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Implementation of The Kanban and 5S Methodology in The Upstream Supply Chain of The Jute Industry: A Case Study in Bangladesh

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Supply chain management, 5S methodology, Kanban, Lean Manufacturing, Jute supply chain, Continuous Improvement, Bangladesh

Abstract

Over the past few decades, Bangladesh, a South Asian nation at the nexus of economic dynamism and social advancement, has seen remarkable expansion in its export industry and income levels. Among all the sectors jute is one of them which has been playing quite a significant role in the export sector of Bangladesh. Bangladesh's jute and jute products have discovered markets for eco-friendly packaging materials in addition to conventional usage, boosting export earnings. But due to several issues, the jute industry is facing lots of problems nowadays. Local traders and farmers are suffering as a result of these issues. The upstream supply chain of jute plays a significant role in the export sector but the jute industry in Bangladesh has a number of serious problems in the upstream supply chain. These include seasonal variations in the availability of raw jute, outdated agricultural methods, inventory issues, and transportation infrastructure, problems with quality control, slow adoption of new technologies, financial issues, environmental concerns, and a lack of market information.

So this paper provides a thorough case study of the effective application of the Kanban and 5S techniques to the upstream supply chain of Bangladesh's jute industry. So improvement of the management of material flow and workstation organization by utilizing the Kanban and 5S concepts is the goal of this research. By creating a model for the local farmers and traders, this study adds to the corpus of knowledge on successful supply chain management techniques by demonstrating the beneficial synergy between Kanban and 5S in a practical setting.

Introduction

Jute, also known as the 'Golden fiber' of Bangladesh plays a significant role in the bolstering of the economy of Bangladesh, which is known as a country of agricultural diversity. (Moniruzzaman et al., 2008) Though the jute industry has long been recognized for playing a vital role in Bangladesh's economy (Tazneen et al., n.d.)the supply chain of the jute industry still gets hampered due to several reasons. Because of proper management issues and other problems, the upstream supply chain of the jute industry faces various problems like inventory management issues, supply shortages, transportation & logistics issues, etc. This research paper aims to look into the applicability of 5S and Kanban in the jute industry's upstream supply chain to make the process more smooth, reduce waste, improve inventory management & lastly improve overall production. Both 5s and Kanban are lean manufacturing principles that are vital in making a suitable environment for any organization.

Lean manufacturing is a production philosophy that was created by the Toyota Production System (TPS) in Japan. Its goal is to maximize value by reducing manufacturing process waste. By removing non-value-adding options, lean manufacturing focuses 'on fat cutting (Holy et al., 2022) on higher efficiency, cost reduction, quality improvement, and customer satisfaction. Lean manufacturing consists of a few techniques like 5s, Kanban, Kaizen, JIT, etc. (Kumar & Panneerselvam, 2007)

The 5S methodology is a workplace organizing technique that has its roots in Japan and is utilized often across many sectors to boost effectiveness, security, and general productivity. It has been effectively playing a very important role not only in industries but also in a wide range of sectors, from healthcare and services to logistics and technology. (Al Amin et al., 2019) 5s refers to five Japanese words, each starting with the letter S. They are - Sort(Seiri), Set in order(Seiton), Shine(Seiso), Standardize(Seiketsu), Sustain(Shitsuke). 5S is based on the concepts of simplicity, which not only simplifies physical workplaces but also promotes a culture of continuous development, employee engagement, and safety. By minimizing waste, enhancing visual management, and encouraging a culture of continuous improvement, 5S aims to make the workplace more productive and efficient. (Singh Randhawa & Singh Ahuja, 2017)

The Kanban principle is a modern approach to the Just In Time (JIT) Manufacturing system. Taiichi Ohno first invented the JIT manufacturing system for the Toyota Production System. Kanban aims to provide a visual update of the real-time information for the production and inventory levels, which overall increases the workers' productivity and reduces the cycle time. The paper aims to use the Kanban principle at the upstream level of the supply chain of the jute industry of Bangladesh to improve the overall jute supply chain by enhancing the productivity and efficiency of the suppliers. (Kumar & Panneerselvam, 2007)

By going through papers, we have got to know the importance of 5S,9s, kanban, etc in the jute industry's supply chain. The Jute industry is facing certain challenges in Bangladesh.(Rahman et al., 2018)There are numerous issues in Bangladesh's jute industry, including a lack of scientific knowledge and modern tools, market tools, a lack of quality seeds, low productivity, inappropriate market forecasting, land fragmentation, natural calamities, conflicts, and an economic crisis in the global market, among others. (Akter et al., 2020) So by following the 5S system, considerable gains in safety, productivity, efficiency, and cleanliness can be seen. As 5s affects the total productivity of a production cycle it can play a vital role in the supply chain of the jute industry. (Agrahari et al., 2015)By implementing the 5S methods in a jute mill, 27 seconds was reduced in total cycle time. This affected in various ways at the mill like increasing productivity, reducing lead time, etc.(Al Amin et al., 2019) The jute supply chain is divided into two parts named upstream supply chain & downstream supply chain.(Almas Shahriyar Azad et al., n.d.) By implementing 5s in jute mills define implementing 5s in the downstream supply chain of jute.

The jute industry faces some severe issues in the upstream supply chain of jute. These issues include farmers not getting their proper payment, loss of goods, wastage, bad management amongst local traders, etc.(A Conceptual Model of Upstream Jute and Jute Diversified Products' Supply Chain Management, n.d.) Due to these issues, productivity is decreasing at a very high rate. This research paper is focused on applying the 5S and Kanban methodology in the upstream supply chain of the jute industry. By implementing Kanban & 5s we will be able to ensure the optimized inventory management of jute as well as efficient handling and processing of jute among the farmers and the intermediaries. This will reduce waste at the supplier level as well as improve and increase the overall productivity of Bangladesh.

Literature review

The overall marketing expenses and margins in the jute business have increased over time, but the net margins for jute producers relative to total investment have not significantly increased. The sector has had trouble since the 1990s due to a lack of innovation and antiquated marketing strategies, despite a 39 percent price rise. Government policies have contributed to this collapse, but so too have a lack of modernization and a failure to adjust to global trade norms. Governmental and non-governmental financial institutions must solve funding issues ranging from manufacturing to exports.

