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Abstract

The pharmaceutical industry, particularly in animal health, faces challenges in optimizing production processes to improve efficiency and reduce costs while maintaining product quality and safety standards. This study focuses on addressing a bottleneck in the production line of a local pharmaceutical company, specifically in the manual secondary packaging stage. Four operators are employed to pack blisters into sleeves, leading to inefficiencies, higher labor costs, and potential errors. To overcome this challenge, the company aims to integrate the BIB-BOB machine, which offers a significantly higher output rate of 150 blisters per minute (bpm). However, before implementing this automation solution, a comprehensive cost analysis is imperative to evaluate its financial viability, considering factors such as initial investment, operational costs, labor savings, and productivity gains. The objective is to optimize the packing line to enhance efficiency, reduce costs, and improve overall profitability, all while upholding the quality and safety standards of the packaged medicines.

Key terms – Automation, Efficiency, ROI and Pharmaceutical packaging process.

Introduction

The local pharmaceutical company faces a bottleneck in its production line due to the manual secondary packaging stage, where four operators are employed to pack blisters into sleeves. This manual process not only hampers production efficiency but also incurs higher labor costs and introduces the risk of errors. To address this challenge, the company aims to integrate the BIB-BOB machine, boasting 150 blisters per minute (bpm) output rate, which could double the current packing speed. However, before proceeding with this automation solution, a comprehensive cost analysis is necessary to evaluate its financial viability, considering factors such as initial investment, operational costs, labor savings, and productivity gains. The objective is to optimize the packing line to improve efficiency, reduce costs, and enhance overall profitability while maintaining the quality and safety standards of the packaged medicines.

Background

The pharmaceutical company under study operates in the animal health industry, producing medications such as NexGard against fleas and ticks, and Heartgard against the potentially fatal heartworm disease in pets. This study focuses on optimizing the primary packaging process of Heartgard, a crucial step to ensure the quality and safety of the medication. Currently, the process involves a weight control machine, a blister packaging machine, and four operators who manually handle the blisters by filling them and preparing them for transportation. This manual handling introduces inefficiencies, labor costs, and risks of human error. To optimize through automation, the company is considering investing \$650,800 in a Universal BIB-BOB system as shown in the figure below, visualization tools, spare parts, documentation, conveyors, additional stations, software, installation, and packaging. Although a significant investment, it could increase production speed, reduce labor costs, and minimize errors, improving operational efficiency and long-term competitiveness.



Problem

The local pharmaceutical company faces a bottleneck in its production line due to the manual secondary packaging stage, where four operators are employed to pack blisters into sleeves. This manual process not only hampers production efficiency but also incurs higher labor costs and introduces the risk of errors. To address this challenge, the company aims to integrate the BIB-BOB machine, boasting 150 blisters per minute (bpm) output rate, which could double the current packing speed. However, before proceeding with this automation solution, a comprehensive cost analysis is necessary to evaluate its financial viability, considering factors such as initial investment, operational costs, labor savings, and productivity gains. The objective is to optimize the packing line to improve efficiency, reduce costs, and enhance overall profitability while maintaining the quality and safety standards of the packaged medicines.

Methodology

This study adopts a quantitative approach to evaluate the integration of the BIB-BOB machine into pharmaceutical packaging processes, focusing on key performance metrics, including production output, labor costs, savings per phase, operational costs, initial cost/investment of the BIB-BOB, and return on investment (ROI). The methodology emphasizes collecting, analyzing, and interpreting numerical data to assess automation adoption's financial viability and operational implications.

Quantitative data will be collected from various sources to provide insights into the performance of manual and automated packaging lines. Production output data will be obtained from production logs or databases detailing the quantity of products packaged within a specific time frame. Labor costs will be extracted from payroll records or accounting systems, encompassing expenses related to personnel involved in packaging operations. Savings per phase will be calculated based on reductions in labor costs, error rates, and other operational expenses achieved through automation adoption.

Operational costs, including maintenance expenses, utilities usage, and consumable supplies, will be obtained from financial records or expense reports. The initial cost/investment of the BIB-BOB machine will be determined based on procurement costs, installation fees, and any additional expenses incurred during the setup process.

Quantitative data will be analyzed using statistical techniques to derive meaningful insights and conclusions. Descriptive statistics, such as means, standard deviations, and percentages, will be calculated to summarize the performance metrics for manual and automated packaging processes. Hypothesis testing will determine the significance of differences between the two methods regarding production output, labor costs, savings per phase, operational costs, and ROI.

Regression analysis may be employed to identify relationships between variables and predict the impact of automation adoption on key performance indicators. ROI analysis will be conducted to evaluate the financial benefits of automation integration, comparing the initial investment with the savings achieved over a specified period.

The quantitative methodology outlined in this study provides a comprehensive approach to assess the integration of the BIB-BOB machine into pharmaceutical packaging processes. By leveraging numerical data sources and employing rigorous statistical analysis techniques, this approach aims to provide actionable insights into automation adoption's financial and operational implications, ultimately informing decision-making and optimization strategies in pharmaceutical manufacturing.

