

Food Processing Industry in India: An Industry Analysis

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ABSTRACT

Purpose: This study aims to examine the use of information and communication technology (ICT) in India's food processing industries. It aims to investigate the various ICT tools used in business and examine their Disadvantages, Constraints, Benefits, and Advantages.

Methodology: Academic journals, papers from government and non-governmental organisations, industry publications, market research studies, ICT solution provider websites, academic institutions, research centres, and internet databases were used in the study. Extensive information on ICT usage and influence on the food processing business in India was obtained, assuring the sources' dependability and timeliness.

Findings: According to the report, India's food processing industry has grown significantly since liberalisation in 1991, contributing to global food production while also having a robust food and grocery retail market. ERP systems, quality management systems, IoT applications, big data analytics, food traceability systems, and mobile apps are key drivers of efficiency and development in the sector. Leading industry players such as Britannia Industries, Amul, Parle Products, and NESTLE India have used ICT into their operations to optimise resource management, promote sustainability, and increase customer communication.

Originality/value: The study recommends continued government support through favourable policies, a focus on sustainability practices such as renewable energy and eco-friendly packaging, increased investment in ICT solutions for optimised operations, diversification of product offerings to meet evolving consumer demands, and exploring export opportunities through e-commerce platforms to further boost the food processing industry. Implementing these ideas will assist the sector in maintaining its current growth rate.

Paper type: Case study

Keywords: Food processing industry, Advantages, Benefits, Constraints, Disadvantages, ABCD Listing, Information and Communication Technology (ICT).

I. INTRODUCTION:

India is unquestionably a world leader in agriculture, producing more milk, bananas, papaya, mangos, ginger, pulses, and buffalo meat than any other country [1]. With the potential to increase value, foster trade, generate employment opportunities, and decrease food waste, the Indian food processing sector (IFPS) offers significant growth potential and a promising path for socioeconomic development [1]. The IFPS faces difficulties in terms of overall productivity, lagging behind global food processing supply chains despite the advantage of favourable agri-climatic conditions [2]. The increasing level of agricultural product waste is one of the main concerns afflicting the Indian food processing business. According to recent data, food processing to edible standards in India is just 10%, resulting in significant losses [3]. Furthermore, India's contribution of processed food exports in global commerce is dismally low at roughly 1.5% [3]. Given the ownership of India the world's second-largest arable land, as well as 20 unique agri-climatic areas and 46 of the 60 soil types found globally the sector's potential for expansion is enormous. Rising disposable income, urbanisation, a youthful and increasing population, and the advent of nuclear families are driving India's burgeoning demand for processed food. Domestic food consumption is predicted to reach 318 billion USD by 2020, an increase from 181 billion USD in 2009 [4]. Realising the potential for economic growth necessitates the development of novel food processing processes in order to boost the sector's competitiveness by introducing new goods, enhancing product quality, and lowering production costs [5][6]. Despite its significant

employment generating capabilities, the food processing sector is not effectively capitalising on its potential. The majority of the workforce is still unqualified, with over 80% having a level of education below the 10th standard [7]. As a result, the influence of different government policies and programmes targeted at strengthening the industry has not produced the expected results. Strengthening the sector's research and technological competence, as well as supporting infrastructure and workforce skills, emerge as essential imperatives for its successful growth [7]. The food sector of India is in a precarious situation due to massive loss caused by inefficiencies in the operations of small and medium-sized enterprises (SMEs) [8]. These SMEs face various challenges, including financial difficulties, a lack of technical skills, and insufficient investment. Recognising the importance of technology, particularly Information and Communication Technology (ICT), in meeting these difficulties, its incorporation has become critical for encouraging long-term growth [8]. The use of ICT in food SMEs has shown the ability to increase company efficiency by optimising resource utilisation, decreasing waste, and lowering power usage. From a management aspect, this technology intervention also provides intriguing opportunities for generating sustainable growth [9][10]. Notably, ICT solutions have been demonstrated to improve supply chain operations

including purchasing and managing inventory, hence increasing the sector's long-term profitability [8]. In light of the foregoing, this research tries to completely examine the Disadvantages, Constraints, Benefits, and Advantages of the Indian food processing sector in terms of its potential influence on the nation's economy. This research aims to shed light on strategies to utilise the sector's strengths and minimise its limits in order to achieve sustainable growth and socioeconomic advancement in the Indian environment by assessing existing obstacles and possibilities.

