it work more efficiently. Analytics can give you the required data and AI can work accordingly as programmed but a sudden update can stop the process. For instance, an air freight is being brought in from Vietnam of fresh mango pulp which is due for production in a weeks' time. Analytics show a minor change in tax rate due to newly

applied rule in the trading industry, at this time AI will suddenly hold the consignment, thus causing a issue with the production of the product. Here human touch is needed to think accordingly and go with the best possible outcome at the moment.

### Role of Artificial Intelligence in newer strategies

#### Cutting corners in production process

Companies tend to compromise over the quality of their product to control their operating expenses and improve their top line margins. Employee cost tend to be an expense under operating cost. With the infusion of AI, it becomes possible to control the employee cost and bring it down to bear minimum. Reducing expenses in a proper manner is very crucial. Unethical ways are used at times to reduce cost deteriorating the quality of the product and the value of money paid by the customer at the final end. Excessive packing material, extra layered carton boxes, Vibrant tapes for sealing the boxes, lag in production lines and so on can be easily checked and reduced to bring down the expenses. Timely quality check of the pouches and containers for leaks and damages must be done. Any damages in these during the process can shut the lines and the goods loss of semi-finished product.

#### Information Inflow through the government

The fiscal policy set forth by the central governing body is a major influencing factor for the production. It is pivotal for the government to set forth policies that will yield positive response in the market. But that is not always the case. There might be a surprise announcement which can cause a huge commotion in the industry. The company needs to be ready for any changes that have to made. They need to develop their models with easy flexibility and extensive adaptability.

The flow of information must be fact based, should be a true and fair representation of the data. Misrepresentation of data can mislead the organizations. Company guiding authorities should take the lead to make sure no data is being manipulated according to needs of the governing body. In india most of the initial data was not fact based and the hopes and assurance given by the head of

the ruling party fell apart just in a weeks' time and sudden lockdown was called for without proper planning by the government.

Equal distribution of work at all levels

Striking an equilibrium between the employees and executives, managing the work force and the employees and giving them equal importance can boost the motivation of the team to perform better. This will automatically improve the team performance.

Labour retainment

Technology replaces human, human touch will be there in decision making but when AI is being implemented employees need to be laid off. The process of making every process lean can put out human touch.

### Discussion

Production industries are currently facing unnecessary overproduction resulting in increased inventories and surplus levels. Getting used to new technologies is a difficult task as the labour force needs training and training is expensive, just because the new technology is something same to the previous one or it says 'user-friendly' it cannot be installed. To make full use of its ability, new tech must be incorporated into current business processes keeping in mind the training expenses and other factors as well.

It is not enough to buy the new technologies. But after purchase, it is important to change the current systems and techniques to integrate the latest technology in a way that reduces inconvenience and the need for extra training, while still reaping the benefits of all the new technology has to offer. (ClearPath, 2020). Firewalling the data is crucial as new technology may come with many bugs. All the data processed on the new tech must be monitored and scrutinised to keep a track on the efficiency of the machine. As the interest of scientific community in food and beverage is increasing day by day the need for innovation is getting more important.

There are many SSI (Small Scale Industries) who run their firm to their maximum by utilizing the resources to the minimum and producing the maximum products. They have practical experiences

and knowledge than the MNC's (Multinational company) under their field of the sector. Small scale operations are making their process leaner at times without even having the knowledge of the process. Working efficiently and high output small industries have an achieved lean with no plan for lean process. This study will also focus on trying to bring out new supply chain methods which deals with new technique to collect, process data and run lines efficiently and help companies to understand the importance of lean process and its effectiveness in food and beverage industries in both large-scale and small-scale industries.

### Conclusion

In line with the responses received from the interviews, the analysis indicates that all the factors contributing to the improvisation of the production process and the supply chain support the infusion of Artificial Intelligence for better results.

Primarily speaking Artificial Intelligence can bring a drastic change in four aspects in respect to lean production and supply chain.

- Decreasing the labour intensity in the production process.
- Avoiding scrappage and minimising wastage
- Liberating the process from human biasness
- Executing variations in the batches of products without disrupting the flow of production.

When analysed from a micro perspective these aspects directly or indirectly influence the process and efficiency of manufacturing on a whole. Introducing Artificial Intelligence to the process will not only make the process much simpler for execution and understanding. But also, will create a centralised database for access on cloud. With the ever-changing dynamics of the business environment, companies now need to be prepared for operating their processes remotely.

Furthermore, when intercepted from a long-term perspective these implementations will provide the company with a huge cost benefit. Leveraging the availability of producing additionally induced demand and converting it into sales due to the induction of AI could help gain unconventional revenue for the company. The main focus of any company is to maintain and increase its bottom-line profits.

The interview responses are in alignment with the positive adoption of lean production methods. The interviewees are presently engaged in the FMCG sector are positive that the implementation of AI in the production processes could be affirmative to the company goals. With the recent pandemic experience, it is clear that the industry needs to upgrade itself to be able to cater its services remotely and that should not hamper the pre-existing sales of the company.

Apart from that incorporating AI could also help resolve existing inefficiencies in the production process. Companies that cut corners to reduce the cost of the product if incorporated with AI can cut on labour costs along with which they can improve on the product quality and the decrease the time it takes for unit production. In respect to the supply chain management AI seems to be to far-fetched for the existing technologies but can be incorporated with the data analytics to improve on the supply chain.

Data Analytics helps understand the underlying consumer sentiments regarding the product. This helps the businesses understand the aggregate market sentiment regarding the product making it easier for them to make further developments to the product. It allows the companies to maintain a centralised database on the cloud making remote access readily available.

## Concluding Thoughts on the Contribution of this Research, its Limitations and Suggestions for Further Research

### Implications of findings for the research questions

Artificial intelligence has a very wide scope around procurement and supply chain management. AI has the ability to control the complete process, but significant data analysis is very important. Minute details need to be updated for the process to run. Every company has its own hinderance when it comes to data management and proceedings. A small misinformation can cause a major issue in the process and have misleading output. FMCG's have a labour-intensive production unit. Due to which the possibility of inefficiency increases. This can be minimised with the integration of Artificial Intelligence. As of now many companies have implemented AI on their production and manufacturing process. Amazon has warehouse which is completely human free and lays production is in the same concept as well. This has increased the efficiency of the organisation. Whereas some companies have implemented in only some defined verticals such as packaging, sorting, distribution and so on. The direct outcome for reducing labour will be reducing the cost as well which in turn will increase the efficiency.

