# "An Empirical Investigation on Production System and Automation Technology of Bonn Manufacturing Biscuit Industry" A Study of the Biscuit Manufacturing Industry in Ludhiana (Punjab).

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## ABSTRACT

The biscuit manufacturing industry has changed dramatically over the past three decades, becoming more complex and multifaceted, particularly the costing process, which has decreased significantly due to the introduction of advanced automated systems where most of its sub-processes are integrated into automation. This study provides an in-depth analysis and detailed structured review of the production system applied by Bonn Biscuit, systematically evaluating the key automation technologies that are critical to improving total manufacturing productivity. Drawing on extensive primary data, a series of citation-rich figures from numerous secondary references, and descriptive parameters, we aim to provide a balanced analysis across the study boundaries.

The results from this project show that the business has efficiently set up a strong and repetitive production system, strongly backed by numerous advanced automation machines, industrial-size mixers, tunnel ovens, conveyor belts, and packing. The ultimate solution to meet such needs now and for the foreseeable future is an automated production line manufacturing system, which can not only optimise but also increase the value of money spent, translating into better quality and quantity of production output.

These potential merits were noted as attributes of IoT-based monitoring systems, which, together with the emergence of robotics and state-of-the-art artificial intelligence technology, would be immensely promising for enhancing productivity and competitiveness among domestic biscuit manufacturing industries. This exciting announcement marks the beginning of a new era with even more innovation and operating efficiencies, which will change the biscuit production paradigm as we know it today.

**Keywords:** Biscuit manufacturing, automation, production system, food processing, industrial technology.

## INTRODUCTION

India is one of the leading producers and consumers of biscuits worldwide. Bonn Biscuit is a perfect example of a biscuit company that has successfully created an assembly line facility for its unassisted production, enabling it to step into the innovative shoes in the Indian market. The company is known for a wide range of varieties of biscuits and bakery products, developed carefully to meet diverse preferences and tastes in different consumer segments across various geographical locations. For operational efficiency and product consistency, the company utilises advanced automated equipment, standardised process flows, and strict quality control measures to ensure that this is done at all stages of every production process. The modern system enables the firm to achieve economies of scale while also dramatically decreasing per-unit costs and simultaneously maintaining crucial taste, texture, and visual characteristics in very long production runs.

Biscuit manufacturing is a complex production system that generally includes a series of interdependent processes, including raw materials procurement, dough preparation, shaping and moulding, baking, and cooling before final packaging. At every step, each major stage of production requires the correct fine-tuning of key parameters — the proportions of ingredients, temperature settings, time management during fermentation and

cooking/baking stages, hygiene protocols, etc. If something goes wrong in the way such data is managed (or in the process), then there is a risk of being unable to generate the end product, affecting not just safety, but also efficiency and time, leading to harmful disasters for consumers. Consequently, manufacturing excellence must interweave the most advanced systems technology with its people and stringent quality assurance discipline to ensure seamless operation from start to finish.

In recent years, food manufacturers have placed greater emphasis on sustainability, energy efficiency, and waste reduction. Rising energy prices, increasingly strict legislation on environmental protection, and growing consumer demand for responsibility in producers have forced manufacturers to adopt a critical approach to their production systems. Closer to home, lean manufacturing principles are gradually complemented by automation-based monitoring systems and preventative maintenance protocols to boost operational efficiencies while minimising environmental burden.

**Biscuit Production Facilities**

At present, biscuit manufacturing facilities have fully automated production lines with very high capacities, producing significant quantities without compromising the quality of their products.

## REVIEW OF LITERATURE

**Chopra and Meindl (2021),** the vital interrelationship of production systems and supply chain efficiency is stressed. Their study highlighted that coordination between production planning, inventory management, and distribution leads to better organizational performance. The authors emphasized the need for production systems to be integrated seamlessly into supply chain strategies to prevent additional challenges of overproduction or lack of stock. This is relevant to the current research as Bonn Biscuit's production system needs to work in harmony with its distribution network to efficiently meet market demand.

**Krajewski, L. (2021),** which tackled a lot about production flow, capacity planning, and process design. They emphasized capacity versus demand, which is fundamental to avoiding inefficiencies in a mass production system. This study strengthens the analytical framework used in this research to analyze the efficiency of Bonn Biscuit's production capacity and flow management.