Results and Discussion

In this study, we conducted a comprehensive analysis to assess the impact of implementing the BIB-BOB machine on a manufacturing facility's production efficiency and financial performance. Our evaluation considered various factors, including production output, labor costs, savings per phase, operational costs, and return on investment (ROI).

Table 2
Specs Before the Installation of the BIB-BOB

Operators	4	Mechanic	1
Salary for operators yearly	\$70,000	Salary for mechanics yearly	\$75,000
Total Salary Cost	\$280,000	Mechanical Cost	\$75,000
Total Salary Cost \$355,000			
Production of Blisters per Minuto 80			
Production of Blisters Yearly ≈ 230,000			
Production Cost ≈ \$34,500			

Regarding the impact on the production output, Before the BIB-BOB machine installation, the factory's production rate was 80 blisters per minute, resulting in an estimated yearly production of approximately 230,000 blisters. Following the installation, the production rate surged to 150 blisters per minute, indicating a remarkable increase in production output. Consequently, the yearly production escalated to approximately 450,000 blisters. This enhancement underscores the significant contribution of the BIB-BOB machine to augment production capacity.

Implementing the BIB-BOB machine resulted in a notable reduction in labor costs. Before its installation, the factory employed four operators and one mechanic, incurring a yearly salary of \$355,000 for operators and \$75,000 for the mechanic. The number of required operators decreased to 1 post-installation, while the mechanic's position remained unchanged. Thus, the total yearly salary cost diminished to \$145,000, leading to substantial savings in labor costs. The calculated savings amounted to \$210,000 annually, underscoring the efficiency gains of optimized workforce utilization.

Table 3
Specs After the Installation on the BIB-BOB

Operators	1	Mechanic	1
Salary for operators yearly	\$70,000	Salary for mechanics yearly	\$75,000
Total Salary Cost	\$70,000	Mechanical Cost	\$75,000
Total Salary Cost \$145,000			
Production of Blisters per Minuto 150			
Production of Blisters Yearly ≈ 450,000			
Production Cost ≈ \$67,500			

Although implementing the BIB-BOB machine incurred increased operational costs attributable to higher production volumes, the net financial impact remained positive. The escalated production costs were offset by the substantial savings in labor costs, resulting in a net profit of \$177,000 annually. This demonstrates the machine's efficacy in enhancing operational efficiency and driving financial performance.

Return on Investment (ROI)

The return on investment (ROI) for installing the BIB-BOB machine was calculated to be approximately 27.2%. This indicates that for every dollar invested in the machine, the company can expect to receive approximately \$0.272 in net profit annually.

Considering the net profit of \$177,000 annually and given the total investment of \$650,800.00

Time to Recoup Investment = $(\$650,800.00)/(\$177,000) \approx 3.68$ years

This indicates that the initial investment in the BIB-BOB machine will be recovered within approximately 3.68 years, as reflected in Table 3. Consequently, the investment is expected to generate positive returns and contribute to the company's profitability over the long term.

Table 4
Payback Analysis (ROI)

Total Savings	\$177,000
Total Cost	\$650,800.00
Return of Investment	3.68 years

Conclusions

The integration of the BIB-BOB machine into the pharmaceutical packaging process presents a compelling opportunity for the company. Notably, it substantially enhances production efficiency by doubling the production rate and significantly reduces labor costs by requiring fewer operators. Despite higher operational costs associated with increased production volumes, the net financial impact remains positive, generating an annual net profit of \$177,000. Crucially, the return on investment (ROI) analysis reveals that the initial investment in the BIB-BOB machine will be recouped within approximately 3.68 years, demonstrating the long-term financial viability of this profitable automation solution. By embracing transformative automation technology and optimizing production processes, the company can streamline operations, reduce costs, and enhance market competitiveness while maintaining product quality and safety standards. The successful integration of the BIB-BOB machine exemplifies a strategic investment aligned with the company's goals of improving efficiency, reducing costs, and adhering to standards. As the pharmaceutical industry continues to evolve, leveraging advanced technologies like the BIB-BOB machine will be critical for driving sustainable growth and maintaining a competitive edge.

Future Work

As future work, a new automated case packer machine will be implemented to enhance efficiency in the primary packaging line, increase efficiency, and reduce costs or time requirements. This case packer equipment complements the existing BIB-BOB system, further augmenting cost-efficiency for the pharmaceutical company. Due to the successful improvement process of the BIB-BOB implementation, which achieved the desired return on investment (ROI) and avoided financial losses, expectations for the integration of the case packer machine are equally high. This will allow the company to continue automating its primary packaging lines, adhere to site improvement processes, and maintain a competitive edge within the pharmaceutical industry landscape.

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References

- NexGard. (n.d.). *Trust NexGard® brand products to protect your pets* | NexGard® [Online]. Available: <https://nexgardforpets.com/>
- American Heartworm Society. (n. d.). *Heartworm in Dogs* [Online]. Available: <https://www.heartwormsociety.org/heartworms-in-dogs>.
- Heartgard. (n. d.). *Heartgard® Plus Chews | Heartworm Disease Prevention for Dogs* [Online]. Available: <https://heartgard.com/>.