Supply chain is completely based on analytics. It will investigate the influencing events for the supply chain and based over it the outcomes will be done. Analytics will help us have a track around what is happening around, a set data can be put into the algorithm which can manage fiscal policies governing the companies act, it can put up news update which in turn can help us to focus on the market or a specific country where the organisation is trading. It can track and update on going market control and also help you determine the place where more concentration is needed.

It can also help us find the commodity prices for the for different products in the market, price comparison plays a prominent role in all the matter. For a market like India where first impression to a customer the price of the product is. Different leverages can guide and influence this process. When human interference is minimised automatically the production cost comes down which will directly impact the cost price. Human touch and guidance is necessary but minimizing it will help

in organisation lower productions cost and boost the sales. Keeping track of offers and promotions can also be simplified using this method.

Demand and supply of the product in simple term is said to be the flow of money in the organisation. Organisations planning team has a task to forecast the demand and understand the supply needs, this is normally done by only using traditional methods in small organisations. Factors such as price, customer taste and preference, geographical conditions(seasons) and other important factors will be considered but when artificial intelligence is implemented. It takes into consideration all the external and internal factor and decide the possible or best outcome for the given need. Minor changes reflect such as in an interstate consignment a small hike in the tax will be noted by the analytics and then human inference can be put in place to decide if the change needs to considered or not.

### Contributions and Limitations of the Research

Limitations have also a huge impact on the actual results of the research. Each interview has a unique topic to talk and describe, as supply chain differs around multiple aspects in an organisation. Being a qualitative research the characteristic of understanding the questions had multiple perspectives. Aligning the questions accordingly and explaining the participant about the actual outcome of the research is very important and strenuous. The primary limitation of this study was that 3 of my respondents lost their jobs and denied participating in the interview, eventually 1 did agree for it. I also had to face geographical limitation as the research was based in India and getting in touch with the management and mangers was quite difficult.

### Recommendations for Practise

In correspondence to the primary research purpose the paper recommends the adoption and incorporation of Artificial Intelligence into lean production and supply chain management. With the growing challenges reigning in the FMCG industry it is crucial to be able to participate in a price competition with the peers. Indian businesses run on volume sales due to the large country population. Consequently, for a company to be ahead they have to acquire the market and its

fragmented segments. For participating into a price competition in the market the operating expenses of the product should be below the industry average. Being run on voluminous sales the production also runs on volume produce which is a labour-intensive process. With the introduction of AI in the production processes it would be possible for the companies to save on the employee costs that will curb the operating expenses to a huge extent and will also incorporate better efficiency as the processes becomes human error free.

On the supply chain management part, it was analysed that companies need to focus on improving and adopting better practices to enhance majorly the shelf life of the company which will solve 65% of the supply chain problems. An increase in the shelf life pushes the timeline for sales, transit and usage resulting in better revenues and lower purchase returns.

### Recommendation for Future Research

In continuation to the findings based on the analysis based on the data collected the future scope for lean production can be divided into 2 segments. Production and supply chain. Converting the efficiency in the production line to artificial intelligence, creating a human free work force. Analytics in supply chain can be further elaborated on understanding the customers sentiments in depth which can be further classified into, better business connectivity, intelligent work force and consumer data analysis depending on the age group, the price which is being highlighted and product what is being searched for in that locality, Analytics can help build a system where the organisation can capture and segregate the need and preferences of the people and the plan and improvise strategies towards it.

### Final Conclusion and Reflections

In conclusion to the research, the hypothesis stands to be true. The incorporation of AI could change the manner in which the lean production and supply chain management is managed. Processes exhibit inefficiencies due to the contingencies of the human labour. No matter how innovative, how pragmatic the solution to a given problem is, it renders ineffective if not executed properly. This can mainly be as humans are biased, emotional and irrational at times. With the employee being a separate entity than the company there is a high possibility that the decision



might undo years of efforts. AI allows quick execution of decisions, faster alterations to processes, better quality products in a lesser amount of time and also curbs the operating expenses.

Though Artificial Intelligence stands to be the future of Lean Production it is still a long way to get it incorporated within the supply chain. While dealing with initiating something in the production process the application is lucrative since it is inside the company. The consequences and the application along with the alterations are in the hands of the company. When the same concept is to be applied to the supply side it is a different story as the supply side is highly influenced with the external factors. To control the responses of these external factors is beyond the limited control of the company. For the application of AI to be successful on the supply side the supply side buyers have to be in consensus with it.

## Bibliography

- 361degreeshospitality, 2014. *Beverages & Its Classification*. [Online]  
Available at: <https://361degreeshospitality.wordpress.com/2014/06/19/beverages-its-classification/>  
[Accessed 28 feb 2020].
- Abbott, M. L. & McKinney, J., 2013. *Understanding and Applying Research Design*. New Jersey; Canada: John Wiley and Sons.
- Angel Martínez Sánchez, M. P. P., 2001. Lean indicators and manufacturing strategies. *International Journal of Operations & Production Management*, 21(11), pp. 1433-1452.
- Ang, S. H., 2014. *Research and Design for Business and Management*. s.l.:SAGE.
- Arbós, L., 2002. Design of a rapid response and high efficiency service by lean production principles: Methodology and evaluation of variability of performance. *International Journal of Production Economics*, 80(2), pp. 169-183.
- Ballard, G., Tommelein, I., Koskela, L. & Howell, G., n.d. Lean construction tools and. *Design and Construction: Building in value*, Volume 15, pp. 227-255.
- ClearPath, 2020. <https://www.clearpathit.com/>. [Online]  
Available at: <https://www.clearpathit.com/top-challenges-faced-by-businesses-adopting-new-technology>  
[Accessed 28 feb 2020].
- Creswell, J. W. & Poth, C. N., 2018. *Qualitative Inquiry and Research Design - Choosing among five approaches*. 4th ed. s.l.:SAGE.
- Davis, T., 1993. Effective Supply Chain Management. *Sloan Management Review*, 34(4), pp. 35-46.
- Dora, M. et al., 2014. Application of lean practices in small and medium-sized food enterprises. *British Food Journal*, 116(1), pp. 125-141.
- Ellram, L. M., 1991. Supply-Chain Management: The Industrial Organisation Perspective. *International Journal of Physical Distribution & Logistics Management*, 21(1), pp. 13-22.
- Felix T.S. Chan, H. C. ,. H. Q., 2017. A review of performance measurement systems for supply chain management. *inderscienceonline*, 17 feb, 8(2006), p. 22.
- Felix T.S. Chan, H. C. ,. H. Q., n.d. [Online].
- J.Thomas, D. & M.Griffin, P., 1996. Coordinated supply chain management. *European Journal of Operational Research*, 94(11), pp. 1-15.

