Improvisation of Supply Chain process using Artificial Intelligence - Case Analysis on Dairy Industry

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Abstract: Dairy industry has been ever evolving since ages and has flourished over the years. On the other side, AI has seen limited application in supply chain management (SCM). To fully exploit the potential benefits of AI for SCM, this paper explores various ways by which AI can enhance the supply chain process in the dairy industry. In doing so, this paper reviews the basic process of SCM and identifies how AI can be fruitful for the dairy industry especially in the area of supply chain.

Keywords:AI, Dairy Industry, Inventory planning, model, Supply Chain Management, Warehouse management

I. INTRODUCTION

Supply chain is a set of process or activities that starts from ordering and receiving raw material to manufacturing of products and delivering it to the customer. Artificial intelligence (AI) is the simulation of human intelligence machines to increase the efficiency of any business. In case of dairy products the supply chain process has to be very quick and uninterrupted as dairy products are non-durable. The efficient supply chain process of any dairy business consists of few important factors that are to be taken into consideration.

The factors realized for having an efficient supply chain management in any dairy business are; Inventory management which is used for managing the raw materials and to keep them fresh as long as possible. Packing which ensures that the material used for packing doesn't deteriorate the quality of the product so as to not hamper the health of the consumer.

Storage refers to the storage of final goods which are to be kept in the warehouses till the order is received or the transportation is in place. Transportation plays an important role in the entire process as a delay in transportation can destroy the quality of any dairy products. Distribution refers to the transfer of goods from the wholesaler to the retailer and then to the end customer/consumer. The distribution has to be as fast as possible to ensure delivery of a good quality product to the customer.

In this paper we shall study how Artificial Intelligence can be embedded in the supply chain process of a dairy company/business to achieve faster delivery of quality products.

II. BACKGROUND STUDY

AI has been used in the dairy industry since a long time but its usage is mainly focused on dairy farming and the production process. AI is not being prominently used in the supply chain processes. But in 2017, Cornell University and IBM announced a partnership to use AI to identify food hazards in milk that will protect global milk supply. By looking at genetic sequencing and bioinformatics analytics, IBM and Cornell hope to identify traits and determine what should be normal and what is abnormal. [1]

The Indian dairy industry supply chain is quite complex because of its dependency on a number of factors such as storage temperature, cold chains availability, weather, perishability/shelf life, first and last-mile distance, packaging, etc. Under supply chain, cold chain technology is expected to progress by leaps and bounds. The coming years will witness the rise of energy-efficient and cost-effective cold chain warehouses, cold boxes, Phase Changing Material (PCM) pads, temperature-controlled cold chain packing, refrigerated vehicles, cold chain pallet shippers, and other advanced cooling technologies. [2]. Also, as per a study, AI as service will reach $1.3 billion by 2024.

III. KEY OBJECTIVES

3.1: To realize how AI can impact SCM in the Dairy Industry

3.2: To understand the current supply chain process of the dairy industry

3.3: To imply a model to improve the efficiency in supply chain using AI

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IV. BASIC SUPPLY CHAIN MODEL IN DAIRY INDUSTRY

A basic supply chain model in any dairy business starts from Supply procurement after the production process is completed wherein, we identify how we manage the inventory till the time it is ready for transportation to the warehouses with cold storage. The finished product is then transported as and when distributors are ready it is transported to the retail outlets which in turn is delivered to the end customer. But this process is time consuming and thus could affect the quality of milk products.

