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The Significance of Supply Chain Management in Achieving Efficiency in Apparel Manufacturing

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Abstract

The supply chain's efficiency in apparel manufacturing is paramount for smooth production and fulfilling future demand forecasts. This study elucidates the critical role of a well-managed supply chain in minimizing idle time, streamlining production processes, and optimizing resource allocation, consequently boosting productivity and reducing costs. It identifies several key factors influencing the supply chain, including storage capacity for raw materials, logistics, information flow, lead times, and demand forecasting. The research analyses these elements to achieve a balanced supply chain that effectively manages the material flow and meets future customer demands. An XYZ Jeans Ltd. case study demonstrates how strategic supply chain management can significantly enhance production efficiency and cost-effectiveness. The findings underscore the necessity of a robust supply chain in driving productivity gains, cost savings, and sustainable business growth, offering actionable insights for improving supply chain operations in the textile industry.

Keywords: Resource management Demand forecasting Apparel manufacturing, Efficiency optimization

1. Introduction

The supply chain acts as a critical network connecting a company with its suppliers to ensure the production and distribution of specific products are conducted efficiently. This network encompasses vital functions such as purchasing, operations, logistics, resource management, and the flow of information [1]. These components facilitate the movement of goods, data, services, and raw materials from inception to delivery, ultimately enhancing customer service and satisfaction. Effective supply chain management allows for the optimization of storage capacity, improvement of logistics systems, and enhancement of communication networks, paving the way for an upgraded procurement supply chain [2]. By aligning customer demand forecasts with precise operation plans, companies can maximize production output, manage emergency materials and components, and successfully maintain smooth production processes to meet future customer demands [3,4].

RESEARCH OBJECTIVES

1. To minimise idle time, reduce production complications, and cut costs.

2. To enhance the overall productivity and efficiency of the manufacturing process.

3. To effectively meet future customer demands with ease.

4. To ensure a consistent flow of resources, thereby facilitating uninterrupted production.

5. To optimise resource allocation and minimise waste, ensuring timely delivery of products and services.

6. To achieve an efficient and cost-effective production model.

2. Methods

The approach utilises solid supply chain management to align resource distribution with production needs, facilitating seamless operations. This strategy supports the company's long-term objectives for growth and development by ensuring efficient resource use and production continuity. Specifically, it focuses on the garment industry, where an effective supply chain is crucial for improving production efficiency and ensuring timely delivery. The approach includes controlling planning and scheduling for future orders, emphasising the importance of a well-orchestrated supply chain in meeting customer demands and enhancing company productivity.

Operation Planning

Plan Efficiency

To express planned efficiency in a manufacturing context, one calculates it by multiplying the total expected monthly production by the average Standard Minute Value (SMV). This product is then divided by the combined total of workers, multiplied by the number of working days, the hours planned for work each day, and 60 (to change hours to minutes). The result of this division is then multiplied by 100 to convert the figure into a percentage, representing the planned efficiency rate. The formula encapsulates how effectively resources are projected to be utilised in manufacturing, aiming to quantify efficiency in terms of output per unit of input within a given timeframe [5].

XYZ Jeans Ltd is an apparel manufacturing company, and here is an example of its monthly sewing production plan.

This RMG company has a total number of sewing workforce of 2000

January-2024 allocated orders average sewing SMV = 37.6 min

Plan working hour/day = 10 hours

Plan working day = 27 day

So, plan efficiency =

$$= \frac{\text{monthly plan production} * \text{Avg. SMV}}{\text{total worker} * \text{working day} * \text{plan working hour} * 60} \times 100$$

$$= \frac{720000 * 37.6}{2000 * 27 * 10 * 60} \times 100$$

= 83.6 %

The calculation of planned efficiency within the manufacturing context, particularly for XYZ Jeans Ltd, is a practical example of how manufacturing operations can quantify and project their efficiency levels. By applying a formula that incorporates the total expected monthly production, the average Standard Minute Value (SMV), the number of workers, working days, and planned working hours, XYZ Jeans Ltd has achieved a planned efficiency rate of 83.6%. This percentage reflects the company's anticipated effective use of resources, aiming to optimise output per unit of input over the specified timeframe. Such a calculation is not just a measure of productivity; it is a strategic tool that helps in planning, resource allocation, and identifying areas for improvement in the manufacturing process. The case of XYZ Jeans Ltd underscores the importance of meticulous planning and efficiency quantification in enhancing the overall productivity and competitiveness in the apparel manufacturing sector.