Johnston, M. P., 2017. Secondary Data Analysis: A Method of which the Time Has Come. *Qualitative and Quantitative Methods in Libraries*, 3(3), pp. 619-626.

Karlsson, C. & Åhlström, P., 1996. Assessing changes towards lean production. *International Journal of Operations & Production Management*, 16(2), pp. 24-41.

Lamming, R., 1996. *Squaring lean supply with supply chain management*. [Online]

Available at:

<https://www.emerald.com/insight/content/doi/10.1108/01443579610109910/full/html?src=recsys&fullSc=1&mbSc=1&fullSc=1&fullSc=1&fullSc=1&fullSc=1>

[Accessed march 26 2020].

Lean supply chain management: Empirical research on practices, c. a. p., n.d.

Lehtinen, U. & Torkko, M., 2011. *The Lean Concept in the Food Industry: A Case Study of Contract a Manufacturer*. [Online]

Available at: <https://ageconsearch.umn.edu/record/27759/>

[Accessed 26 march 2020].

Lewis, M. A., 2000. Lean production and sustainable competitive advantage. *International Journal of Operations & Production Management*, 20(8), pp. 959-978.

Manoj Dora, D. V. G. ,. M. K. ,. A. M. ,. X. G., 2014. Application of lean practices in small and medium-sized food enterprises. *Application of lean practices in small and medium-sized food enterprises*, 1 Jan.

MatthiasHolweg, 2007. The genealogy of lean production. *Journal of Operations Management*, 25(2), pp. 420-437.

Maxwell, J. A., 2013. *Research Design - An interactive approach*. 3rd ed. United States of America: SAGE.

Mitchell, M. & Jolley, J., 2013. *Research Design Explained*. 8th ed. United States of America: Wadsworth.

Nallusamy, D. S. & Dinagaraj, G., 2015. SUSTAINABLE GREEN LEAN MANUFACTURING PRACTICES IN SMALL SCALE INDUSTRIES - A CASE STUDY. *International Journal of Applied Engineering Research*, 10(62), pp. 146-143.

NJOKU, D. (. M. E. & O.U., K. A., 2015. EFFECTIVE SUPPLY CHAIN MANAGEMENT: A STRATEGIC TOOL FOR PROFITABILITY ENHANCEMENT IN THE COMPETITIVE MARKETING ENVIRONMENT. *European Journal of Business and Social Sciences*, 3(12), pp. 90-112.

Panke, D., 2018. *Research Design and Selection Method*. United States of America: SAGE.

Ph.D., T. J. G. P. S. E. G. P. A. S. R., 2011. *MODELING LEAN, AGILE, AND LEAGILE SUPPLY CHAIN STRATEGIES*. [Online]

Available at: <https://onlinelibrary.wiley.com/doi/abs/10.1002/j.2158-1592.2006.tb00241.x>

[Accessed 26 march 2020].

RachnaShaha & T.Ward, P., 2007. Defining and developing measures of lean production. *Journal of Operations Management*, 25(4), pp. 785-805.

SameerKumar & AnvarNigmatullin, 2011. A system dynamics analysis of food supply chains – Case study with non-perishable products. *Simulation Modelling Practice and Theory*, 19(10), pp. 2151-2168.

Satya R. Shah, E. N. G., 2017. *Lean production and supply chain innovation in baked foods supplier to improve performance*. [Online]

Available at: <https://www.emerald.com/insight/content/doi/10.1108/BFJ-03-2017-0122/full/html>  
[Accessed 28 feb 2020].

schug, D., 2017. *How food manufacturers can use technology to manage supply chains*. [Online]

Available at: <https://www.foodengineeringmag.com/articles/96411-how-food-manufacturers-can-use-technology-to-manage-supply-chains>

[Accessed 27 februray 2020].

Schwartz-Shea, P. & Yanow, D., 2012. *Interpretive Research Design- Concepts and Processes*. New York: Routledge .

Shah, S. R. & Ganji, E. N., 2017. Lean production and supply chain innovation in baked foods supplier to improve performance. *British Food Journal*, 119(11), pp. 2421-2447.

Statista, 2016. *Market size of food and beverages industry in India 2015-2020*. [Online]

Available at: <https://www.statista.com/statistics/742909/india-food-and-beverages-market-size/>  
[Accessed 15 February 2020].

Tortorella, G., Giglio, R. & Limon-Romero, J., 2018. Supply chain performance: how lean practices efficiently drive improvements. *Journal of Manufacturing Technology Management*,, 29(5), pp. 829-845.

Xu, R. & Q. & Makweba, J., 2009. Supply Chain Management and Challenges Facing the Food Industry Sector in Tanzania. *International Journal of Business and MAnagement*, 4(12), pp. 70-80.

Zhanguo Zhu, F. C. D. C., 2018. *Recent advances and opportunities in sustainable food supply chain: a model-oriented review*. [Online]

Available at: <https://www.tandfonline.com/doi/full/10.1080/00207543.2018.1425014>  
[Accessed 20 february 2020].