II. REVIEW OF LITERATURE:

Agriculture is an important source of employment in India, and the country is recognised as a worldwide producer in the global food market. However, productivity levels are not as high as intended, owing to obstacles such as a lack of awareness of variables such as a trained personnel shortage, the usage of outmoded technology, and governance concerns [11]. Adoption of ICT breakthroughs can help overcome these difficulties and boost agricultural output. Farmers may have access to accurate, timely, and relevant information and services by harnessing information and communication technology. As a result, a more productive agricultural environment is created [12].

Table 1: Related works on processing industry.

Sl. No	Area	Contribution	Authors
1	Food security and ICT	This study investigates the critical role of technology in improving global food security, utilising data from 106 nations from 2012 to 2018. The data unambiguously show that technology has a favourable influence on global food security. The impact of technology on nations in the Organisation for Economic Co-operation and Development (OECD) is most visible in enhancing food supply. In contrast, non-OECD nations rely heavily on technology to improve food affordability. Furthermore, the report emphasises the rising importance of technology in enhancing food security for OECD countries in recent years. These findings highlight the vital potential of technology as a key driver in tackling global food security concerns.	Gouvea, R., Kapelianis, D., Li, S., & Terra, B. (2022) [13]

2	ICT Applications	<p>This chapter digs into Industry 4.0's transformational influence on the food-processing industry, emphasising the vital potential of disruptive computer-based processes. It focuses on the revolutionary effects of massive amounts of data, artificially intelligent systems, wireless sensors, the Internet of Things (IoT), and other technologies related to information and communication in the food industry and supply chain applications. ICT integration has resulted in substantial breakthroughs in food sourcing, production, and distribution practices, which are poised to revolutionise the whole sector. The chapter further delves into the breadth of automation and digitalization in sustainable food processing, highlighting various interesting applications and presenting essential principles and methodologies via current case studies.</p>	<p>Raja, V., Krishnamoorthy, S., Moses, J. A., & Anandharamkrishnan, C. (2022)[14]</p>
3	Problems and obstacles	<p>The purpose of this article is to highlight the key obstacles faced by agro-based businesses in Malaysia, as well as the driving reasons behind these concerns. The survey included 450 respondents from six agro-based businesses in Peninsular Malaysia: food processing, non-food processing, farming, animal raising, fisheries, and plantation. The research identified five main problems that agro-based entrepreneurs face: a lack of awareness of the advantages of technology for communication and information (ICT), a shortage of knowledge about ICT, an absence of skills or knowledge in using ICT, a lack of time set aside for ICT activities. The Chi-square test revealed that academic attainment had a significant link with all five major difficulties, whereas age had a significant relationship with two of the five major problems.</p>	<p>Hassan, M. S., Shaffril, M., Azril, H., & D'Silva, J. L. (2009) [15]</p>
4	Factors influencing the adoption of ICT	<p>This study aims to pinpoint the variables influencing the adoption of environmentally friendly supply chain management techniques in the Australian food industry. They identified fifteen essential characteristics that influence the adoption process at several levels using multiple case studies: national, industrial, supply chain, and</p>	<p>Yao, C., Peng, X., Kurnia, S., & Rahim, M. (2022)[16]</p>