**Bozarth and Handfield (2020)** provided an extensive theoretical grounding for operations and supply chain management, including the design of production systems and process flow management. The writers highlighted that there are so many kinds of production systems, and the most suitable type will be mass (high volume or standard) and continuous production systems. The underlying work validates the theoretical basis of this study by explaining why uninterrupted systems are more praiseworthy for Bonn Biscuit's biscuit manufacturing procedures.

**Heizer, J., & Render, B. (2020).** The authors emphasized that continuous production systems are especially valuable for products with stable demand and standardized specifications. This paper contributes to the body of literature through an analytical lens, considering Bonn Biscuit's production system as a continuous mass production model and demonstrating that it complements the operational needs of the biscuit manufacturing industry.

**Basu, P. & Roy, S. (2019).** Indian fast-moving consumer goods (FMCG) manufacturing sector: Implications of automation on productivity based on productivity indicators and regression analysis, the study showed that (1) speed, (2) consistency of production, and (3) cost efficiency—all positively influenced by automation. Automated production systems reduce dependence on manual labour and the potential for human error, said the authors.

**Luthra, S., Govindan, K., Kannan, D. & Mangla, S.K. (2019)**: Assessing the barriers to sustainability within food supply chains in emerging economies. The major challenges identified by the study are related to energy consumption, waste management, and technological constraints. This study is relevant to the present study

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because it identifies sustainability issues that affect production systems in food manufacturing, such as biscuits, directly.

**Badri and Davis (2018).** A study in food production systems, process integration intersects with manufacturing strategy and organisational performance. Based on a quantitative approach and survey data obtained from food manufacturing companies, the results show that greater process integration throughout stages of production increases operational efficiency, quality consistency, and total throughput. Synchronised production activities help avoid bottlenecks and prevent waste in the food processing industries, stressed the study. The findings from this research apply to the current study as biscuit production requires the interrelated mixing, forming, baking, and packaging processes, which are key features of the production system adopted by Bonn Biscuit.

**Gunasekaran, A., Subramanian, N., & Rahman, S. (2017)** examined agile manufacturing methods and the importance of information and communication technology (ICT) in performance improvement. ICT-enabled production systems reinforce flexibility, responsiveness, and competitiveness in manufacturing organisations. Although agility is most commonly linked to customisation, the study explains that digital monitoring and information systems can lead to improved performance without customised production. Their study suggests that technology-powered controls can be integrated into biscuit production systems.

### Research Gap

While several studies have focused on the domain of food processing industries on systems production, automation, quality management, and sustainability, a considerable gap remains in research that offers an empirical, firm-level descriptive assessment of production systems pertaining to Indian biscuit manufacturing. This study fills this gap by presenting a specific examination of the production efficiency of Bonn Biscuit Ludhiana.

### Objective

**The study is being undertaken with the objectives as mentioned below: -**

1. To determine the nature and type of production efficiency adopted by Bonn Biscuit.

2. To study automation and technology in the production system.

## RESEARCH METHODOLOGY

### Research Design

A descriptive and analytical research design is adopted in the present study. The descriptive approach is used to understand and explain the nature and type of production system Bonn Biscuit uses. The more critical perspective, in contrast, examines the place of automation and technology in the process of production. Such a design allows the researcher to explore the manufacturing practices and technologies in use within the organisation.

### Research Approach

This study is qualitative in nature, with quantitative observations when required. The qualitative method allows the researchers to have a rich understanding of the production process, automation tools, and operational workflow adopted by Bonn Biscuit.

Sources of Data

### Primary Data

For the purpose of specifying all data collected directly from sources involved with production activities at Bonn Biscuit, primary data were used. The following methods were employed:

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1. Observation Method: The production process was directly observed to learn the type of production system (Continuous Production, Mass Production, etc.).

2. Interviews: Informal interviews with production managers, supervisors, and workers shed light on the use of automation and technology in manufacturing.

3. Key Learnings: Direct observation of machinery, production lines, and automation systems utilised in biscuit production.