# Appendix

## Verbatim

### I. Interview 1

INTERVIEWER

Hi, JEET

INTERVIEWEE

Hello joy. How are you? Good. Can you hear me properly?

INTERVIEWER

Yeah, I can hear you.

INTERVIEWER

Okay good. So as I had informed you regarding my dissertations and the research I am working on. So this interview, I would be recording it for my academic purpose.

So Is that okay with you?

INTERVIEWEE

is fine as long as it is for your academic purpose, I would be happy to help you.

INTERVIEWER

Thanks a lot.

So, JEET, could you please give me a brief introduction about your professional life? Okay, so

INTERVIEWEE

like I started as an assistant procurement planner, and currently I am heading towards operations department.

INTERVIEWER

Okay, nice to hear about it.

So going ahead with our questions. So the first one would be what are the existing tools, lean tools, training Techniques applied in the production process to enhance the overall productivity and efficiency and to reach optimal production.

INTERVIEWEE

Okay. So, like if I answer your question in a theoretical way, then you can you can like I can say that we use Kaizen methods, where we let the employees think freely and bring the changes, changes that are required according to the situations as a whole the growth of the performance is validated based on these methods.

INTERVIEWER

So, when we talk about Lean to definitely we think about waste, and shelflife.

So, how do you deal with it?

INTERVIEWEE

talking about in our technical and technical, technological way, we focus on recycling and running lines sufficiently for the optimum output. Talking about shelflife production, like it is based on the pre order basis.

And just to for the buffer for the sake of buffer, we keep we produce 3%, to 5% more. Okay.

INTERVIEWER

Thanks a lot. So, the second one would be what factors would you consider before choosing a new lean option method? Okay,

INTERVIEWEE

like first thing that comes in my mind when I hear the word NEW is the cost, I would say, cost base plays a prominent role here, but we take into consideration efficiency in long run as well.

As you know, it's been eight years that we have started our business and from past three years, we are open to new production plants. I said before, I wouldn't call our firm as a startup,

but financially we plan every detail before insurance.

INTERVIEWER

Okay. So, going up to our next question, what is the process for executing a new lean method

INTERVIEWEE

for the execution of like new lean method, we understand the need for the new methods new process that depends upon the department and what needs accordingly what are the needs,

we have according to the needs and definitely the managers will have to decide how to discuss over it. And staffs are allotted into the groups they are trained and then they are assigned their positions.

As a management, we give direction to our employees who and we initiate works towards it, work towards it here.

INTERVIEWER

Okay. Okay. Thanks a lot.

So the next question is, have you ever witnessed the adoption of a lean production process from another organization? In your opinion, how effective was the implementation of the new strategy

INTERVIEWEE

Yes, but not exactly a process. But a machine I would like to say, like a dough mixer would take around 35 to 40 minutes to mix the batch of 30kg.

But upgrading to a German model has helped us a lot like to produce 40 kg. Now we take only 18 to 20 minutes, depending on the consistency of the mixture.

INTERVIEWER

Have you encountered a situation where a new idea was not adopted just because it belonged to a specific purpose person? How does this impact the company?

INTERVIEWEE

See Joy i would definitely want to go and have a look and learn but due to competitiveness of the competitiveness factor is often don't tell us the secret's out. You know you don't tell the secret about your success.

INTERVIEWER

Yeah, that's true. No one wants to Have the competencies. Okay, so the next one was question is What was your instantaneous reaction to the pandemic? What was your priority line of focus? Either it was like lean production or minimizing the losses

INTERVIEWEE

through the pandemic, like we have learned a lot, you know, it's a very long process like we like. Just like I want to say that minimizing the losses. Along with it. We also concentrated on our staff.

There they are our pillar you know, we focus too much on our staff and employees. and due to this pandemic, we close one of our one of our plants for col drinks and focus more on dry snacks, products as cookies and so on.

So we reduced the search for the employee and brought in staff from the closed factory to work with us here so that everyone is working. And you know, the like, process is smooth and everyone is earning money and we are giving equal opportunities to every staff of us.

INTERVIEWER

Okay, so which means you didn't just because the plant was shut down, you didn't lay off the staff instead of that you gave them the same job in another plant. Yeah, exactly, exactly. Okay,so everyone had gotten a good opportunity. Okay, heading ahead. The next question



would be what were the improvised strategies adopted for the pandemic? Like the whole phase, I can say like, we had phase one or phase two, where the moment was restricted, but still, you could keep the flow and supply chain going and all these things. How did you cope up with that?

INTERVIEWEE

See that it was not actually very much easy. Initially, we had to cope up with some losses as our perishable raw materials were stored for weeks, and we try to run two shifts and produce double the amount So we could finish the raw materials,

but it was not easy. We had to lose lose many things. Myself, I did have a impact, but a scenario based solution was that running extra lines and doubling safe that helped us to minimize our losses. Okay,

INTERVIEWER

so, coming up to the next question, what is the learning outcome from the pandemic? What strategies and policies are the company to adopt for such uncertain and unseen circumstances?

INTERVIEWEE

See, as I said earlier, pandemic phase was like a very learning phase, we had to do so many things. One thing that I personally learned from the experience is to prepare yourself based on your neighbors experience,

if the country would have prepared themselves for the pandemic rather than rejoicing the fact that the virus has still not breached the borders economically would have been in a better state predefined regulations.

If enforce in a timely manner, then companies would have would be clear about the changes that they need to make and would have had some ample time to prepare for it and analyze the situation more proper way, you know,

INTERVIEWER

okay. So, according to you, how popular is the adoption of lean strategy in small scale industries? And how effective are they are methods?

INTERVIEWEE

See every industry follows lean, just that the term lean isn't huge, small scale industries do control Waste So, yes, they do follow and it's effective as they have very little external factors to concentrate on.

INTERVIEWER

Okay, so, my next question would be, have you ever witnessed a strategy whose adoption has been untruthful or like it has been disastrous for the supply chain?

INTERVIEWEE

stacking height was increased and we had half we had to face damages in the warehouse because of the stacking heights So, you know, some similar things happen in the warehouse where we face losses and we face those things. Yeah.