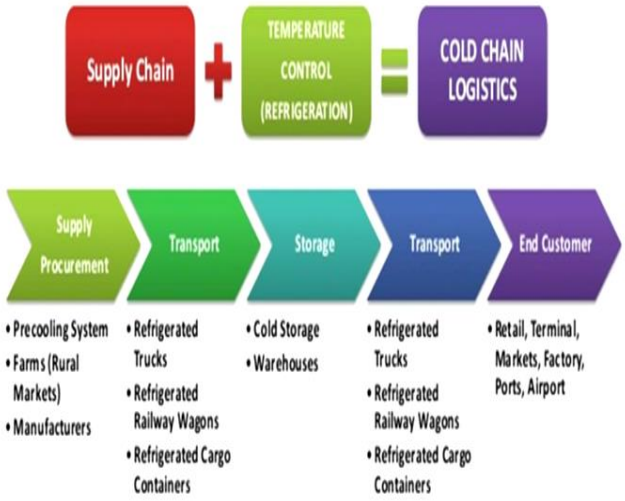
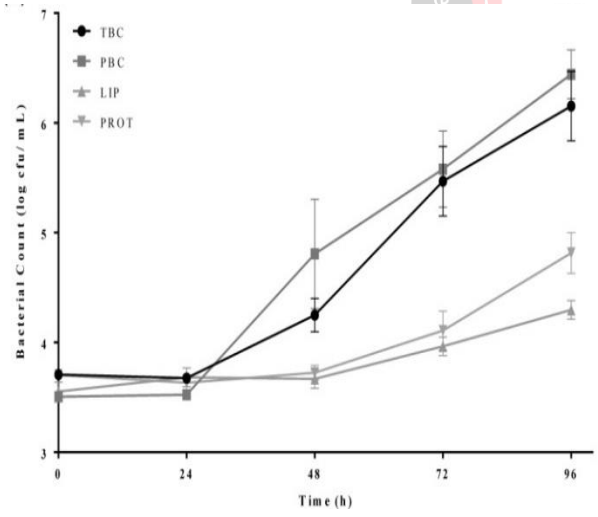


Fig 4.1: Basic SCM model in Dairy industry



Graph 4.1: Growth of bacteria in Dairy products over time after production [3]

Graph 4.1 explains how the bacteria count goes on increasing exponentially after 24 hours after production which explains the need of having a speedy supply chain process.

V. SCOPE OF AI IN SCM

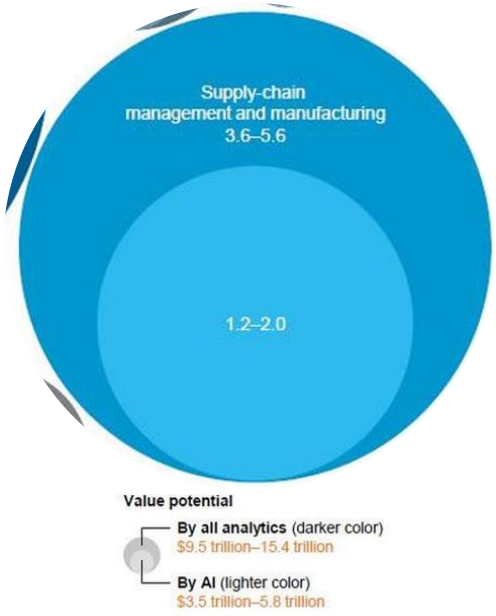


Fig 5.1: Scope of AI in SCM [4]

Fig. 5.1 clearly shows that the use of AI in supply chain management is between 3.6-5.6% but the use of AI in SCM in the dairy industry is approximately 1.2-2.0%. This states that there is a lot of scope of implementing AI in SCM in the Dairy Industry.

VI. NEW MODEL OF SUPPLY CHAIN MANAGEMENT WHICH COULD USE AI FOR MAKING THE PROCESS MORE EFFECTIVE

- *Inventory Planning*

Predicting what to keep in stock is a major challenge in supply chain management; cutting down needless inventory helps in stocking more products and freeing up space in the warehouse.

Predictive modelling uses AI to examine consumer trends and help us identify which products to stock. We can reduce revenue losses from not having the right products immediately available up to 65 percent. Predictive modelling can also cut forecasting errors by anywhere from 20 to 50 percent. There are too many variables at play for humans to accurately predict the appropriate inventory levels in real time. AI can solve these inaccuracies, making our facility more efficient. [5]

- *Warehouse management*

Today there are various AI examples where warehouse robots pull products from the shelves for shipping. This helps protection of human workers from dangerous tasks around a warehouse.

When handling food, robots can be located in freezers or near ovens, while these environments generally do not harm robots, some defence must be made to ensure the robots operates efficiently. The robots based inside

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freezers for palletizing operations preclude undesirable frosty condensation from building up on ice cream packages. [6] It also improves accuracy and safety in the warehouse. Smart robots can avoid obstacles by shelving which can turn out to be easier while retrieving or storing products.