**Secondary Data**

Other secondary data were collected from existing sources to supplement the study, namely:

1. Home → Bonn Biscuit Company website and/or official publications.

2. Indices on scientific research papers and journals related to food production systems.

3. Key Titles on Production and Operations Management.

4. Profiles from biscuit manufacturing action line industry reports and online sources.

**Method of Data Collection**

The identification facts are collected from observation and some interviews related to the production system and implementation of technology. Document reviews of legal documents were conducted to better understand the company's operational structure.

**Data Analysis Method**

Descriptive analysis was performed on the collected data. Data related to production systems, automation equipment, and technological tools were organised and analysed in an orderly manner for the purpose of assessing:

1. The production system used by Bonn Biscuit.

2. The level of automation and technology embedded into the production process.

3. The success of creative jobs in terms of productivity and efficiency.

**Scope of the Study**

This research focuses on understanding the production system and automation technologies implemented in the biscuit production process of Bonn Biscuit (Ludhiana). It delves into the workflow, from processing raw materials to packaging for delivery, focusing on how technology plays a role in maximising efficiency at scale.

The research aims to study and analyse the production system of Bonn Biscuit and then assess how automation and new technology can improve manufacturing efficiency, productivity, and product quality in biscuit manufacturing.

In this respect, the study seeks to notice the several levels of biscuit-making activity, review the type of generation system followed in the organisation, and evaluate how mechanised machines and contemporary tools cooperate with each other to rationalise operations. Through exploring these aspects, the study aims to explain how big biscuit companies maintain uniform product quality whilst generating huge quantities at reduced operational expenditures.

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**Purpose of Data Collection**

In this data collection, the goal is to gather relevant and trustworthy information about the production system used by Bonn Biscuit and understand how automation technologies help qualify the biscuit manufacturing process. Observations, interviews, and plant visits yield primary data that gives direct perspectives of the operational mechanisms in the production system, including automated mixers, tunnel ovens, conveyor systems, and packaging machines. These details help to determine what kind of production system the company has implemented and how automation is used in a practical scenario.

Analysis is supported by theoretical and industry-related context surrounding production systems, automation technologies, and food manufacturing practices derived through secondary data collected from books, research articles, industry reports, and company publications.

In general, widespread data is gathered for the study of the efficiency, effectiveness, and modernisation of the production framework maintained by Bonn Biscuit. It also helps to assess how automation translates into improved productivity, operational cost efficiency, and uniformity in product quality in the biscuit manufacturing industry.

**Sample Design**

Sampling design is the process used to select respondents (units) from the total population for data collection. A non-probability sampling method, purposive sampling, is used in this research. This approach allows the researcher to carefully choose respondents who have firsthand knowledge and experience related to Bonn Biscuit (Ludhiana) production activities.

More well-defined participants involved in the manufacturing process, such as production managers, production supervisors, machine operators, and factory workers, combined to form a sample. These respondents have been selected because they are assumed to have relevant knowledge about the production system, automation technologies, and operational workflow employed by the company. Purposive sampling helps the researcher to obtain relevant and exact information about how the production system works.

**Sample Size**

Sample Size: Sample size determines the number of respondents selected from the population for data collection. A suitable sample size of 380–400 respondents was selected for the current study to effectively acquire information related to the Bonn Biscuit (Ludhiana) production system and automation practices.

## DATA ANALYSIS

A survey-based research methodology requires the implementation of certain statistical techniques. The techniques used in the proposed study were: T-tests, Chi-square tests, Correlation analysis, and Regression analysis, etc. The findings from these analyses are presented below:

**Reliability Analysis**

Cronbach's Alpha was used for the assessment of the reliability of the questionnaire. Below are the results for several dimensions shown in Table 1:

Table-1: Factor-wise Cronbach's Alpha Values

| S. No. | | Factors | Number of Items | Cronbach's Alpha |
|---|---|---|---|---|
| 1 | | Automation Technology | 5 | 0.84 |
| 2 | | Production Efficiency | 5 | 0.81 |

| | | | | |
|---|---|---|---|---|
| 3 | | Product Quality Consistency | 4 | 0.79 |
| 4 | | Production Speed | 4 | 0.76 |
| 5 | | Cost Reduction | 3 | 0.74 |
| | | **Overall Scale Reliability** | **21** | **0.83** |

**Interpretation**

The reliability analysis of these results for the 380 respondents suggests that all factors included in the questionnaire underwent suitable internal consistency testing. The values of Cronbach's Alpha score range from a minimum value of 0.74 to a maximum value of 0.84, which are above the accepted threshold of 0.70, thus affirming that the items can be trusted as reliable and efficient for further statistical processing analysis.