		organisational. Among these elements, we uncovered two previously unknown ones: environmental uncertainty and supply chain partners' ICT resources. Interestingly, competitive pressure, which has been highlighted in previous research, did not show to be important in our study. The findings of this study have important significance for both academic research and practical applications in the field of SSCM.	
5	ICT Investment	The study investigated how ICT investments impacted the South African agro-processing industry. Although enterprises that used more ICT had larger increases in worker productivity, overall ICT policies had little effect on sector growth. Investment in ICT over the long run increased employment, production, and worker productivity, with higher effects in ICT-intensive industries, particularly the food industry. Current policies should concentrate on increasing access to and use of ICT in non-ICT companies, particularly agro-processing, to spur growth. To encourage ICT investment and skill development in the sector and to target ever-more ICT-intensive businesses, a tax incentive plan is suggested.	Kalaba, M. W., & Lefophane, M. H. (2021)[17]
6	ICT and Supply Chain Management	The challenges in the supply chain for agricultural products were covered in this essay, along with how ICT fits into the picture. The impact of the management of supply chains (SCM) practises on organisational performance is also examined. Data from 121 directors and officers of an official food distribution agency were gathered for the study using a structured questionnaire. The results of structural equation modelling with partial least squares (PLS) demonstrate a strong correlation between ICT & SCM practices (logistics convergence and supplier relationships). Additionally, SCM practises including supplier relationships, information sharing, and logistics coordination have a positive and significant effect on the operation of the company.	Kumar, A., Singh, R.K. & Modgil, S. (2020)[18]
7	Location and adoption of ICT	This study investigates the trend of web technology adoption in the agri-food industries, taking into consideration various critical factors such as	Domenech, J., Martinez-Gomez, V., & Mas-Verdú, F. (2014)[19]

		<p>geography, economic performance, and a track record of accepting advancements in the past. Our findings show that rural locations, in conjunction with unique company characteristics, play a critical role in speeding the adoption of web technologies. Conversely, metropolitan regions have a slower rate of adoption in this arena.</p>	
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The food processing industry is now dealing with quality delivery difficulties, which has become one of the sector's most difficult responsibilities, owing to a persistent scarcity of competent and trained labour [20]. Despite the collaborative nature of the sector, which merges agriculture and industry [21], many challenges impede its growth and market expansion. These barriers are classified into three types: supply-side (such as a lack of trained labour and the influence of a changing political climate), demand-side, and regulatory. To guarantee long-term success and capitalise on the numerous opportunities presented by the food business, these problems must be addressed appropriately.

III. OBJECTIVES OF THE STUDY:

- To understand the adoption of ICT in food processing industries in India.
- To study the various ICT tools implemented in India's food processing industries.
- To analyse the Disadvantages, Constraints, Benefits, and Advantages of ICT in food processing industries

IV. RESEARCH METHODOLOGY:

Several secondary sources were used to gather information about ICT (Information and Communication Technology) in the food processing business in India, including:

- - Academic Journals and Research Papers: Academic journal articles and research papers on ICT applications in the food processing sector in India were examined. Springer, Taylor & Francis, and Emerald Insight were all solid locations to start your search.
- - Reports from Government and Non-Governmental Organisations: Reports and publications on the use of ICT in the Indian food processing sector were reviewed by government agencies, industry groups, and research organisations. Relevant reports were available on the websites of the Ministry of Food Processing Industries, FICCI (Federation

of Indian Chambers of Commerce & Industry), and CII (Confederation of Indian Industry).

- - Industry Publications: Magazines, newsletters, and websites relevant to India's food processing business were investigated. They frequently included essays and case studies on the use of ICT in various industry processes.
- - Market Research studies: Market research studies sought insights into the current trends and potential uses of ICT in India's food processing industry. Helpful reports came from reputable market research companies.
- - ICT Solution Provider Websites: The websites of firms that specialise in providing ICT solutions for the food processing industry were examined. They may have produced case studies, whitepapers, and blog posts highlighting the advantages and applications of their technology in this industry.
- - Academic Institutions and Research Centres: The websites of Indian universities and research centres with a focus on agriculture, food processing, and technology were investigated. They often released research findings and papers on ICT integration in the food processing sector.
- - Online Databases and Search Engines: To identify relevant scholarly publications and research papers on the issue, search engines such as Google Scholar, ResearchGate, and SSRN were used.
- Using these secondary sources, extensive information on how ICT was being used and its influence on the food processing business in India were acquired. The sources' trustworthiness was confirmed, and they were assured to be up to date for the most accurate and dependable information.