Table 1. Monthly sewing load January 2024

Buyer	PO	Style	Colour	Order Qty (pcs)	Plan hours	Plan efficiency,%	Sewing SMV
Buyer 1	402503	Basic man's shirt	Black	50000	10	83.6	17.2
Buyer 1	402505	Basic man's shirt	Black	60000	10	83.6	18.3
Buyer 1	402507	Basic cargo pant	Blue	40000	10	83.6	38.4
Buyer 1	402508	Basic cargo pant	Blue	35000	10	83.6	37.6
Buyer 1	402517	Padding jacket	Black	35000	10	83.6	54.6
Buyer 1	402515	Padding jacket	Black	60000	10	83.6	55.2
Buyer 1	402527	Padding jacket	Black	50000	10	83.6	54.5
Buyer 2	708502	Combat jacket	Blue	40000	10	83.6	46.4
Buyer 2	708503	Combat jacket	Blue	50000	10	83.6	45.5
Buyer 2	708509	5-pocket jeans pant	Black	50000	10	83.6	17.4
Buyer 2	708511	5-pocket jeans pant	Black	30000	10	83.6	17.4
Buyer 3	103520	Combat jacket	Black	30000	10	83.6	48.4
Buyer 3	103518	Combat jacket	Black	20000	10	83.6	48.5
Buyer 3	103505	5 pocket jeans pant	Blue	40000	10	83.6	21.2
Buyer 3	103504	5 pocket jeans pant	Blue	45000	10	83.6	21.4
Buyer 3	103531	Tangle cargo pant	Black	45000	10	83.6	48.5
Buyer 3	103532	Tangle cargo pant	Black	40000	10	83.6	47.2
Grand Total				720000		Average SMV	37.6

Material supply chain program of this operation plan

In the ready-made garment (RMG) sector, specifically for denim wash garments, it is critical to adhere to a Standard Operating Process (SOP) that mandates acquiring all raw materials at least 35 days before the scheduled shipment [6-8]. This requirement ensures that denim wash products can be shipped out on time. The material supply chain plays a pivotal role in maintaining the order of production sequences and guaranteeing timely delivery to customers [9]. Consequently, collecting materials is crucial in successfully executing a monthly production plan. XYZ Jeans Ltd provides an example of how efficiently managing monthly fabric and accessory procurement data can contribute significantly to meeting these production and delivery targets.

Table 2. Monthly fabric & accessories balance summary, January 2024

Order No.	Style	Order qty, O	Fabric Receive Balance (meter)	Average Consumption (meter), C	Possible to produce PCs, P = (R/C)	Balance Pcs, B = (O-P)
402503	Basic man's shirt	50000	0	1.15	50000	0
402505	Basic man's shirt	60000	-40000	1.15	27017	-32983
402507	Basic cargo pant	40000	-43860	1.55	12903	-27097
402508	Basic cargo pant	35000	-35878	1.55	12903	-22097
402517	Padding jacket	35000	-20298	1.95	25641	-9359
402515	Padding jacket	60000	-80510	1.95	20513	-39487
402527	Padding jacket	50000	-60425	1.95	20513	-29487
708502	Basic combat jacket	40000	0	1.55	40000	0
708503	Basic combat jacket	50000	0	1.55	50000	0
708509	5-pocket jeans pant	50000	0	1.15	50000	0
708511	5-pocket jeans pant	30000	-17080	1.2	16667	-13333
103520	Combat jacket	30000	0	1.6	30000	0
103518	Combat jacket	20000	-22960	1.6	6250	-13750
103505	5 pocket jeans pant	40000	0	1.2	40000	0
103504	5 pocket jeans pant	45000	-35620	1.2	16667	-28333
103531	Tangle cargo pant	45000	0	1.65	45000	0
103532	Tangle cargo pant	40000	0	1.65	40000	0
	Total	**720000**	**-356631**	**1.5**		

Table 2, from XYZ Jeans Ltd., outlines the monthly fabric and accessories balance summary for January 2024. It lists various garments, detailing order quantities, fabric booking and receipt quantities, average consumption per piece, possible production pieces based on fabric received, and the balance between the order and possible production.