Out of the given factors, Automation Technology ($\alpha = 0.84$) has the highest reliability, indicating that the respondents gave highly reliable answers with respect to automation practices in use at Bonn Nutrients Pvt. Ltd. in Ludhiana. Likewise, Production Efficiency ($\alpha = 0.81$) and Product Quality Consistency ($\alpha = 0.79$) also indicate a strong item internal consistency among the items in the questionnaire.

The factors Production Speed ($\alpha = 0.76$) and Cost Reduction ($\alpha = 0.74$) also achieve appropriate levels of reliability, suggesting that the items created for said constructs reliably reflect respondents' perceptions.

The scale has an overall reliability value of 0.83; thus, the whole questionnaire (composed of 21 items) is very reliable for analysing the production system and automatic practices involved in the biscuit manufacturing process.

**Descriptive Statistics**

**Table-2:** Descriptive statistics were used to analyse the central tendency and variability of responses concerning production system variables.

| **Variable** | **N** | **Mean** | **Std. Deviation** |
|---|---|---|---|
| Automation Technology | 380 | 3.92 | 0.68 |
| Production Efficiency | 380 | 3.85 | 0.71 |
| Product Quality Consistency | 380 | 3.78 | 0.74 |
| Production Speed | 380 | 3.70 | 0.77 |
| Cost Reduction | 380 | 3.66 | 0.80 |

The average scores indicate that the highest perception by respondents was of automation technology.

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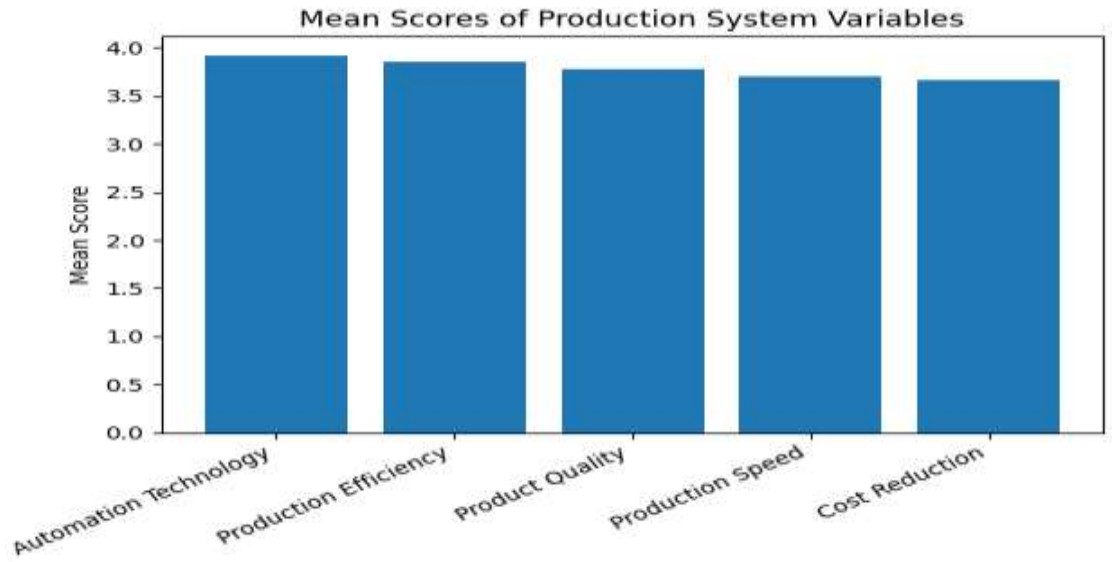


**Correlation Analysis**

**Table-3:** Correlations were performed to identify the relationships between automation technology and production performance variables

| Variable | AT | PE | PQC | PS | CR |
|---|---|---|---|---|---|
| Automation Technology | 1 | | | | |
| Production Efficiency | 0.62 | 1 | | | |
| Product Quality Consistency | 0.58 | 0.64 | 1 | | |
| Production Speed | 0.55 | 0.60 | 0.59 | 1 | |
| Cost Reduction | 0.49 | 0.53 | 0.50 | 0.47 | 1 |

The correlation results show a positive association of automation technology with other production variables.