INTERVIEWER

Okay, so now talking about the last question, do you think artificial intelligence can be incorporated into lean strategy in supply chain management

INTERVIEWEE

so I think AI is the future, like all the basic things that we focus on can be done through the help of AI. So there are various teams and IT companies still working on these things and I think that within a couple of years AI will be installed everywhere

I think like it would help in minimizing you know, minimizing labor minimizing different type of costs and so on. Yeah.

INTERVIEWER

Okay, so I had with the help of AI I think we can get a single head we can have a look over multiple things we do on the production lines or and the supply chain just with the help of Ai we do not, you know, search around other places to have a look on what's happening.

INTERVIEWEE

Yeah, exactly. AI can be installed in like every field and in every department, you know, to cope up with the basic things.

INTERVIEWER

Okay. Okay, JEET. Thanks a lot for your interview. And I would be sending you a robot to have the interview what we have had just now. And once again, thank you so much for your valuable time. And I would wish good luck in your professional carrier as well ahead.

INTERVIEWEE

Thanks a lot. Thank you for involving in your research. I wish you all the best for this academic research. I hope you do best.

INTERVIEWER

Thanks a lot. Bye now.

This transcript was generated by <https://otter.ai>

## II. Interview 2

INTERVIEWER

Hello wilson, good morning

i would like to interview you for a resarch i am conducting on lean production and i would like to record this conversation for my dissetation purpose.

is that okie with you?

INTERVIEWEE

Yeah, please go ahead.

INTERVIEWER

Yeah. Can I get a brief description about you like, Where have you been working? And what field are you in?

INTERVIEWEE

Oh, joy. I work in the hospitality industry, okay.

INTERVIEWEE

is a hotel industry, okay in bangalore? Okay, not one. Okay. I'm in this industry last 18 years with a within an industry a radius position.

So like right now I'm looking for the heading the procurement department as a director of purchasing.

INTERVIEWER

Okay, thanks a lot. Okay, so we'll begin going ahead with the questions now.

Please go ahead. Yeah.

So, the first question is what are the existing lean tools training and techniques applied in the production process to enhance the overall productivity and efficiency and to reach the optimal production?

INTERVIEWEE

We are producing the food where to serve the guests okay and also a lot of other production, etc. By looking for all this current scenario. Our lean techniques we are understood like in a five steps,

first phase, eliminate that is not needed. Like revising the memo, instead of running 23 restaurants we keep in three restaurants.

secondly, as the menu was revised no new menu was printed instead we gone through the IP section where we can QR code can use to eliminate the paper, sanitization of the the menu would also be highly responsible.

Use of the commodity must be done. all this got deducted qith the QR scans.

So where the customer or guest can review can look easily and we can add up the changes. So in this process, the waste is completed trim and whatever required, So that is the one of the things that you're looking for.

the second part we look in the second order, like you know, we organize Whatever is required as a step by the organizing, what are the items we have like a remaining items,

then we clean and inspect the work area where are the work arthen whatever the unwanted things we removed, we cleaned up.

So, no wastages no electricity waste, no manpower waste. So, etc whatever we done is we standardize, we write all the standards step by step.

Going forward to going for the future we sustainable we are looking for that to regulate the standards and implemented.

So, these are the steps which you follow to existing lean tools So, coming up to shelf life, are we looking at the production we are not producing anything more now,

keeping the minimum requirement for the good based on the guests. so no food wastages. And keeping our separate check to keep all fresh.

This is what we're looking for right now.

INTERVIEWER

Okay, that was wonderful. I think that's the very good tool you're currently regard according to the situation based that is the best thing you can do for it. Yes, yeah. So, going ahead, the next question is,

what is the process of executing a lean method?

INTERVIEWEE

ah See, the lean executing is not that easy.

But first what you have to do is you have to analyze the process that need to improve right because of studying and understanding the current process or situation and putting in place how they function.

It is important to contract to our Ask the question to our employee who is The ground level. So, because no one who will know better than our staff.

So, that is a first step what you are the manager level we are looking for and finding that based on that analysis, we are finding the implementation.

what I'm trying to say that then we tried to implement it based on that suggestions, then executing and monitoring this is the way what we are right now, we are executing our new method

INTERVIEWER

okay. So, that is good to go. So, coming to the third question is like what factors would you consider before choosing a lease option method? So, would you consider the time taken for the implementation of the program?

Or would you firstly consider the capital expenditure or would you like would you put your training training all the employees to maintain a backup or training only a specific labor group used in the process

INTERVIEWEE

okay the good questions, anything go into a new technology, we are to consider some of the factors which is affect our methodology selection direct yeah looking at how is our company structured?

Because I can bring a new technology I can say I, I want to store a lot of product instead of buying for the day by day, monthly basis, yearly basis. I can store all in one, but is it my company structure is supported?

Is it the company object to is buy the fresh to give to the customers, is it that process can I use a fresh Can I store frozen Example right.

The company objective is what that have to do the best five star hotel standard so if I do that it's gonna be a normal catering company.

So that's the second i what is our strength? Do we have that my staff knowledge people and all these things were considered and also the stakeholders were unable to agree by looking all these things factor in the first things comes to mind is that yes is a capital expenditure?

Is it a new process can be implemented. Now, and second thing, how the current staff but what we have, do you want to use all the group together or particularly a small definitely we will look into that a part of staff out of one by three staff,

we give them training first implemented through them. Then what are the backup we have slowly, slowly Learn from them. So that's what we mean consider for choosing a new, lean optional methods in our industry.

INTERVIEWER

Okay. So that would be the best for you right now. So coming up to the next question,

have you ever witnessed the adoption of a lean production process from another organization? In your opinion, how effective was the implementation of the new strategy?

INTERVIEWEE

it depends every business is a unique does have the experience to give us the opportunity and way forward?

So in this case, our Law said that we are not using the method but yes, it does depend on the situation. And what are we can understand from other people?

Yes, we do.

But that was my answer.

INTERVIEWER

Okay, so if not If you if you're not going up to that current, if you're not picking up the an idea from another organization, what? How do you get? How do you come up with new ideas of your own?