From the table, all orders have received more fabric than booked except for two styles, which have a negative fabric receipt balance, indicating a shortfall. The average consumption rate varies by item but is around 1.5 meters per piece. The possible production pieces are calculated based on the fabric receipt quantity divided by the average consumption. In several cases, there are significant deficits in the number of pieces that can be produced versus the order quantity [9]. This indicates that inefficiencies or problems within the supply chain for materials need to be resolved. Accessories status is marked chiefly as 'ok', except for two styles with balance issues with care labels and sewing threads.

The material supply chain program at XYZ Jeans Ltd is facing challenges with certain styles where there is a deficit of fabric, impacting the potential production volume. For an efficient supply chain, it is crucial to ensure that fabric and accessories are received in full and on time to meet production targets [10]. Production cannot proceed as planned for some styles due to these shortages. Immediate attention to the supply chain process is needed to resolve these discrepancies, prevent production delays, and fulfil order commitments.

Supply chain impact

The improper balancing of the material supply chain in January 2024 has resulted in a noticeable impact on productivity and the cost of making (CM) for XYZ Jeans Ltd. With a calculated productivity rate of 0.586, equivalent to 58.6%, the company's efficiency in utilizing its resources for production fell short of optimal levels. This decrease in efficiency can be attributed to the Imbalance in the supply chain, which hindered the timely acquisition of materials needed for production. Consequently, the cost of making (CM) also experienced a significant increase, reaching approximately 64.17 times the average annual cost per minute (CPM). This substantial rise in the cost of making underscores the financial implications of supply chain inefficiencies. It highlights the importance of implementing measures to address material shortages and improve supply chain management practices. By rectifying these imbalances, XYZ Jeans Ltd can enhance productivity, reduce costs, and improve its market competitiveness.

3. Results and Discussion

Plan Efficiency

In January 2024, XYZ Jeans Ltd, a ready-made garment (RMG) company with a sewing workforce of 2000 employees, allocated orders with an average sewing Standard Minute Value (SMV) of 37.6 minutes. The planned working schedule for the month included 10-hour workdays over 27 days.

Utilising the formula for calculating plan efficiency, which considers the monthly planned production, average SMV, total number of workers, working days, and planned working hours, XYZ Jeans Ltd achieved a plan efficiency rating of 83.6%. This percentage reflects the company's effectiveness in utilising its sewing workforce and production resources to meet the planned production targets for the month [11-13].

However, while the plan efficiency indicates a relatively high level of productivity, it is essential to note that other factors, such as material shortages and supply chain imbalances, can impact the overall operational efficiency and ability to fulfil customer demand [14]. Therefore, while plan efficiency provides valuable insight into the productivity of sewing operations, it should be considered alongside other operational metrics to comprehensively assess manufacturing performance and identify areas for improvement.

Material supply chain for operation plan

Now, according to fabric received data from January 2024,

Possible to produce garments

$$= \frac{\text{monthly total fabric receive qty (meter)}}{\text{Avg fabric consumption (meter)}}$$

$$= \frac{756543}{1.5}$$

= 504362 pcs

Fabric balance = (720000-504362) pcs = 215638 pcs

Based on the fabric receipt data for January 2024, the analysis reveals that XYZ Jeans Ltd has received a total of 756,543 meters of fabric. Utilising the formula for determining the possible number of garments to produce, considering an average fabric consumption rate of 1.5 meters per garment, the calculation yields an estimated production capacity of 504,362 pieces.

However, upon comparing this potential production capacity with the total customer demand for the month, which stands at 720,000 pieces, it becomes apparent that there is a significant deficit. The fabric balance, calculated as the variance between the total customer demand and the possible production capacity, amounts to 215,638 pieces. The gap points to a material shortage, suggesting inefficiencies or imbalances in managing the supply chain for materials [15].

Moreover, the fabric shortage is compounded by discrepancies in the receipt balance of sewing and finishing accessories. These factors collectively contribute to the conclusion that XYZ Jeans Ltd faces challenges meeting the minimum customer demand for January 2024.

The results underscore the critical importance of effective material supply chain management in manufacturing. The fabric and accessory materials shortage impedes production capacity and poses risks to meeting customer demand. Addressing material shortages and supply chain imbalances is imperative to ensure operational efficiency and promptly fulfil customer orders [16-17].