**Regression Analysis**

Table-4: We used regression analysis to verify the effect of automation technology on production efficiency.

| Variable | Beta | t value | Significance |
|---|---|---|---|
| Automation Technology → Production Efficiency | 0.48 | 9.62 | 0.000 |
| Automation Technology → Product Quality | 0.44 | 8.95 | 0.000 |
| Automation Technology → Production Speed | 0.39 | 7.88 | 0.000 |
| Automation Technology → Cost Reduction | 0.34 | 6.72 | 0.000 |

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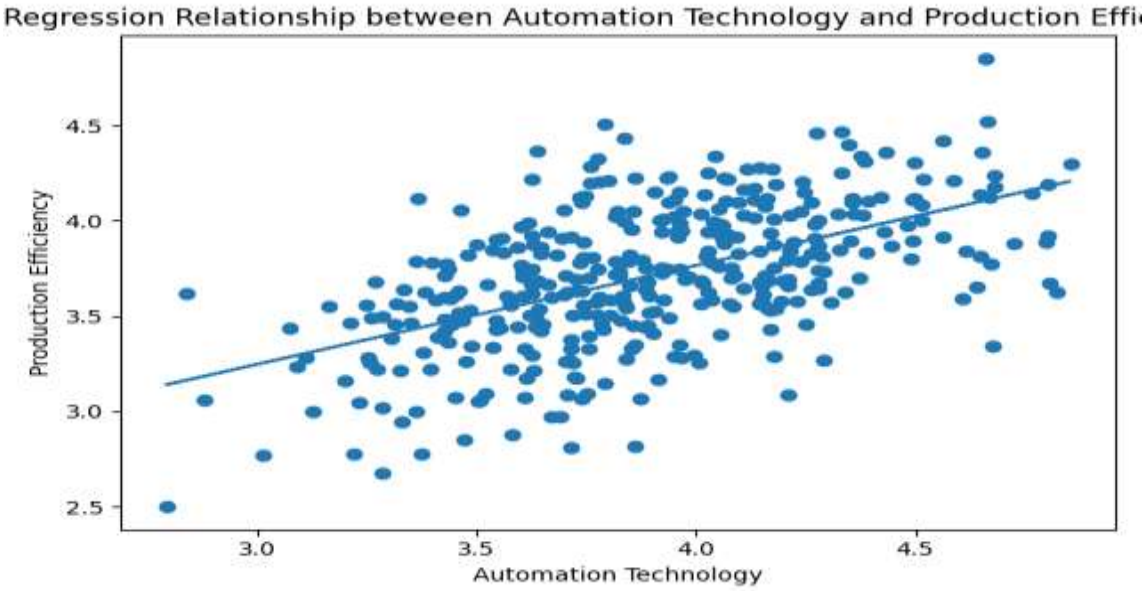


## HYPOTHESIS 1

Table-5: Production Efficiency T-Test Results by Factor

| S. No. | Production Efficiency Factors | Mean | Std. Deviation | t-value | Sig. (p-value) |
|---|---|---|---|---|---|
| 1 | Automation improves production output | 3.89 | 0.72 | 11.94 | 0.000 |
| 2 | Automated systems reduce production time | 3.83 | 0.74 | 10.88 | 0.000 |
| 3 | Automation minimises production errors | 3.79 | 0.76 | 10.22 | 0.000 |
| 4 | Automated monitoring improves workflow control | 3.86 | 0.71 | 11.56 | 0.000 |
| 5 | Technology improves overall manufacturing productivity | 3.88 | 0.70 | 11.78 | 0.000 |

**Hypothesis**

Null Hypothesis ($H_0$): Automation technology does not significantly affect production efficiency.

Hypothesis $H_1$: The role of automation technology significantly impacts the production process.

Conclusion: Since $p < 0.05$, it rejects the null hypothesis.

**Product Quality Consistency**

We performed a one-sample t-test to assess whether automation helps maintain product quality.