MD. Sadiqur Rahman Toky (2022) has provided information about a number of difficulties that the jute business encounters including production problems, technology obsolescence, labor shortages, financial restrictions, price issues, and worries over seed quality. It is essential for the industry's stability and competitiveness in the global market to address these difficulties like labor shortages, pricing issues, and poor infrastructure that hinder jute production. Neglected machinery and corruption contribute to low output. Outdated technology limits capacity use, especially in weaving mills. Untrained workers and informal recruitment affect productivity. Microfinance and local lenders support growers, while jute mills struggle with capital management due to past debt. Despite government efforts, low prices discourage farmers, compounded by slim margins and high delivery costs. Low-quality seeds and reliance on Indian sources also impact jute quality. The study emphasizes the importance of the jute sector to Bangladesh's economy and to the demand for jute on the global market. To maintain and grow jute exports and take advantage of the demand for eco-friendly products throughout the world, the government should prioritize efficient management, fair pricing, high-quality goods, modern technology, and R&D.(Rahman Toky et al., 2022)

A. M. Almas Shahriyar Azad (2020) has discussed several marketing-related issues that are among the biggest difficulties the Bangladeshi jute sector is now facing. Although government and non-government organizations have made an effort, the execution of suggestions is still poor, which limits the industry's potential for growth. Market research is essential for sustainability. Despite the prospects offered by developing markets in numerous nations, there is a dearth of entrepreneurship in the jute industry. The cottage industry's unstructured, sparsely populated skilled labor force depends on jute. The majority of businesses continue to use conventional techniques, therefore innovation in the diversification of jute products is still restricted. Progress is further hampered by a lack of promotional organizations. Many jute enterprises lack the automation that is necessary to increase efficiency, which results in delayed and unpredictable delivery procedures and limits the potential for growth in the global jute product market.Improved payment procedures for farmers are required since the jute sector in Bangladesh confronts difficulties in all aspects of production and sales. Although they perform a crucial role, intermediaries need improved coordination. Jute industries require modernization, better working conditions, and worker remuneration. Jute is in great demand both domestically and abroad. Outsourcing and improved marketing techniques might help you take advantage of this demand and get a sizable market share. (Almas Shahriyar Azad et al., n.d.)

Swapna Akter (2020) has provided information about the jute industry in Bangladesh faces a number of difficulties, such as farmers' lack of access to modern tools and scientific knowledge, insufficient storage facilities that raise costs, market fluctuations that cause uncertainty, high transportation costs brought on by inadequate rural infrastructure, and low productivity. The issues facing the sector are made worse by incorrect market forecasts, land fragmentation, insect assaults, a lack of sufficient water, natural calamities, a decline in global demand, and manufacturing closures. The sector needs greater coordination, modernization, qualified staff, enhanced forecasting, and consideration of environmental and market considerations in order to handle these difficulties and survive. Also, the paper has proposed several policy ideas to alleviate the issues the Bangladeshi jute sector is experiencing. These include developing aggressive marketing and pricing strategies, ensuring quality control and cost management, promoting cooperative farming, developing effective production strategies, avoiding the closure of jute mills through planned, balanced growth, establishing new markets, offering training initiatives for technical expertise, conducting extensive research for product development, improving transportation infrastructure, boosting the number of government purchase centers, and more. These policy recommendations are provided to assist jute farmers, industrialists, planners, and academics in tackling the sector's issues and fostering growth. The study underlines the necessity to solve the industry's concerns for sustainable economic development. (Akter et al., 2020)

Ahmed Asifur Rab (2018) has discussed how the industry's downfall can be attributed to competition from synthetic alternatives, insufficient investment in diversification, and technological transformation. However, the demand for environmentally friendly products, particularly jute as a natural and renewable fiber, presents an economic opportunity. Bangladesh's economy stands to benefit from producing diverse items with modern technology, leveraging even the byproducts of jute. While some believe intermediaries diminish farmers' profits, they play a crucial role in the jute industry's current state, given the financial limitations of producers. Eliminating intermediaries entirely might worsen the situation. Nonetheless, further research is necessary to improve the jute marketing system and enhance farmers' earnings, securing their continued interest in jute cultivation. (Rab, 2018)

Mehedi Ahsan Ashif (2018) has established a conceptual framework for Bangladesh's downstream supply chain for jute and jute-based goods is the goal of this study or paper. Finding out potential ways to remove obstacles from the downstream supply chain would also help the Bangladeshi jute industry's supply chain become more effective overall.The article delved into creating a sub-supply chain model of jute diversified products that covers various stages, processes, and steps. In addition, the model expresses the essence of the supply chain in the jute diversified industry, as relevant problems are identified and relevant solutions are also drawn on paper. As a matter of fact, all composite factories, the equipment, employees, working conditions, and the environment in these factories are highlighted in order to indicate the full understanding of the supply chain stages of the industry. Henceforth, the paper and the proposed model will help relevant groups such as composite jute mill owners, and the government, Thus, if appropriate urgency is shown in solving the problems in each part of the proposed supply chain model, the aforementioned factors outlined in this research paper will increase the overall production of jute diversified products.(Habib, 2018)

Md Al Amin (2019) has conducted research that focuses on the recommendation of the implementation of 5S in a jute mill in order to solve the problems related while improving the productivity and the efficiency of the mill. This research clearly shows that training workers on the 5S rules are very essential. Furthermore, it is really important to know which method can help us begin the process of continuous improvement in order to achieve increased productivity and safety in the workplace through the participation and knowledge of the involved staff. This is an overview of the 5S recommendations for Aleem Jute Mill. This section seeks to connect the previously noted issues with the 5S procedures. In other words, this section truly demonstrates which 5S practices will solve specific waste-related issues. Seiketsu and Shitsuke's roles haven't been made clear, though, to avoid seeming repetitious. This is so because Seiketsu

and Shitsuke are essential to resolving each of the seven difficulties. Employing Seiketsu will make it so that difficulties do not recur frequently, and Shitsuke will make it so that employees utilize 5S routinely, both of which will greatly aid in resolving the aforementioned issues. (Al Amin et al., 2019)

A study on the marketing of raw jute in Bangladesh was carried out by Md Sumon Rahman (2018) and the paper highlights the goal of making profits in manufacturing by minimizing non-value-added activities. It presents the 9S concept, an extension of the 5S, to reduce waste and increase productivity. Rooted in Japanese principles, 5S consists of five steps: Sorting, Sorting, Polishing, Standardizing, and Maintaining. It focuses on efficiency improvement through a jute industry application of 9S, including advanced aspects such as Work, Safety, Spirit, Simplicity, and Dexterity. The industry's first observations revealed the problems that led to the implementation of the 9S. The implementation spanned six months and resulted in a quarterly increase in productivity from 1,477.41 to 1,837.04 tons. Successful 9S implementation helps production by eliminating non-value-added activities and improving production rates. (Rahman et al., 2018)

Randhawa (2017) has performed a study that highlights the importance of strong leadership support, employee involvement, and integration with other management practices for successful 5S implementation. Resistance to change is one of the most prevalent obstacles.