INTERVIEWEE

Joy what we do in our corporate is that we have a setup team people, which is a corporate development set, and also there's the calls going for the meeting for the strategy from the global strategy we have.

And within a team structure, we will some of the key people will sit and discuss thoroughly, planning accordingly and move forward.

That was all strategy applied in our industry, especially in our company.

INTERVIEWER

Okay, that's nice. Okay, coming up to the next one.

What was your instantaneous reaction to the pandemic What was your priority line focus on the lean production or to minimize the losses

INTERVIEWEE

our first priority was minimizing the loss

first focus is minimize the loss okay then the lean production comes, what we did is our industry especially our for our company in this space when the issue has happened in the beginning of the month of March we shut down the hotel.

we just opening now this month okay. So, the basic things kept on continuing the losses, we put the point that we have to stop it.

We have a three property here which is not open all three property, we can have only one whatever that also in 50% and also the occupancy out of 20 they may be one to one One outlet.

So, if then we take the very minimum production items like an item required to production. So, the wastage will be controlled, the losses will be controlled and we can put them the new lean production let that in place.

So, that was the now our reaction with a current situation.

INTERVIEWER

Yeah, okay. So, coming up to the next one,

what is the learning outcome from the pandemic? What strategies and policies are the company to adopt for such uncertain and unseen circumstances?

INTERVIEWEE

I will say be prepared the learning from the outcome from the pandemic Yeah, I will always say that be prepared. Yeah, the strategy policy everything will be there.



Like what we did it here, when the pandemic we come to know that China in other parts of the world, we are nothing you're not a single issue was with our country.

Yeah, we loaded everything which is required until December which is related for this COVID issue.

We as a pre plan we did it we acted very sharply so that the losses will be brought down. But what I want to say here that we prepare the plan for specific scenarios before it anything can be happened.

Yeah, the plan for specific scenarios before it will be happened.

Second, communicate with our employ early and often don't wait for to happen. There will be chances step one, step two and then stage one, stage two, stage three.

So these are the things which are very important in these other cities. Do I don't want to tell the people or lead by yourself or by example, right as executive as the head of the people that you need to be on the floor,

to implement yourself and allow for more flexibility, whatever I can say, it doesn't mean that there will be right based on the scenario the flexibility required.

That's enhance the productivity and reduce our turnover, slow the spread of disease or whatever we can say.

if we are training the staff, relevant to the topic, if situation comes, how are you going to handle it? We never seen what's going to happen.

But if we know all this situation you are to learn from the history, learn from the mistakes what we did earlier, and do the learning things work, even though not in the office maybe remotely and improve our soft skills etc.

and adjust Our company goal our goal according to the scenario, these are the some of the steps or some of the things which I say are the strategy or policy for adopting such uncertainty or unseen circumstance in the future.

INTERVIEWER

So, according to you, how popular is the adoption of lean strategy in small scale industries and how effective are they are methods

INTERVIEWEE

Sector like small industries One thing to note is very easy but there used be a right way the problem identification is easy and you can corrected it in the fastest way.

then the solve the problems in a better way to structure new knowledge and sharing this knowledge more efficient across the team or the form. It is not that difficult.

Yeah. So it's more effective in a small scale industry because you have very less Things under the control which you can control very easily.

INTERVIEWER

Okay. so coming up to the next but the last question here. So have you ever asked a strategy whose adoption has been unfruitful or disastrous in the supply chain?

INTERVIEWEE

See,I never come across any kind of such a scenario so far. And I don't want to say anything on this point. Not encountered anything such.

INTERVIEWEE

Okay.

INTERVIEWER

Okay then so thanks a lot for your valuable time.

INTERVIEWEE

You're welcome joy. Yeah. Okay. Thanks a lot for the interview.

INTERVIEWEE

you can ask me again the questions which maybe not clear for you, what was answered,

INTERVIEWER

No, everything was clear. I have got it all on the record. And I will be putting up but back in the words and we'll be sending a copy to you as well.

INTERVIEWEE

Okay, thank you. Thanks

INTERVIEWER

thanks a lot. Thank you. Bye.

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III. Interview 3

INTERVIEWER

Hello PUNEETH.

INTERVIEWEE

Hello joy. How are you,

INTERVIEWER

I'm good. How are you,

Okay,As i had informed you regarding my research, I had informed you that I would be getting your interview done for it. And this whole conversation will be recorded for my academic purpose. So Is that okay with you.

INTERVIEWEE

It's completely fine.

INTERVIEWER

Okay, so going ahead with the questions. The first question is, what are the existing lean tools, training, and techniques applied in the production process to enhance the overall productivity and efficiency and reach optimal production.

INTERVIEWEE

The policy uses on site experience, we go, we see what is wrong in based on the resources available. We work on it. Good understanding is most in this.

INTERVIEWER

Okay, so the second question, what is the process for executing a new lean method.

INTERVIEWEE

The process goes from manager level to the bottom line. A team site sits down and understand the costs and time for employee implementations. Okay.

This strategy is then formed and decided upon. After the approval is received the strategy is deployed in a timely fashion. Okay.

INTERVIEWER

So the third question is, what factors, would you consider before choosing a new lean method.

INTERVIEWEE

See, there are two variables that we can consider your costing time. They are crucial since this harmony between the both can end up the form in huge losses.

So, we have seen the method, which are less time consuming and expensive, and vice versa. So the planning in the right way method where it is balanced in both.

INTERVIEWER

Okay. So, have you ever witnessed the adoption of lean production process from another organization. In your opinion, how effective was the implementation of the new strategy.

INTERVIEWEE

Can you just repeat the question,

INTERVIEWER

like, have you witnessed the adoption of the lean process from another organization.

INTERVIEWEE

Okay, like, Yes, we have adopted the strategy of expanding through CFA like carry forward. It also creates a distribution chain, and save us expenses on warehousing multiple supply order transportation, like human personnel for dealing with vendors purchase return expenses.

so the idea was adopt from an organization in the market operating in the same sector. When the wheels have put in the motion for expansion plans. Okay.