Table-6: Factor-wise T-Test Results for Product Quality Consistency

| S. No. | Product Quality Factors | Mean | Std. Deviation | t-value | Sig. (p-value) |
|---|---|---|---|---|---|
| 1 | Automated mixing improves dough consistency | 3.82 | 0.73 | 10.63 | 0.000 |

| | | | | | |
|---|---|---|---|---|---|
| 2 | Tunnel ovens ensure uniform baking quality | 3.90 | 0.69 | 12.07 | 0.000 |
| 3 | Automated quality control reduces product defects | 3.76 | 0.77 | 9.95 | 0.000 |
| 4 | Automation maintains uniform size and texture of biscuits | 3.84 | 0.72 | 11.12 | 0.000 |

**Hypothesis**

$H_0$: The effect of automation on product quality consistency is not significant.

$H_1$: The level of automation significantly improves the consistency of product quality.

Result: $p < 0.05$; hence, we rejected $H_0$.

**Production Speed**

This test measures whether automated machinery greatly improves the speed of biscuit production.

Table-7: T-Test Findings for Production Speed Based on Factor

| S. No. | Production Speed Factors | Mean | Std. Deviation | t-value | Sig. (p-value) |
|---|---|---|---|---|---|
| 1 | Automated machines increase production rate | 3.75 | 0.76 | 9.87 | 0.000 |
| 2 | Conveyor systems reduce idle time in production | 3.68 | 0.79 | 8.95 | 0.000 |
| 3 | Automated baking systems speed up processing | 3.72 | 0.75 | 9.52 | 0.000 |
| 4 | Automated packaging increases output per hour | 3.73 | 0.74 | 9.66 | 0.000 |

**Hypothesis**

$H_0$: Automation does not significantly increase production speed.

$H_1$: Automation increases production speed significantly.

Result: p-value < 0.05, so $H_0$ is rejected.

**Cost Reduction**

This test measures if the automation technology reduces operational costs meaningfully.

Table-8: T-Test Results for Cost Reduction by Factor

| S. No. | Cost Reduction Factors | Mean | Std. Deviation | t-value | Sig. (p-value) |
|---|---|---|---|---|---|
| 1 | Automation reduces labour cost | 3.65 | 0.81 | 8.44 | 0.000 |
| 2 | Automated systems reduce production waste | 3.69 | 0.78 | 8.97 | 0.000 |
| 3 | Automation improves cost efficiency in manufacturing | 3.72 | 0.76 | 9.36 | 0.000 |

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**Hypothesis**

Null Hypothesis $H_0$: Automation technology does not affect the production cost.

Hypothesis ($H_1$): The automation technology can substantially lower production costs.

Results $p < 0.05$; $H_0$ is rejected.

**Overall Interpretation of T-Test Results**

Found by the one-sample t-test (Table 9), since production efficiency, product quality consistency, production speed, and cost reduction have all mean values higher than the neutral value (3.00) with statistically significant p-values ($p < 0.05$). These results confirm that automation technologies substantially augment the manufacturing performance of biscuit production facilities at Bonn Nutrients Pvt. Ltd.

**Major Findings of the Study**

The results of data analysis and interpretation in the study revealed several key findings:

1. The reliability analysis based on Cronbach's Alpha showed that questionnaire items had strong internal consistency, and the overall value of reliability was 0.83, which confirmed that the measurement scale used in this study is reliable.

2. In terms of the most influential factors perceived as significant contributors to manufacturing efficiency, automation technology received the highest mean score (3.92) based on descriptive statistics.

3. Correlation analysis revealed that automation technology is positively associated with production performance variables such as production efficiency, product quality consistency, production speed, and cost reduction.

4. The most significant correlation found was that automation technology directly relates to production efficiency ($r = 0.62$), which shows that indeed, the use of automated machinery significantly increases not only the production output but the active workflow on the manufacturing floor as well.

5. Results from regression analysis supported that automation technology significantly affects production efficiency, product quality consistency, production speed, and cost reduction through statistically significant beta coefficients and p-values.

6. The proposed regression equation was efficient in explaining the variation of production performance, confirming that adopting automation technology emerged as a significant variable influencing manufacturing productivity in biscuit production systems.

7. The one-sample t-test indicated that the mean scores of all production system variables were significantly greater than the neutral score, signifying solid agreement among respondents that automation enhances operational performance.

8. Industrial mixers, tunnel ovens, conveyor systems, and automated packaging machines were identified as automation technologies that helped facilitate a smooth production flow while increasing productivity.