Common obstacles include a lack of commitment from senior management, a lack of clarity on the mission, low staff enthusiasm, inadequate communication, and cultural difficulties. Implementation of 5S success factors like building a pleasant learning environment regarding 5S is key, and top management should take the lead inside the 5S program. Strong top management support and dedication are also essential. It's crucial to connect 5S projects with other efforts to improve quality. The engagement of all employees and regular PDCA (Plan, Do, Check, Act) cycles are crucial for improving industrial relations. Open communication and trust with trade unions are also key. The benefits and successes of 5S implementation and integration with other management practices are also highlighted in the report. (Singh Randhawa & Singh Ahuja, 2017)

C. Sendil Kumar (2006) has conducted a study about the vital component of JIT, the Kanban system includes plastic cards that contain information for production/assembly at every stage and guide the product's completion path. Kanban serves as a multi-stage production scheduling and inventory control system, facilitating high throughput, capacity utilization, and reduced production time. The paper delves into the Kanban system, explaining its role as a communicator and feedback agent for JIT. Explains push and pull systems, operation of Kanban cards, inhibition mechanisms, Toyota's formula, and performance measures. The main focus of the paper is on JIT production, the transformation from push to pull, and the importance of the Kanban system in increasing production efficiency and inventory control in the production context. (Kumar & Panneerselvam, 2007)

In all of these articles, the focus was on what type of problems the jute industry in Bangladesh is currently going through. And in order to mitigate these problems and improve the productivity of the jute industry, lean manufacturing tools were used which improved the productivity of the jute mills and reduced the time cycle. However, no specific solutions or models were developed in order to reduce problems and improve the performance of the farmers and the suppliers of the jute. Moreover, based on the articles, it can be seen that lean manufacturing tools, especially the 5S and the Kanban principles can be applied in aspects of life.

That is what this paper aims to focus on. The goal of this paper is to develop an optimized working model using the 5S and the Kanban for the farmers and the intermediaries. This model will consist of certain activities and plans that will enable the farmers and intermediaries to organize and efficiently carry out jute storing and sorting activities. Thus,

waste in the upstream supply chain will be reduced and the productivity of the supplier will increase with a reduced cycle time and increased sales in jute.

Methodology

The Jute industry in Bangladesh has many problems. And the industry of this ' Golden Fiber' (Moniruzzaman et al., 2008) has a very big supply chain that works behind the functionality of any jute mill. Based on our search, we are planning to focus on the upstream supply chain of the Jute, that is the production and the supplier level. Our target audience is the farmers, the intermediaries, and their workers. Our aim is to optimize the performance of the farmers and the intermediaries by mitigating their problems. And as tools we have planned to use the 5S methodology and the Kanban Principle.

We analyzed the current scenario of the Jute industry in Bangladesh. Then based on our analysis, we figured out the KPIs regarding why the Jute industry is facing ongoing difficulties. Finally, we pinpointed one of the sectors of the entire Jute supply chain and constituted a theoretical model in order to optimize that part.

Analyzing The Current Situation of The Jute Industry in Bangladesh

In order to figure out the current info on the industry, we have gone through a thorough literature review where we have gone through multiple journals and articles to get a clear idea about the current scenario of the Jute industry. We also have gone through many Government and non-Government online platforms in order to gather necessary information regarding the activities and achievements of the Jute industry of Bangladesh.

Data Collection

We have collected our necessary data and statistical information through many online platforms. We have gone through papers, journals, and articles. These articles documented many statistical records, on the Jute farmers, and the intermediaries and their problems. Most of the data they collected in either questionnaire form or interview. Thus, we have used those data and statistical reports to gather our quantitative information. Most of the data were collected in a secondary way where experiments were conducted mostly in the Faridpur and the Narayanganj districts of Bangladesh. (Moniruzzaman et al., 2008)

Implementation of 5s

After conducting the qualitative data analysis, issues, and challenges in certain areas within the upstream supply chain are noticed. To mitigate this issue, a model was developed using the 5S methodology. '5S' is one of the lean management methodologies that focuses on how a workplace or process should be organized and optimized to increase efficiency, productivity, safety, and overall effectiveness. This method entails the methodical execution of five important steps: sorting, organizing, shining, standardizing, and sustaining. As the upstream supply chain has a huge impact on the final product of jute, a model has been developed using the 5s methodology for the farmers and local traders that will significantly develop the upstream supply chain of jute.

Implementation of Kanban

Following a careful review of the qualitative data, we have pinpointed a number of urgent problems and difficulties. And apart from 5S, a model for applying the Kanban principle has been developed as well. Kanban is a lean management strategy that emphasizes workflow visualization, efficient work-in-progress management, and process optimization to raise overall effectiveness, productivity, and efficiency. The Kanban system will be skillfully staged at the key junctures of the jute supply chain. A Kanban system will be implemented by the intermediaries and the farmers which will play a significant role in optimizing work conditions.

Proposed Plan: Current Scenario and A Brief History of the Jute Industry in Bangladesh

To start off by giving our solutions, let's have a glimpse at the Jute industry of Bangladesh. As it always has been and is still now, jute is the golden fiber of Bangladesh. According to Bangladesh Investment and Authority Board (BIDA), Bangladesh is the second largest Jute producer in the world. According to a survey by the Food and Agricultural Organization(FAO) in 2019, the estimated annual production of jute in Bangladesh was 1.6 million tons. In the fiscal year of 2021, according to a report of TBS, the jute exporting rate of Bangladesh rose to 31% through which Bangladesh earned a total of 166.14 crore USD.(Rahman Toky et al., 2022) Currently, there are around 230 jute mills up and running in Bangladesh which provide breadwinning opportunities to around 100,000 people in Bangladesh. (bida.gov.bd)

The jute industry of Bangladesh has a golden heritage and long history, even before its emergence as a country. The industry started its journey in the 1960s and s1970s when the sector contributed a major segment in the economy of Bangladesh. After the liberation, in 1972, the Government of Bangladesh nationalized all the jute mills in the country, and thus, an official journey of the jute industry began. In 1973, the contribution of the jute industry in the export sector in Bangladesh was 89.9%. However, due to the capital crisis, the Government of Bangladesh soon started the privatization process from 1982 to 1985 when 34 jute mills out of 74 were privatized. (Akter et al., 2020)

This way, the jute industry started to rise in Bangladesh, and soon Bangladesh became one of the top exporters in the global jute market. In 2018, Bangladesh exported the highest amounts of jute in the whole history of the jute industry of Bangladesh where Bangladesh covered 33% of the global jute market and became 2nd highest jute producer right after India. Covering 79% of the market which is specifically 299 thousand tons of jute that have been exported, Bangladesh was its top performer in the field of jute production and manufacturing. (Rahman Toky et al., 2022)

The Supply Chain of The Jute Industry

The basic supply chain of the jute industry starts from the raw materials that are jute, which then goes through the manufacturing segment, where the jute is used in mills in order to manufacture jute-based products, and then finally the jute-based products are distributed among the customers. (Almas Shahriyar Azad et al., n.d.)