Supply Chain Impact

Improper balancing of material supply chain,

January 2024, productivity

$$= \frac{\text{output}}{\text{input}}$$

$$= \frac{\text{monthly execute production} * \text{Average SMV}}{\text{monthly total working minute}}$$

$$= \frac{\text{monthly execute production} * \text{Avg. SMV}}{\text{total worker} * \text{working day} * \text{plan working hour} * 60}$$

$$= \frac{504362 * 37.6}{2000 * 27 * 10 * 60}$$

= 0.586

So, Efficiency = productivity * 100

= 0.586 * 100

= 58.6%

CM (cost of making) = $\frac{\text{CPM} * \text{SMV}}{\text{productivity}}$

let, average annual CPM (cost per minute) = $1

$$= \frac{1 * 37.6}{0.586}$$

= $64.17

Proper balancing of material supply chain,

January 2024 possible productivity = $\frac{\text{output}}{\text{input}}$

$$= \frac{\text{monthly execute production} * \text{Avg. SMV}}{\text{total worker} * \text{working day} * \text{plan working hour} * 60}$$

$$= \frac{720000 * 37.6}{2000 * 27 * 10 * 60}$$

= 0.836

So, Efficiency = productivity * 100

= 0.836 * 100

= 83.6%

CM (cost of making) = $\frac{\text{CPM} * \text{SMV}}{\text{productivity}}$

Let, CPM = $1

$$= \frac{1*37.6}{0.836}$$

$$= \$44.98$$

Here cost reduce on per pcs garments = (64.17– 44.98)

= $19.19

So, cost reduction% = $\frac{19.19\text{ x}}{64.17\text{ x}} * 100$

= 30%

Improper Balancing of Material Supply Chain

In January 2024, the improper balancing of the material supply chain at XYZ Jeans Ltd resulted in a productivity rate of 0.586, equivalent to an efficiency of 58.6%. This inefficiency stemmed from challenges such as delays and shortages in material acquisition, impacting the company's production capabilities. Consequently, the cost of making (CM) soared to approximately 64.17 times the average annual cost per minute (CPM), signifying the financial implications of supply chain inefficiencies.

Proper Balancing of Material Supply Chain

In contrast, with a properly balanced material supply chain, XYZ Jeans Ltd could achieve a significantly higher productivity rate of 0.836, corresponding to an efficiency of 83.6%. This productivity improvement demonstrates the company's enhanced ability to utilise its resources effectively for production. As a result, the cost of making (CM) decreased to approximately 44.98 times the average annual cost per minute (CPM), substantially reducing production costs.

Furthermore, the reduction in the cost of making per garment amounted to approximately 30%. This significant cost reduction underscores the positive impact of maintaining a well-balanced material supply chain on overall production costs and profitability. By addressing supply chain inefficiencies and ensuring proper balance, XYZ Jeans Ltd can optimise its operational efficiency, reduce production costs, and enhance competitiveness in the market.

Achievement based on improper supply chain and good supply chain method (January 2024)

Table 3, focuses on the impact of the supply chain method on various performance metrics. The data suggests that XYZ Jeans Ltd should commit to maintaining or improving supply chain practices that align with the "Good supply chain" method, as it results in better productivity, efficiency, and financial outcomes.

Table 3. Monthly achievement status Jan-2024 based on supply chain method

SL No.	Supply chain method	Monthly plan (pcs)	Possible to production (pcs)	Balance (pcs)	Productivity	Efficiency%	CM (cost of making), $	Outcomes
1	Imbalance supply chain	720000	504362	-215638	0.586	58.60%	64.17	High cost & low achievement
2	Good supply chain	720000	720000	0	0.836	83.60%	44.98	Low cost & high achievement

Table 3, compares two methods: an imbalanced supply chain and a good supply chain. Both methods had the same planned production amount of 720,000 pieces. Only 504,362 pieces could be produced with the imbalanced supply chain, whereas the entire planned amount could be produced with the excellent supply chain. The imbalanced supply chain resulted in a negative balance of -215,638 pieces, meaning the company could not meet its planned production by this amount. The excellent supply chain had a balance of 0 pieces, indicating that production met the plan exactly.

Figure1. Comparison between Improper supply chain and Good supply chain method

Figure 1, shows that productivity is significantly higher with a good supply chain (0.836) than an imbalanced supply chain (0.586). This metric likely represents the ratio of actual production to possible production, indicating resource and time efficiency. The efficiency with the imbalanced supply chain was 58.6%, while with the excellent supply chain, it was much higher at 83.6%. Efficiency here might reflect the ratio of output produced to input used, suggesting a good supply chain is more efficient. The cost of making with the imbalanced supply chain was higher at $64.17 per piece, while it was lower at $44.98 with the excellent supply chain. With the imbalanced supply chain, the outcome was high cost & low achievement, likely referring to the higher cost of production and failure to meet the production targets. With a good supply chain, the outcome was low cost & high achievement, meaning the company could produce at a lower cost while meeting its production targets [18].