V. INTRODUCING FOOD PROCESSING INDUSTRY:

Manufacturing, consumption, and exports of the Indian food production sector have all increased significantly, making it one of the most

significant industries in the nation. The government has taken significant steps to promote investment and growth since the sector was liberalised in August 1991. Examples of these measures include international collaborations, joint ventures, divisions that are entirely focused on exporting, and the granting of industrial licences. Due to this, India received FDI inflows of Rs. 2,934.1 crores in FY21. India continues to play a vital role in the global food industry, contributing significantly to food production and enjoying a burgeoning food and groceries retail market estimated at US\$ 11.3 trillion in 2021 [22].

The food processing business in India has grown recently and is now a thriving new industry that includes a wide range of goods such as poultry, meat, fisheries, vegetables, spices, fruit, dairy products, alcoholic beverages, grains, cocoa products, chocolates, sweets, and more. Notably, the nation's agricultural and processed food exports in FY22 reached an astounding US\$ 25.6 billion, setting a new record. The Directorate General of Commercial Intelligence and Statistics reports that, between April and June 2022, exports of just APEDA items totaled US\$7.4 billion, a 31% increase over the same time in the prior fiscal year [22].

Table 2: Export Growth rate of food processing industry

Product Categories	Export Growth
Fruits and vegetables	59.1% (↑)
Cereals and miscellaneous processed items	37.66% (↑)
Meat, dairy, and poultry products	9.5% (↑)
Basmati rice	25.5% (↑)
Non-basmati rice	5% (↑)
Miscellaneous products	50% (↑)

Source: IBEF (2022) [22]

Through processed vegetables and fruits accounting for 59.1% of all exports, cereals and other processed goods for 37.66%, meat, milk, and poultry items for 9.5%, basmati rice for 25.5% of all exports, non-basmati rice for 5%, and other products for 50%, several product categories experienced significant export growth. APEDA predicts an annualised rate of growth of 3% CAGR through 2022 and 2030 despite the food industry's ongoing transformation.

5.1 Britannia Industries Ltd and ICT.

Britannia Ltd is a recognised firm with a long tradition spanning 120 years, having begun as a biscuit producer in Kolkata in 1892. Today, it serves over a billion people in India, providing a varied assortment of delectable and healthy snacks for a variety of customer categories and events. The firm is quite proud of its goods, which blend

delectable flavours with health advantages. Their aim is to be a Responsible Global Total Foods company, demonstrating their dedication to developing goods that are not only excellent for customers but also beneficial for the environment. Britannia's success is fuelled by their devoted R&D team's on-going innovation, which has resulted in household brands like Good Day, Marie Gold, and 50-50 cookies. In addition to their traditional products, they have created a range of cakes and nutritious snacks, such as NutriChoice Digestive Biscuits and NutriChoice 5 Grain Biscuits, to fulfil the needs of health-conscious consumers. Britannia, as a responsible company, works to reduce its environmental effect by using renewable energy, minimising packaging waste, and encouraging sustainable agricultural practises. They also actively contribute to the improvement of the communities in which they operate [23].

Table 3: Company Performance of Britannia Industries Ltd.

Performance	2018	2019	2020	2021	2022
Revenue from Operation (In Rs. CRS.)	9380	10482	10987	10482	9380
Net Profit (In Rs. CRS.)	948	1122	1484	1760	1603
Dividend (%)	1250	1500	3500	6200	5650
Market Capitalization	59677	74150	64661	87316	77232

(In Rs. CRS.)					
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Source: Britannia Ltd. (2022b) [23]

Britannia Ltd's R&D activities are strategically integrated with sustainability and corporate responsibility, with the goal of leaving a better world for future generations. Their mindful approach extends to environmental effect, with the goal of reducing their carbon footprint, conserving natural resources, minimising waste, and embracing sustainable practises. Notably, their team was instrumental in reaching 'plastic waste neutrality' across their national operations in FY 2021-22, recycling nearly 35,000 metric tonnes of plastic garbage. Britannia Ltd is also committed to harnessing Information and Communication Technology (ICT) in their quest of sustainability, including new ICT solutions to optimise resource management, improve eco-friendly packaging, and streamline operations. Their vision for sustainability is expressed in their aim of achieving 100% Extended Producer Responsibility (EPR) compliance, which includes rethinking packaging, encouraging plastic alternatives, using recycled plastics in food packaging, and removing plastic trays. Britannia Ltd's persistent dedication to sustainability, along with a strategic focus on ICT integration, illustrates their efforts to create a greener and better future [24].