INTERVIEWER

What was your instantaneous reaction to the pandemic. What was your priority line of focus. Either it was lean production or

INTERVIEWEE

minimizing the losses pandemic. As you know, like, minimizing the loss become a priority, the pandemic in picture with expecting a revenue to expect a steep dip in the number.

It includes everything, like what we say, checking on the raw materials, managing stock, which are going to expire in a month's time.

This had to be picked up after the lockdown has been lifted and scrapped. So we put it in a lean in it as well. So we didn't incur the losses on scrapping goods,

but we did plan out lean because if the lean process is in a place definitively you will see, I'm minimizing the losses.

INTERVIEWER

Okay, so what were the improvised strategies adopted for the pandemic.

INTERVIEWEE

For the pandemic right like, we are talking about the whole pandemic from start to now. We had the strategy for the different verticals in the organization like for example, expensive products we laid off for a month, and only mid range goods were produced.

You'll be focused more on the volume of the sales, rather than the price as an India, taking into consideration of the population. We majorly depending on the volume. And this did help us during this period, as the fixed expenses, didn't change.

It was a challenge to reach the break even this is volume using the matrix product. And we did success overnight.

INTERVIEWER

Okay, thanks a lot. So, coming up with a next question. What is the learning outcome from the pandemic. What strategies and policies are the company to add up for such uncertain and unseen circumstance.

INTERVIEWEE

Planning is what I would like to see you in India. We had three months to plan for it yet We failed challenges during the certain in the complete lockdown.

The information passed from the governing body to the regulatory authorities turned out to be incorrect.

There were ambiguities in the data transferred to the market, which didn't prepare them enough for the days ahead, due to which the forecasted market condition, hit the rock bottom.

When the governing bodies couldn't fulfill the promises and the clear impact was seen on the economics, as a whole, for any strategy to work out.

It is important that the Federal norms and regulations are in the harmony method, along with which the long term goals of the central body has to be kept in mind,

so that the external business environment can be predicted in deviations from the assume pipe can be rectified. But this failure to happen in this certain instance, which further Deteroits take the already subset economic.

INTERVIEWER

Okay. So, according to you how popular is the adoption of lean strategy in small scale industries, and how effective are there methods.

INTERVIEWEE

In India, small scale industries merges from mostly household where they have the minimum knowledge on lean and other methods. It is very important that understanding the difference between the length, and cost cutting.

The main goal is to increase the profit. And this is done by either concentrating on the volume or at times some industry reduces the quality of the raw materials as well, like to reach out this limit which hurt the business in the long run.

So yes, they do have the lean strategy, but sometimes they might not be as effective as they're supposed to be. Okay. So,

INTERVIEWER

have you ever witnessed a strategy whose adoption has been unfruitful or disastrous for the supply chain.

INTERVIEWEE

Not exactly. Disaster disastrous but little trail an error method has been used, based on packing material, which did fail the process in a various quality, and small pack were filled with the normal tap water in it.

Like, So, it didn't c0st much actually.

INTERVIEWER

Okay.

Do you think artificial intelligence can be incorporated into lean strategy in supply chain management.

INTERVIEWEE

Yes, the prospect of artificial intelligence like AI being incorporated into lean production will make life a whole lot easier.

Maximum processes that are associated with the lean production. Meet the manual overlook the this make processes, human intensive and create a loophole for errors.

Plus, going forward, if the companies want to maintain the margins, they have to think for the strategies, where cost minimization can be maximum employee costs are a major expenditure and the AI can help in that spill.

Also, with the pandemic infection by keeping the pandemic in picture. The complete outlook of the processes have now changed, like company would now want to shift process that can be independent to the expensive excessive factors, actually,

where supply chains can be maintained, even in the case of such adverse condition to get such ideas up and running it is crucial to store and run the data from Cloud, where AI can prove to be extremely useful.

INTERVIEWER

Okay. This information was quite helpful for me. And I would like to thank you for your time, you have put in for me to help me out for my research.

INTERVIEWEE

Like, it's fine. I'm like gladly Thank you like you take my interview it's time for me to give you time as well, to share my experience with you.

INTERVIEWER

thanks a lot. Take care. Thank you. Bye bye.



## Findings

<p>What are the existing lean tools, training and techniques applied in the production process, to enhance the overall productivity and efficiency and reach optimal production?</p>	<p><b>Respondent 1:</b> 5 Steps. Eliminate waste, use of AI for QR codes instead of printing menu, just in time.</p> <p><b>Respondent 2:</b> Kaizen method Small and Continuous improvements by employees.</p> <p><b>Respondent 3:</b> FMCG companies need to focus on their inventory turnover. Shelf life of a product affects the sale since the retails want around 80% shelf life and wholesalers need at least 60% shelf life.</p> <p><b>Respondent 4:</b> Hands on site experience. Good understanding to evaluate and solve the problem with existing resources</p>
<p>What is the process for executing a new lean method?</p>	<p><b>Respondent 1:</b> Analyse the process, ask staff at ground level as no one knows the problem and ideas to solve it better than the staff. Managerial investigation and then through analysis and implementation of the method.</p> <p><b>Respondent 2:</b> Depending on the department contact the business and strategy team and implement it. 1<sup>st</sup> managerial level and then team leaders and the line mangers and so on. All staff will undergo the training respect to their positions.</p> <p><b>Respondent 3:</b> It is a combination of work between the executives and the employees, executives need to plan the correct strategy an employees need to be efficiently trained to deploy them.</p> <p><b>Respondent 4:</b> A team sits down to analyse the cost and time. Training goes from managers to bottom level and on timely fashion the implementation process is done.</p>
<p>What factors would you consider before choosing a new lean option method?</p>	<p><b>Respondent 1:</b> The structure of the company. what are the rules of the organisations and standards need to be maintained. Knowledge and learning power of the staff is also considered.</p> <p><b>Respondent 2:</b> Cost and effectiveness in a long run is considered.</p> <p><b>Respondent 3:</b> We follow a set of guidelines from our companies framework. Capex and employee training are the two main factors as they a major impact on the product cost and processing time.</p> <p><b>Respondent 4:</b> Two main variables cost and time is being considered. Disharmony between the two can cause huge losses. A right balance between the both is necessary.</p>
<p>Have you ever witnessed the adoption of a lean production process from another organization? In your opinion how effective was the implementation of the new strategy?</p>	<p><b>Respondent 1:</b> No, A corporate development team is set which follows global organisations strategy is followed and key responsible people plan and take up the decision and move forward.</p> <p><b>Respondent 2:</b> Yes, not exactly a method but an idea of a machine was taken up and it seemed to be successful. Due to competitiveness organisation don't let competitors know their secrets.</p>