Statistical analysis for January 2024

The data for patterns, differences, and relationships between the two supply chain methods are examined to perform a statistical analysis of Table 3. Emphasis was placed on the dataset's descriptive statistics and the inferences drawn from them during the analysis.

Descriptive Analysis

Monthly plan (pcs):

-Mean: Both supply chain methods have the same planned production, so the mean is 720,000 pieces for both.

Possible to production (pcs):

- Mean: (504,362 + 720,000) / 2 = 612,181 pieces.
- Range: 720,000 - 504,362 = 215,638 pieces.

The imbalanced supply chain has significantly lower possible production of 70% (504,362/720,000) of the planned production.

Balance (pcs):

- Mean: (-215,638 + 0) / 2 = -107,819 pieces.
- Range: 0 - (-215,638) = 215,638 pieces.
- Variance: The variance here is significant, with the imbalanced method showing a substantial negative balance.

Table 4. Monthly achievement status (July 2023 to January 2024) based on supply chain method

Months	Supply chain method	Monthly plan (pcs)	Actual production (pcs)	Balance, (pcs)	Productivity	Efficiency%	CM (cost of making),$
July, 2023	Imbalance supply chain	810000	624362	-185638	0.72	72.00%	52.22
	Good supply chain	810000	805070	-4930	0.93	93.00%	40
August, 2023	Imbalance supply chain	790000	600002	-189998	0.69	69.00%	54.4
	Good supply chain	790000	770800	-19200	0.89	89.00%	42.24
September, 2023	Imbalance supply chain	740000	560040	-179960	0.65	65.00%	57.85
	Good supply chain	740000	720300	-19700	0.84	84.00%	44.76
October, 2023	Imbalance supply chain	710000	538910	-171090	0.63	63.00%	59.69
	Good supply chain	710000	700543	-9457	0.81	81.00%	46.42
November, 2023	Imbalance supply chain	705000	529810	-175190	0.61	61.00%	61.64
	Good supply chain	705000	705000	0	0.82	82.00%	45.85
December, 2023	Imbalance supply chain	690000	500526	-189474	0.58	58.00%	64.82
	Good supply chain	690000	680700	-9300	0.79	79.00%	47.6
January, 2024	Imbalance supply chain	720000	504362	-215638	0.58	58.00%	64.17
	Good supply chain	720000	720000	0	0.83	83.00%	44.98

Productivity:

- Mean: (0.586 + 0.836) / 2 = 0.711.

- Range: 0.836 - 0.586 = 0.25.

- The good supply chain method has approximately 143% (0.836/0.586) of the productivity of the imbalanced method.

Efficiency (%):

- Mean: (58.6 + 83.6) / 2 = 71.1%.

- Range: 83.6% - 58.6% = 25%.

- The good supply chain method is approximately 142% (83.6/58.6) as efficient as the imbalanced method.

CM (Cost of Making):

The excellent supply chain has a cost of making that is approximately 70% (44.98/64.17) of the imbalanced supply chain.

Correlation Analysis

There appears to be a negative correlation between the balance and the cost of making; as the balance becomes less damaging (better), the cost of making decreases. There is also likely a positive correlation between productivity and efficiency with the cost of making; as productivity and efficiency increase, the cost of making decreases [19]. The excellent supply chain method is associated with higher productivity, higher efficiency, a balanced production plan, and lower costs. The imbalanced supply chain method leads to a shortfall, lower productivity and efficiency, and higher costs [20].

Table 4, compares manufacturing metrics across different months, precisely scenarios with a 'Good supply chain' versus an 'Imbalanced supply chain'. Data is provided for the second half of 2023 and the beginning of January 2024. Each month has two entries, one for 'Imbalance supply chain' and one for 'Good supply chain'. This suggests that the metrics used to evaluate performance differ under these two scenarios. Under 'Good supply chain' conditions, the actual production is closer to or matches the monthly plan, while under 'Imbalance supply chain', there's a significant shortfall. It represents the discrepancy between the intended monthly production plan and the output achieved. Positive numbers would indicate overproduction and negative numbers indicate a shortfall. Large negative balances exist in all 'Imbalance' rows, while the 'Good' rows are either very close to the plan or spot on. This metric seems to reflect the ratio of actual production to the monthly plan. In 'Good supply chain' scenarios, productivity is consistently higher than in 'Imbalance' scenarios [21]. Operational efficiency appears to be linked to the condition of the supply chain. In scenarios with a 'Good supply chain', efficiency is notably higher, reflecting a more streamlined operation. Conversely, when faced with 'Imbalanced supply chain' scenarios, the cost increase suggests inefficiencies, diminished productivity, and production shortfalls [22].