Thus the supply chain of the Jute industry will look as the following,

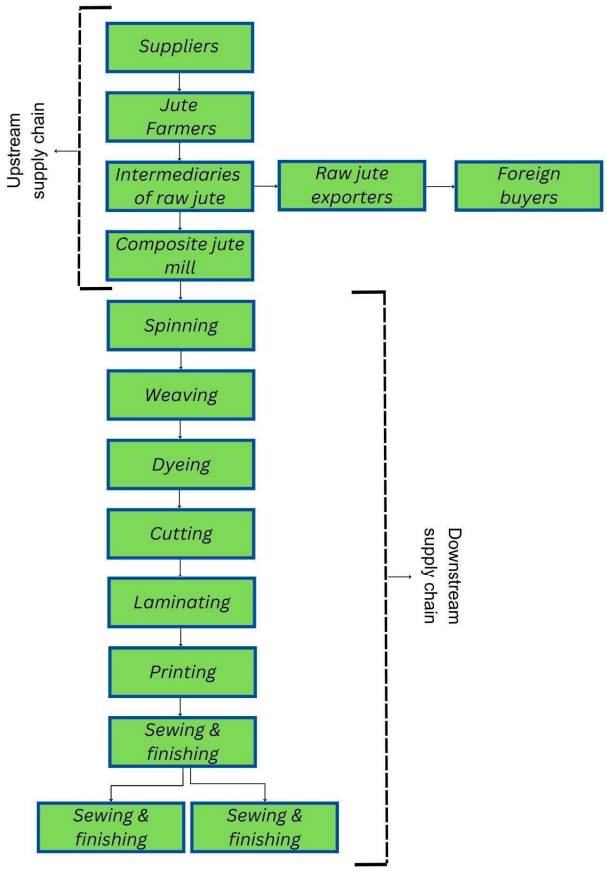


Fig. entire supply chain of the jute industry of Bangladesh, Source: The author

The paper aims to focus on and improve the upstream supply chain of the jute which mostly includes the suppliers and the production sector of Bangladesh. Thus, we will jump onto the upstream supply chain of the jute industry.

The Upstream Supply Chain of Jute

The upstream supply chain of the Jute industry consists of two major segments. The first one is the producer part. This includes the jute farmers who cultivate jute on their land and then preprocess the jute and store it in their houses. And the second segment is the supplier segment which basically includes the intermediaries who collect the raw jute from the farmers and provide it to the jute distributing sector, which is the third segment of the upstream supply chain of the jute industry.

Speaking of intermediaries, there are multiple supplier intermediaries that work between the jute farmer and the jute mills. This makes the upstream supply chain for the jute very complex and large. (A Conceptual Model of Upstream Jute and Jute Diversified Products' Supply Chain Management, n.d.)

There are six different types of intermediaries that work in the jute upstream supply chain. They are briefly discussed below-

Faria

Faria mostly buys unsorted and raw jute directly from the jute farmers. Usually, they buy 10-15 maunds from different farmers and when they gather up around 50 maund of jute they sell to the higher order of the intermediaries. They are usually not professional suppliers and thus they do not have specific inventory or storage to keep the jute. Thus, they supply jute in a small amount for a seasonal profit.

Beparis

This is the second level for the intermediaries. They usually buy jute from the Farias or even from the jute farmers directly. Beparis are more regular than the Farias and they usually have specific storage allocated for jute thus they can supply large amounts of jute to the distributors.

Kutcha Baler

The Kutcha balers process the raw jute based on its color. Technically, they sort out the jute collected from the Beparis and then they loosely press the jute which is also known as 'Kutcha baling'. Afterward, they provide the sorted raw jute to further intermediaries.

Pucca Baler

The Pucca Baler takes the loosely processed jute from the Kutcha baler and then processes the jute more precisely and specifically. Firstly, they get rid of any unnecessary parts of the jute such as roots. Then they press the jute hydraulically. And finally, they get the raw jute ready as commercially graded.

Once the intermediaries are done, then the jute goes to the distributors, the last segment of the upstream supply chain of jute. Usually, the processed jute reaches the Government jute distributors first. However, private mill agents can also take the processed raw jute and provide it to the specific mills they are assigned to. (Almas Shahriyar Azad et al., n.d.)There are multiple upstream supply chain channels of the jute through which the jute proceeds within the intermediaries. The infographics are given below-