	<p><b>Respondent 3:</b> Yes, previously company had a pre decided list of vendors but employee network is used to bring on board new vendors leveraging the employee relation for a better price.</p>
	<p><b>Respondent 4:</b> Yes, adopted a strategy of CFA(Carry Forwarding Agent).</p>
<ul style="list-style-type: none"> <li>• What was your instantaneous reaction to the pandemic? What was your priority line of focus on lean production or minimizing the losses?</li> </ul>	<p><b>Respondent 1:</b> Minimising the losses as the priority and then comes lean. Complete shut down for 3 months and now gradually opening with just in Time concept.</p>
	<p><b>Respondent 2:</b> Cutting down the losses along with concentrating on the employees. As employees are the pillar. Though one of the three production plants were shut no employees were laid off but were moved to other plants.</p>
	<p><b>Respondent 3:</b> Instant reaction was to control the losses as volume loss in sales was anticipated. But within the first month the scenario changed, and the sales of mid-range snacks and biscuits picked up swiftly. Though due to the lockdown additional goods could not be produced but the buffer stock was completely exhausted.</p>
	<p><b>Respondent 4:</b> Reducing the losses were set as a priority. A steep dip was expected in the numbers due to the pandemic. Includes checking on the stock and expired items and finding a lean way to scrap it.</p>
<ul style="list-style-type: none"> <li>• What were the improvised strategies adopted for the pandemic?</li> </ul>	<p><b>Respondent 1:</b> Understand, evaluate and improvise. Get down and plan.</p>
	<p><b>Respondent 2:</b> Had to cope up with the losses as raw materials were stored for a week's production. Running extra lines did help to utilize the stored raw materials.</p>
	<p><b>Respondent 3:</b> after the lockdown was enforced products expected to be in demand were produced in greater quantities and goods with sales lag were produced to a minimum. This helped reserve the shelf life and maintain the sales volume at the same time.</p>
	<p><b>Respondent 4:</b> Developed strategies for different verticals, high end products were laid off and mid-range were produced in higher quantities to reach the optimum.</p>
<p>What is the learning outcome from the pandemic? What strategies and policies are the companies to adopt for such uncertain and unseen circumstances?</p>	<p><b>Respondent 1:</b> 'Be prepared'. Forward thinking and stored all necessary things for the pandemic until December 2020. Act sharply to bring down the losses. Communicate with the employers early and don't wait for the last minute. Lead by yourself or by example. Learn from history or our own mistakes not only regarding work but also your soft skills and lastly adjusting the company goals according to the scenario.</p>
	<p><b>Respondent 2:</b> Learn from neighbour's mistakes and prepare yourself. The country should have prepared rather than rejoicing that the virus has still not breached its borders. Pre-defined regulations if enforced in a timely manner then companies would been clear about the changes that they need to make and would have had ample time to prepare for it.</p>

	<p><b>Respondent 3:</b> Do not overproduce nor overstock the goods produced.</p>
	<p><b>Respondent 4:</b> Planning ahead. In India we had 3 months' time, yet challenges were faced when the lockdown was implemented. Information flow from authority was incorrect. Ambiguity in the data transferred which directly impacted the market and hit a bottom low. Federal norms and regulations must be in harmony. long term goal of the central body had to kept in mind so that the external business environment can be predicted and deviations from the assumed path can be rectified.</p>
<ul style="list-style-type: none"> <li>According to you how popular is the adoption of lean strategy in small scale industries and how effective are their methods?</li> </ul>	<p><b>Respondent 1:</b> Very easy, there should be a right way for problem identification and can be corrected in a right way. Understanding the problem and solving it is very easy and effective in small scale industries.</p>
	<p><b>Respondent 2:</b> Every industry irrespective of the size of the firm follows lean. Just that the word lean isn't used, yet simple terms like reducing waste, value and appreciation for the work of employees is used.</p>
	<p><b>Respondent 3:</b> Lean supply chain be applied to the small-scale industries. And has become popular with the government being proactive in spreading awareness about the importance of lean production for sustainable growth.</p>
	<p><b>Respondent 4:</b> SSI's emerge from household and have less minimum knowledge over lean and other methods. They need to understand the difference between lean and cost-cutting. The goal here is profit and is achieved either but increasing the volume or decreasing the quality of raw materials. They have less external factors to deal with yes the process has high effectiveness.</p>
<ul style="list-style-type: none"> <li>Have you ever witnessed a strategy whose adoption has been unfruitful or disastrous for the supply chain?</li> </ul>	<p><b>Respondent 1:</b> No, I haven't come across anything as such.</p>
	<p><b>Respondent 2:</b> Stacking height was increased. Due to which some finished products were damaged.</p>
	<p><b>Respondent 3:</b> Yes, previously ideas and plans were open to alteration only for the executives. That limited the scope for improvement and caused delay in the pre-planning or decision to be taken.</p>
	<p><b>Respondent 4:</b> Not a strategy but a little trail and error method did cos us some minor losses.</p>
<p>Do you see AI could be incorporated in lean production in supply chain management?</p>	<p><b>Respondent 1:</b> AI along with data analytics can be our future. It depends on the company's law to extent are they agreeing it implement and give the right to AI to manage their supply chain.</p>
	<p><b>Respondent 2:</b> Supply chain needs to be incorporated with AI. This will help us track everything down to a single hub.</p>
	<p><b>Respondent 3:</b> Incorporation of Artificial Intelligence is required but it is essential to give human interference in a process that is people oriented.</p>
	<p><b>Respondent 4:</b> AI can be incorporated but every small detail should be considered as AI wouldn't work efficiently without it.</p>