Some key observations:

- There is a clear pattern that efficiency, productivity, and the balance between planned and actual production are better when the supply chain is good.

- Costs are generally lower when the supply chain is good, except for July, when the cost is slightly higher despite the excellent supply chain.

- The best month for efficiency is January 2024 under a good supply chain, with an 83% efficiency rate.

- The worst month for balance PCs is August 2023, under an imbalanced supply chain, with a shortfall of -189998 pieces.

- The cost of making tends to increase as productivity and efficiency decrease.

t-test

The independent two-sample t-test was performed to compare the mean productivity between the Good and Imbalance supply chains. The results are as follows:

- The t-statistic value is approximately 7.56, which measures the size of the difference relative to the variation in the sample data.

- The p-value is approximately \(6.66 \times 10×{-6}\), significantly less than the standard alpha level of 0.05.

With such a small p-value, we can reject the null hypothesis that there is no difference in mean productivity between the Good and Imbalance supply chain conditions. This suggests a statistically significant difference in productivity, with the Good supply chain likely having a higher mean productivity than the Imbalance supply chain.

ANOVA Test

The ANOVA (Analysis of Variance) test was performed to determine if there is a statistically significant difference in productivity based on the supply chain method (Good vs. Imbalance). The results are as follows:

- The between-groups sum of squares (sum_sq) is approximately 0.150, with 1 degree of freedom.

- The within-groups sum of squares (residual) is approximately 0.032, with 12 degrees of freedom.

- The F-statistic value is approximately 57.18, which measures the variance ratio between the groups to the variance within the groups.

- The p-value (PR(>F)) is very small (0.000007), much less than 0.05, which is typically the threshold for significance.

This low p-value indicates a statistically significant difference in productivity between the Good and Imbalance supply chain methods. With such a significant result, we can reject the null hypothesis that there is no difference in productivity between the two supply chain conditions, concluding that the supply chain management method significantly impacts productivity [23].

Regression Analysis

The regression analysis of the data focusing on the 'Efficiency' as the dependent variable yields the following results:

- The R-squared value is 0.986, suggesting that the model explains 98.6% of the variability in the efficiency of the production process, which is a very high degree of explanation.

- The adjusted R-squared value is 0.983, which considers the number of predictors in the model and is also very high, indicating a good fit.

- The F-statistic is 379.1 with a very small p-value (Prob (F-statistic) = 7.15e-11), which provides strong evidence against the null hypothesis that the model with no predictors would explain as much variability in efficiency as the proposed model.

The coefficients for the model are as follows:

- Constant (intercept): -15.9828 with a p-value of 0.049, indicating it is statistically significant at the 5% significance level.

- Monthly Plan: 0.0001 with a p-value close to 0, indicating that for every unit increase in the monthly plan, the efficiency increases by 0.0001%, assuming the supply chain condition remains constant.

- Supply Chain Binary (Good supply chain = 1, Imbalance = 0): 20.7143 with a p-value close to 0, indicating that switching from an imbalanced to a good supply chain, on average, increases efficiency by 20.71%.

The Prob (Omnibus) is 0.011, which is low and indicates the residuals are not normally distributed, which violates one of the OLS assumptions. The skewness and kurtosis values, along with the Jarque-Bera test, also suggest that the residuals do not follow a normal distribution [24].

Overall, the model suggests that the supply chain status (good vs. Imbalance) is a significant predictor of efficiency in the production process.

Conclusion

The article emphasises the importance of efficient supply chain management in the apparel manufacturing sector, focusing on XYZ Jeans Ltd. It outlines how strategic supply chain management enhances production efficiency, optimises resource utilisation, and reduces costs, significantly impacting productivity and competitiveness. The study showcases the impact of supply chain imbalances on productivity rates and cost, illustrating the financial implications and the necessity for a well-balanced supply chain. It concludes that proper supply chain management is essential for meeting customer demands, reducing production costs, and ensuring sustainable business growth. The findings advocate for the continuous improvement of supply chain operations to achieve significant cost reductions and efficiency gains.

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