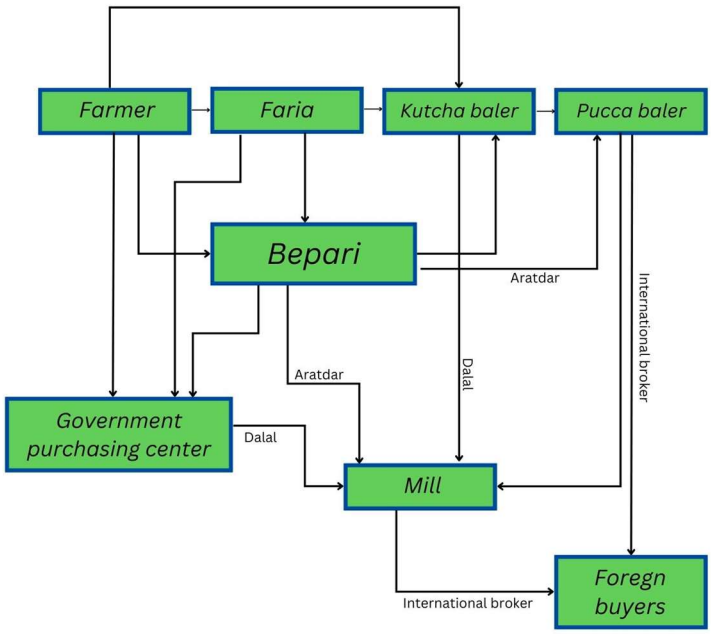
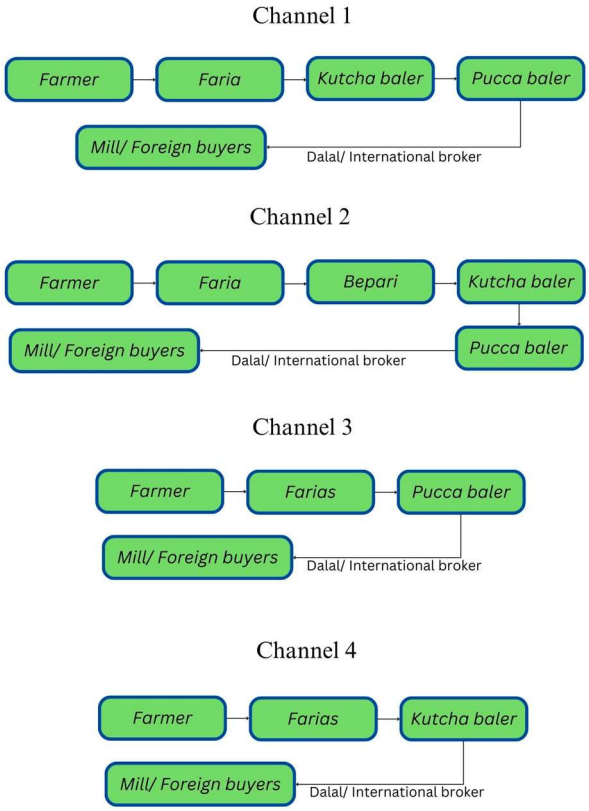

Farmer
Faria
Kutcha baler
Pucca baler
Bepari
Aratdar
International broker
Dalal
Aratdar
Government purchasing center
Dalal
Mill
International broker
Foregn buyers

Fig. General distribution system of the jute supply chain in Bangladesh, Source: The author



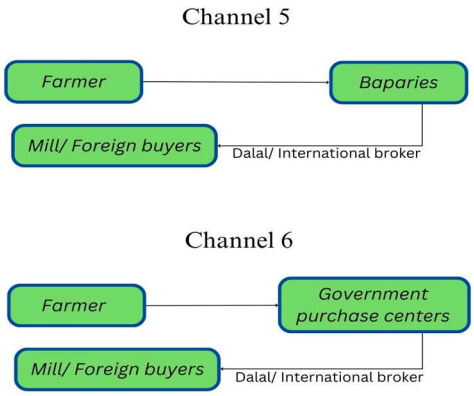


Fig. Variation of distribution channels among the intermediaries, Source: The author

The Problems of The Upstream Supply Chain of Jute

The upstream supply chain of the jute is one complex web of intermediaries, producers, and distributors. As a result, there are certain complications and problems that arise in the upstream supply chain of jute (Almas Shahriyar Azad et al., n.d.) the general problems of the upstream supply chain that we have found-

- Negligence in paying properly to the jute farmers leads to insufficient earnings of the jute farmers.
- High transportation costs in the rural areas of Bangladesh.
- Lack of strong marketing strategy, weak forecasting, and irregular marketing of the jute.
- Lack of scientific knowledge of the farmers regarding the cultivation of jute, leading to reduced efficiency of farmers.
- Lack of transparency and ethical working principle among the distributors as well as the intermediaries increases corruption and development of a syndicate of price hiking.
- Lack of adequate storage facilities
- Lack of water leads to jute retting problems, making the cultivation process lengthy and uncertain.

In this paper, the goal is to implement the 5S methodology as well as the Kanban principles in order to improve the overall productivity of the workers as well as to improve the functionality of the intermediaries as well as the distributors. Thus, we will specifically focus on the inventory and storage problem that can be improved with the help of the lean manufacturing tools mentioned above.

Farmer-Level Problems

Farmers mostly have two types of problems. First of all, the high cost of transportation. And the second one is the storage problem. Most of the farmers and intermediaries reside in the hills and remote areas. And these places do not

have adequate transportation routes. (Sinan Hassan et al., 2022) Usually, farmers do not have any type of storage facility or warehouse to store their cultivated Jutes. As a result, they end up with tons of jute placed in a small place in their house. Since they have to store the jute in the house, they mostly keep the jute along with their household belongings. This makes the storing of jute unorganized. As a result, the farmers then become tense as the jute storage becomes one big mess and thus, it becomes difficult for them to efficiently handle the jute. Thus, they always tend to sell the jute as soon as possible at any rate to the intermediaries and the intermediaries buy the jute at a very cheap and unfair price from the farmers.

Intermediaries Level Problems

The storage issue also rises at the intermediaries level as well. As stated, Farias usually don't have any separate storage area to store the jute they bought from farmers. As a result, they also lack proper inventory management as they keep the jute unorganized. Even if we look further into the Beparis, Kucha baler, or Pucca baler intermediaries, we may not see any pattern or principle of maintaining proper storage or material handling followed. In most cases the Beparis may have separate jute storage, they usually do not have any infographic to assist them. And when it comes to the Kutcha baler and Pucca baler, no specification of the storing area or the sorting area has been seen which usually can lead to a slight delay in the cycle time of the overall processing of the raw jute.

Thus, in a nutshell, the problems of the upstream chain that we are planning to focus on are-

Segments of The Upstream Supply Chain	Problems
Producers(Farmers)	● Lack of separate inventory to store raw jute from the field ● Unorganized storing of Jute in their own residents ● Lack of any database system to keep updated on any real-time information regarding the storing and selling of jute to the intermediaries
Intermediaries(Farias, Beparis, Kucha Baler, Pucca Baler)	● Lack of usage of any inventory management methodology ● No specification or separation of the workplace of the intermediaries

Solution for The Problems

In this paper we are mainly focusing on the inventory related problems that the farmers and the intermediaries face at the upstream supply chain level. As stated in the previous segments, these problems can be solved with the help of the 5S methodology as well as the Kanban principle.

Using The 5S Methodology

As we know, the 5S methodology is a collection of 5 Japanese terms(Seiri, Seiton, Seiso, Seiketsu, Shitsuke) which aims to reduce waste in the manufacturing environment as well as ensure a continual improvement of the quality of the product (Al Amin et al., 2019)

However, this 5S methodology can be applied not only in a manufacturing environment but also in any type of workplace. (Singh Randhawa & Singh Ahuja, 2017) Thus, this 5S methodology can be applied to the workplace of the intermediaries as well as the jute farmers in order to improve their jute storing and management activities.