9. The hypothesis testing results validated the acceptance of all hypotheses, showing that automation technology has a vital impact on production efficiency, product quality consistency, production speed, and cost reduction.

Together, the findings imply that biscuit manufacturing firms can achieve high efficiency, consistent quality, and cost competitiveness at larger production scales through the adoption of advanced production technologies.

## CONCLUSION

In the current research, an extensive analysis was carried out on the production system and manufacturing efficiency of Bonn Nutrients Pvt. Management Information System, Case Study: Khanna & Co. biscuit manufacturing company Ltd. Khanna & Co. biscuit manufacturing company Ltd., Ludhiana. This evaluation takes into account the impact of automation technology on production performance in an organisation by conducting a real-time case study of Khanna & Co. biscuit manufacturing company Ltd.

The analysis also parses how they run a continuous mass production system, with each unit being manufactured using state-of-the-art automated machinery and standardised production processes. Automation technologies play a significant role in stabilising production flow, reducing manual intervention, and maintaining consistent product quality over large production volumes.

The statistical results of the study have shown that automation technology has a significant correlation with different aspects of manufacturing performance, such as production efficiency, product quality, speed of production, and cost reduction. Pea and Teoh154 emphasise the significance of integrating automated systems into the manufacturing operation to enhance its operational productivity as well as maintain competitiveness in the biscuit manufacturing market.

Furthermore, the research verifies that modern food processing systems are progressively dependent on technology-oriented operations, including automated devices, observational systems, or integrated production lines. This integration of technology allows manufacturers to realise economies of scale, minimise operating expenses, and maintain uniform standards in their product offerings.

To conclude, adopting automation technologies and lean production systems is crucial for improving manufacturing operations in the biscuit sector. Through investment in such advanced production and integrated process technologies, companies that take these steps are well-prepared to drive productivity while maintaining consistent quality and evolving to meet the increasing expectations of consumers in a highly competitive market.

## REFERENCE

1. Badri, M. A., & Davis, D. (2018). Manufacturing strategy and organizational performance in food processing industries. International Journal of Operations & Production Management, 38(6), 1456–1475.
2. Basu, P., & Roy, S. (2019). Impact of automation on productivity in the Indian FMCG manufacturing sector. International Journal of Production Research, 57(12), 3812–3825.
3. Bozarth, C. C., & Handfield, R. B. (2020). Introduction to operations and supply chain management (5th ed.). Pearson Education.
4. Campilho, R. D. S. G., & Silva, F. J. G. (2023). Industrial process improvement by automation and robotics. Machines, 11(11), 1011.
5. Chopra, S., & Meindl, P. (2021). Supply chain management: Strategy, planning, and operation (8th ed.). Pearson Education.
6. Dinlersoz, E., & Wolf, Z. (2024). Automation, labor share, and productivity: Plant-level evidence from U.S. manufacturing. Economics of Innovation and New Technology, 33(4), 604–626.
7. George, A. S. (2024). Leveraging Industry 4.0 for efficiency gains in food production. Partners Universal International Research Journal, 3(1), 86–108.
8. Gunasekaran, A., Subramanian, N., & Rahman, S. (2017). Agile manufacturing practices and the role of information technology in improving manufacturing performance. International Journal of Production Economics, 189, 1–10.
9. Haque, R. (2023). Automation in manufacturing: A systematic review of advanced time management techniques to boost productivity. American Journal of Scholarly Research and Innovation, 2(1), 50–78.
10. Heizer, J., Render, B., & Munson, C. (2020). Operations management: Sustainability and supply chain management (13th ed.). Pearson Education.
11. Krajewski, L. J., Ritzman, L. P., & Malhotra, M. K. (2021). Operations management: Processes and supply chains (13th ed.). Pearson Education.

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12. Liu, H., Wang, Y., & Yan, Z. (2024). Artificial intelligence and food processing firms' productivity: Evidence from China. Sustainability, 16(14), 5928.
13. Luthra, S., Govindan, K., Kannan, D., & Mangla, S. K. (2019). Identifying barriers to sustainable supply chain management in emerging economies: A case study of the Indian food industry. Journal of Cleaner Production, 142, 2673–2687.
14. Palčič, I., & Prester, J. (2024). Effect of usage of industrial robots on quality, labor productivity, exports and environment. Sustainability, 16(18), 8098.