- *Smarten Your Shipping*

AI can make more accurate predictions for shipping times with the latest advancements happening in the industry. And also, today, driverless cars are in testing but we can see them as a future norm for commuting to places. Thus with machine predicted shipment times, one can stage their warehouse to receive shipments. AI will make shipment problems outdated and in turn also makes the customers happy with the arrival at highest accuracy

TransVoyant uses machine-learning artificial intelligence to account for weather, natural disasters, road conditions and more to make accurate arrival times for shipments. [5]

- *Automated guided vehicles (AGVs) for transportation*

AGV's helps in simultaneous localization and mapping, and machine vision, AGVs can enable automated material handling across traditional manufacturing boundaries by moving between buildings. AGVs have thepotential of being made relatively more autonomous by integrating them with data from existing warehouse management and control systems through a connecting software layer called warehouse execution systems (WES).

WES use AI to make existing logistical systems more efficient over time, and many of the top AGV players have made clear strategic decisions towards acquiring WES capabilities. We discuss some use-cases of some of the top AGV manufacturers using AI to offer WES services. [7]

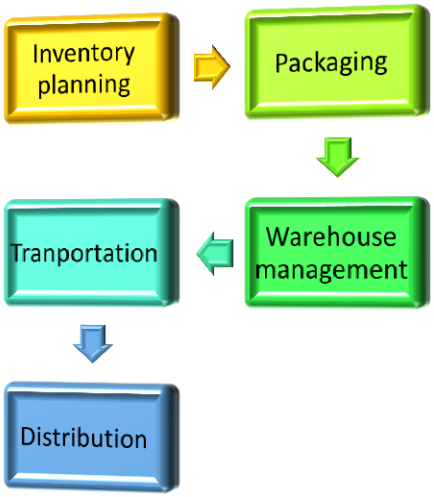
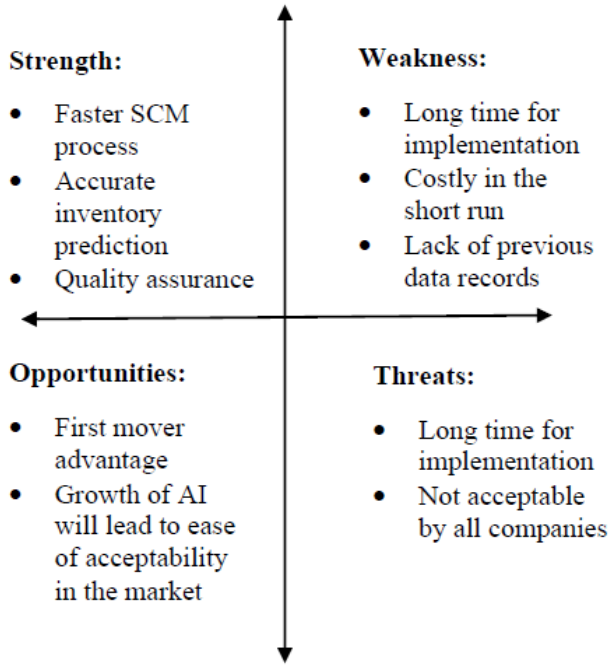


Fig 6.1: Proposed SCM model incorporating AI

VII. SWOT ANALYSIS OF THE PROPOSED



The SWOT analysis of our proposed model showcases how strong our model is in terms of application and also what could be our possible threats in the existing market and what could be our future threats while application of our model real-time.

VIII. FUTURE OF SUPPLY CHAIN WITH AI

The future of supply chain clearly shows a need for the use of AI to collect and integrate data. Lack of use of latest technology will make supply chain to be inefficient. The industry requires AI due to higher consumer expectations and demands through the supply chain for faster turnarounds [5]

IX. CONCLUSION

Supply chain has a great potential to improve in future with respect to the dairy industry although it is well established with it processes. With the introduction of AI in almost every business process the supply chain can be enhanced for speeding the process further and increase efficiency of the system with also focusing on good quality assurance by delivering as fast as possible.

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