In order to improve the work environment of the farmers and the intermediaries, we have deduced the following 5S methodology that the farmers can go through-

Seiri (Sort)

Since farmers and Farias store the raw jute in their own houses, they must classify a place for that. They can initially mark up a specific area in their residents where they are going to keep the jute. Then, they must mark and remove any type of objects that are required to keep with the jute in the marked area. This way, the farmers and the Farias can store the jute properly in their own houses, even if they have a very small area to use for. The same thing can be said for other intermediaries such as the Beparis, Kucha Balers, and Pucca Balers. These intermediaries usually have a specific place to store the jute. However, they must mark the storage area and then classify all the objects in the storage area based on their necessity of keeping the storage area. Thus, the objects that are not relatable to keep in the jute storing section must be sorted and then removed from the storing section and kept in a specific place.

In this case, the Red Tag method can be used. In this method, all of the unnecessary objects are labeled with the help of red tags. Finally, all the objects with the red tags are to be gathered in one specific spot. Ultimately, the unrelatable objects are not only getting removed from the storage space but also getting organized and kept aside from the workplace. (Al Amin et al., 2019)

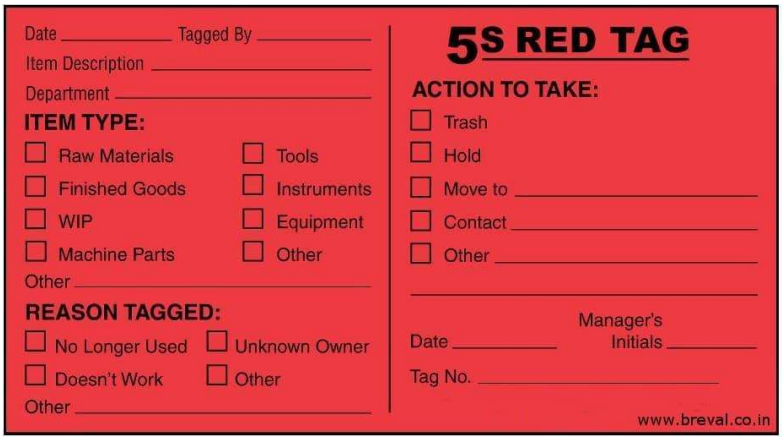


Fig. Reg tag to mark unrelatable objects, Source: The internet

As a result, the jute can be kept in a neat order which will make the farmers and the intermediaries more motivated to work which can increase their productivity. Moreover, since the jute is organized, it will be easier to move along the workplace. Adding to that, the sorting and separation of the unrelatable objects will also make it easier for the farmers and the intermediaries to identify and remove the objects. This will reduce the amount of waste in the workplace as well as the working time as well.

Seiton (Set in Order)

Intermediaries, especially the Kucha Baler and Pucca Baler process the jute and then store it. However, these intermediaries do not specify the areas where they are processing the jute and where they are storing the jute. This often leads the workers into confusion and they often have to check or backtrack whether they are working at the right place or not.

Therefore an order of the work areas can be developed. For this, the labeling or the marking method can be used. The work areas must be separately marked in order to specify which is the sorting place and which is the storing place. In This case, several ways can be used. Such as-

- Using colored paints to mark different workplaces with different colors, can make it easier to identify the separate workplaces
- Using placards with separate naming for the different types of workplaces.
- Re-ordering the work areas in such a way that the workers can work without any backtracking. For instance, the processing and sorting area of the raw jute must be placed before the storing area of the processed jute

In this way, the workplaces for the intermediaries will get arranged thus, it will enable the workers to work efficiently and effectively. Processing and storing of the jute will become smoother. As a result, the overall time cycle of processing and storing jute will reduce.

Fig. Marking and organizing the work areas, Source: The internet

Seiso (Shine)

Keeping the workplace clean plays an important part to provide a moral boost to the workers. The place where the farmers and the intermediaries work. For farmers, in most cases, while gathering and storing the jute, many wastes and filths such as unnecessary jute roots, and not-usable fibers can get into the storing place. Moreover, when the intermediaries process the jute, they often sort the jute based on their quality. Thus, there remains a high chance that most of the waste that is being sorted out at the processing zone can make the place dirty. Besides, over time the workplaces can also get dusty.

Now filths and dust must be dealt with in order to ensure a clean workplace. Otherwise, the workplace may seem congested because of dirt and unnecessary objects and as a result, the workers may feel uncomfortable. This can reduce the productivity of the workers. Moreover, first and filth can also cause health risks for the workers.

Therefore the farmer and the intermediaries must clean their working places. They can clean their workplaces based on a specific cleaning routine. According to the cleaning routine, the workers must swipe the workplace i.e. the sorting place and the storing place at the very beginning of every working day. And once their work is done, they must swipe the place again before leaving the workplace. This way, the filth that came from working will be cleaned and every day the workers can work in a fresh and clean environment. And at the end of every week, a full mopping of the workplace must be done with the help of a mop, brushes, and detergents.

Adding to this, it must be made sure that the workplaces, especially the processing, must have adequate air ventilation systems. This will ensure a clean flow of air for the workers to work. Ultimately, this will make sure that the workplaces are neat and clean and the workers will be able to work with much comfort. As a result, the overall productivity of the farmers as well as the intermediaries will increase which will eventually reduce both waste and delay of time.

Seiketsu (Standardize)

Now the previous 3S that have been implemented, must be standardized so that the workers maintain them on a regular basis. Otherwise, the application of the 5S methodology will not be possible. In order to do so, the Intermediaries and farmers can run their own auditing system. This way, they run weekly, bi-weekly, or monthly inspections of the storing and processing section to check whether the 5S policy is getting maintained. The audit must be conducted to see if the places for storing sorting jute are marked or not, if there are any unnecessary objects in the workplace or not, and if the places are properly cleaned or not. This way, not only the framers and intermediaries will be able to have a real-time update on their working area but also they can check their workplaces and see if any of the 5S's need any modification or not. Based on that they can implement the 5S methodology in a more effective and efficient way. Moreover, audits or inspections will also make the workers under the intermediaries work more sincerely. Thus an efficient working environment will be possible to develop and sustain.

Shitsuke(Sustain)

Maintaining 5S every day can be hectic for the farmers as well as the intermediaries and their workers. They may think that the 5S may just make their everyday work more troublesome. (Al Amin et al., 2019) Therefore, along with audits and inspections, the farmers and the intermediaries must follow up a regular routine of maintaining the 5S methodology. They must take an understanding of how significantly the 5S methodology improves the overall working conditions of both the farmers and the intermediaries. Therefore after every audit, the farmers and the intermediaries

should keep a record of the inspections. Eventually, these records will provide them with real-time info on the productivity of the farmers and the intermediaries, and their workers have increased.

Using The Kanban Databoard

The farmers and the intermediaries can use the Kanban table or the Kanban data board to keep updated about their jute inventory. To do so, the farmers or intermediaries can set up a data table or card known as a Kanban card. In the card, they can store the following information-

- How much jute they have gathered or stored
- How much jute got processed
- Amount of rejected jute and the amount of accepted jute
- How much jute they selling to the distributor or the intermediaries
- How much jute they are planning to sell

Once the card is ready with this information, they can put it up at the workplace or near the storing section where it can be visible. The card must be updated after a certain interval of time.
This way, the farmers can keep information on their regular jute storage.

Based on this principle of Kanban, here is the following model Kanban board the farmers and the intermediaries can maintain in their workplace-

1st Step

Create a Kanban board that will have information mostly of the inventory of the jute. Thus the card can have the following criterion-

1. **Received** - This will define how much raw jute has been received from local farmers.
2. **In stock** - How much jute is currently available in stock will be represented by this.
3. **Sold**- When the jute is sold to buyers, the amount that was sold will be shifted from in stock to sell.
4. **Delivered** - This option will define how much jute has been delivered.

The target of storing this type of information is to set an inventory limit. So as long as the in-stock amount is equal to the inventory limit, no raw jute will be received. As long as the in-stock does not reach the inventory limit, news jute will be received. Thus, it can reduce the overproduction of the jute

2nd Step

Once the first step of deducing the data board is done, we can define the Kanban cards with the following additional information as well-

1. **Jute type**- The type of jute will be specified on each card.
2. **Quality of jute**- The jute quality will be properly mentioned on the cards.
3. **Quantity of jute**- The card will also show the number of jute related to each Kanban card.

With this information stored, the farmers or the intermediaries will be able to check on the quality of the jute, especially the intermediaries who sort out the jute(Pucca Baler and Kutcha Baler). Thus they can have real-time updates on the amount of acceptable jute as well as the amount of rejected jute.

3rd step

Set a reorder point. Reorder point defines the amount of inventory at which a new order should be made to refill stock before it finishes. When the actual inventory level exceeds the reorder mark, a new purchase order is initiated to maintain appropriate stock levels. So for keeping our stock refilled, we need to set a reorder point.

Expected Outcome

The aim of our paper is to reduce unnecessary waste, and time, and ultimately improve the overall productivity of the farmers and the intermediaries. And that is exactly what can be ensured through the 5S and the Kanban model. In a glimpse, the 5S and the Kanban model that have been described earlier are given below-

The 5S Model

Name of The Steps	Activities	Outcomes
Seiri (Sort)	● Mark a specific area to store the jute and also mark the jute processing area ● Use 'red tags' to mark unrelatable objects ● Keep all 'red tagged' unrelatable objects away from the jute storing place as well as the jute processing zone	● Reduces waste in the storage and processing section ● Removal and sorting of unrelatable objects make the movement of the workers and the farmers smooth ● Reduces bottleneck and time for storing and processing jute
Seiton (Set in Order)	● Separately label the processing area, and the processing sector of jute ● Set up a proper order of the jute processing and jute storing sectors	● Makes the workplace organized. ● Sequential layout will reduce backtracking of the workers. ● Work-time will reduce
Seiso (Shine)	● Clean and swipe the workplaces every day before starting the work and after completion of the work ● Ensuring proper air ventilation at the workplaces ● Conduct a monthly cleaning campaign throughout the entire storing place and the jut processing place	● Unnecessary wastes are removed ● Ensures a healthy and safe environment at the workplace for the workers. ● Provides the workers and the farmers a morale boost, which encourages them to work more efficiently
Seiketsu (Standardize)	● Conduct audits and inspections on a regular interval	● Farmers and intermediaries will be able to check

		whether the previous 3S's are being implemented or not ● Inspections and audits can uncover the flaws in their working system and thus will enable them to maintain an optimal jute processing and storing condition
Shitsuke (Sustain)	● Framers and Intermediaries should develop a mentality to accept the 5S ● They have to avoid thinking as a burden	● The significance of using the 5S will get clarified ● The model can be sustained successfully and efficiently

Source: The author

The Kanban Model

Name of Steps	Plans	Outcome
Creation of Kanban board	● Setting different columns for received, in stock, sold and delivered.	● A proper account of raw jute bought from the local farmers, the amount of raw jute in stock, and sold jute to mills. ● Keeping the data altogether in a systematic order so that the whole process flows in the right way.
Defining Kanban cards	● Definition of Kanban cards that hold the info of jute types, quality & quantity.	● Proper information on the type of jute & how much is in stock right now. ● Detailed information on the jute's quality & how much jute needs to be discarded. ● Farmers and intermediaries can keep real-time information on the quality of the jute stored
Setting reorder point	● Setting a reorder point at which a new order will be placed.	● Reorder new stock at the proper time will help to keep the stock refilled all the time. ● Keeps the process flow proper. ● Will prevent the shortage and reduce reorder time ● Optimizes lead time

Source: The author

These are the models that have been developed for the farmers as well as the intermediaries. With these models being followed, the farmers and the intermediaries will be able to mitigate their jute storing problem, and optimize the available inventory for the jute, set up an effective jute handling and maintenance management, thus ultimately leading to reduced lead time at the supplier level, increased productivity of the upstream supply chain of the jute.

Discussion

Both the 5S methodology and the Kanban principle are lean manufacturing tools. Thus, a common practice is to implement these tools in any manufacturing sector. The same can be even done for the jute industry, it is in fact, being implemented in the manufacturing sector of any specific jute products at any jute mill.

As the jute industry's upstream supply chain is now getting hampered because of many reasons & due to several issues, the jute industry's overall profit margin is decreasing, both the Kanban and 5S methodologies can be applied at the upstream supply chain of the jute industry. The aim of these two tools is to help either individually or collectively to organize the workplace, work, and thus remove unnecessary workloads and thus increase efficiency and effectiveness. So by focusing on these two methods of lean manufacturing, the overall process will be beneficial, the farmer's profit margin can be increased, problems amongst the local traders can be solved, etc.

All the papers that have been gone through for literature review mostly focused on implementing the lean manufacturing tools, the 5S, and the Kanban principle in the manufacturing sector for the jute products in the mills and the factories. This improved the overall productivity of the jute mills. However, as many papers suggested, a major portion of the current challenges the jute industry faces is at the production level, which includes the farmers and the intermediaries. They have inventory issues, workplace mismanagement, transportation, and many other issues for which the production of the jute is currently at risk. Thus this paper was aimed at using the same 5S and Kanban principles, but instead of the production sector, they are applied at the supplier level at the upstream supply chain of the jute industry of Bangladesh.

The 5S methodology and the Kanban principle have already been applied at the industry level to reduce waste. Using these tools is neither complex nor costly. Basically, it consists of a set of activities and maintaining those activities by following a routine on a regular basis. The farmers and the intermediaries work hard every day to earn their pay as well as to contribute to the industry. However, they commonly face the complexity of storing Jutes and maintaining a convenient workplace for processing them. The 5S methodology can contribute to their problems in this regard.

Moreover, the farmers and the intermediaries, even though they maintain a record of their everyday jute processing information, they mostly do it in an analytical way. However, with the help of the Kanban principle, they can not only keep the records of the jute processing scientifically and systematically, but it will also enhance their efficiency and effectiveness of working. Which can ultimately reduce waste, lead time, increase the production and ultimately improve the upstream supply chain of the Jute industry.

Limitations and Future Recommendations

The goal of this paper is to optimize the inventory and jute handling management for the farmers and the intermediaries. And in order to do that, separate model routines were made for the framers so that they can implement the 5S and the Kanban principle effectively. And it can be seen that the waste was reduced and the inventory management for the farmers and the intermediaries improved as the 5S methodology enabled them to operate in a systematic way. Adding to that, with the help of the Kanban model as proposed earlier, they will be able to keep real-time qualitative and quantitative information on the stored jute as well as the processed jute.
However, there are certain limitations regarding these models. They are-

- One of the major limitations is regarding the implementation of these models. Since the 5S methodologies and the Kanban principle are lean manufacturing tools and are widely used for manufacturing mills, they are not directly used at the supplier level. As a result, the farmers and the intermediaries are not familiar with these models. Thus there remains a possibility that very few farmers and intermediaries will accept these models and implement them.
- The farmers may consider the 5S methodology and the Kanban principle as an extra workload for their everyday work. In the models proposed, the farmers and the intermediaries have to maintain certain activities in order to optimize their working conditions. Ultimately the models will ease their workload and improve the quality of their work. However, since the farmers are not familiar with these models they may find it hectic even though it is making things easier for them. Thus the farmers and the intermediaries may have a tendency not to follow these models and rather stick to their conventional ways of working.
- The models directly put an impact on inventory management and workplace optimization of the farmers and the intermediaries. The farmers and the intermediaries can reduce waste and improve the management of jute handling. However, the 5S and the Kanban models proposed in this article do not play a direct role in optimizing other problems that the suppliers of the jute usually face such as the transportation problem.
- For developing the model, online data and surveys were focused and only a part of Bangladesh (Faridpur and Narayanganj) was considered for the case study and implementation of the models (Moniruzzaman et al., 2008) These models are made as an ideal. However, based on the regional and geographical diversity the model may not work everywhere in Bangladesh.

5S and Kanban, are two of the most interesting lean manufacturing tools as these tools can be used not only in the production sector but also in any aspect of life. Based on this, in this paper, these principles were applied to the upstream supply chain of the jute industry in Bangladesh. The 5S and the Kanban principle can optimize the inventory management as well as the jute handling of the supplier which can lead to reduced waste to an increase in the earnings of the farmers. Along with some limitations, there are some scopes to work further regarding the models proposed in this article. Such as-

- Only one region of Bangladesh (Faridpur and Narayanganj) was considered for this article and most of the data surveys were taken from the online platform. (Moniruzzaman et al., 2008) Therefore, the models can be updated and modified further so that they can be applied in other regions of Bangladesh where jute is cultivated and distributed through intermediaries.
- The objective of this article was to optimize the inventory management of the framers and the intermediaries so that they can store the jute and process it more efficiently with reduced waste and better and improved working conditions. However, the supplier of jute and the farmers also face many other complexities that hamper the smooth production of jute. Such a problem is the high transportation cost problem. The 5S and the Kanban can also be applied for improving transportation issues as well. Thus, similar to the models

proposed here, models can be developed using the 5S, Kanban, or any other lean manufacturing tools to reduce transportation problems.

- In this article, only the 5S and the Kanban principle were used for optimizing the supply chain of the jute industry of Bangladesh. However, there are many lean manufacturing tools such as SMED, VSM, Poka-yoke, etc are available. They can also be implemented at the supplier level of the jute industry.

Conclusion

Jute has been playing a significant role in the Bangladesh economy & Bangladeshi economy places a high value on the jute supply chain which has several functions in the areas of the economy, society, and the environment. As the upstream supply chain of jute has been facing lots of difficulties, lots of problems amongst the local farmers and traders are occurring. So by using 2 lean manufacturing techniques 5s and kanban, significant changes can be made. Operational effectiveness, quality assurance, and general productivity can be improved with the successful adoption of the 5S approach and Kanban system inside the upstream supply chain of the jute sector in Bangladesh. A properly structured and more streamlined work environment can result through the use of the 5S principles, which stand for Sort, Set in Order, Shine, Standardize, and Sustain. These 5 principles also improve waste reduction, higher safety standards, and better resource allocation.

Simultaneously, real-time visibility into material flows and demand patterns has improved total inventory management since the Kanban system was integrated. The Kanban method can successfully reduce bottlenecks and inventory carrying costs by optimizing inventory levels, promoting a just-in-time approach, and reducing overproduction. This has opened the door for a responsive supply chain to meet changing consumer and market demands. A transformational path towards operational excellence and increased customer satisfaction may be sparked by embracing these ideas as Bangladesh works to maintain its position as a major participant in the global jute industry.

However, it is crucial to recognize that a complete change management plan, focused training, and continual monitoring are necessary for a successful deployment. So an idea was so far placed on how we can significantly improve the upstream supply chain of jute by using 5s and kanban but no physical implications haven't made yet. All the ideas will be physically implemented amongst the local farmers and trades in the future. In conclusion, the introduction of 5S and Kanban techniques into Bangladesh's jute industry's upstream supply chain is a significant development with enormous potential for the sector and the country. The jute sector might reach new levels of competitiveness, sustainability, and resilience in the global market if these principles take root and permeate all aspects of a business.

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