5.2 Amul and ICT:

Amul, India's famed dairy cooperative, has a long history dating back to 1946. It was created in reaction to middlemen's abuse of milk farmers, and it has since evolved into a prominent participant in the dairy business. Amul is a shining example of a successful cooperative model, with millions of milk-producing farmers owning and governing it. Amul's success is built on its constant dedication to quality, innovation, and sustainability. The cooperative's ideals are firmly ingrained, and it aspires to have a beneficial influence on society and the environment. Amul's commitment to sustainability is evident in the numerous efforts they have done throughout the years. Amul fosters and promotes environmentally friendly agricultural practises among its dairy producers. This involves using environmentally friendly cow rearing methods, supporting organic farming, and offering training on sustainable agricultural practises. Amul has invested in new technology and practises to promote energy efficiency throughout its activities. This has not only decreased their environmental effect but also helped them save money.

Waste Management: To reduce its ecological imprint, Amul focuses on proper waste

management. In their manufacturing operations, they have incorporated recycling programmes and waste reduction methods.

Packaging Innovation: The organisation has been at the forefront of creating environmentally friendly packaging solutions. They want to limit their use of plastic and have offered eco-friendly packaging choices as part of their commitment to fighting plastic waste. Amul regularly participates in social programmes to enhance rural areas outside of the dairy sector. They have built programmes to help, among other things, education, healthcare, and women's empowerment.

Product Diversification: Amul has consistently extended its product line to meet shifting customer tastes. In response to changing market needs, this diversification involves the introduction of healthier and more environmentally friendly products. Amul has adopted information technology (IT) in order to optimise its operations and supply chain. IT integration has resulted in more effective logistics, inventory management, and improved communication with stakeholders [25].

5.3 Parle and ICT:

The Chauhan family established the private food manufacturing company Parle Products in Vile Parle (East), Mumbai, in the state of Maharashtra, India, in 1929. The multinational company Parle offers a wide range of goods to customers all over the world, including Parle-G, twenty to twenty Cookies, Happy Happy, Hide & Seek, Krackjack, Magix Creme, Milano, Monaco, and Melody. Although the company's sales in FY22 were great at 16,202 crore (US\$2.0 billion), its net income decreased to 256 crore (US\$32 million). Currently controlled by Vijay Chauhan, Sharad Chauhan, and Raj Chauhan, Parle Products has a dedicated workforce of over 50,500 people who help the business expand with time [26].

5.4 NESTLE India and ICT:

The NESTLÉ Anglo-Switzerland Condensed Milk Company (Export) Limited was the company's first venture in India, where it began importing and selling finished goods in the country's market in 1912. The importance of indigenous manufacturing was underlined in the economic policy of India when it gained independence in 1947. In response, NESTLÉ founded a firm in India and opened its first facility

in 1961 in Moga, Punjab, contributing to the growth of the milk economy as envisioned by the government. NESTLÉ established Agricultural Services to promote growth in Moga, training and advising farmers on better dairy farming practises, irrigation, crop management, and aiding with bank loans. The corporation also established milk collecting centres, assuring fair prices and building trust in the dairy industry, resulting in Moga's metamorphosis into a profitable milk region and bustling industrial hub. For nearly a century, NESTLÉ has been a devoted partner in India's prosperity, employing over one million people directly and indirectly, including farmers and suppliers. Delivering Taste, Nutrition, Health, and Wellness through its product offerings, the company focuses on understanding India's changing lifestyles and client wants. By providing a wide variety of high-quality, secure, and cost-effective food products, the company adds value. It does this by utilising an innovative culture and having access to NESTLÉ Group technology and knowledge. Internationally renowned brands including NESCAFÉ, MAGGI, MILKYBAR, KIT KAT, BAR-ONE, MILKMAID, and NESTEA are produced by NESTLÉ India. Additionally, it has introduced products for everyday use including NESTLÉ Milk, NESTLÉ SLIM Milk, NESTLÉ Dahi, and NESTLÉ Jeera Raita. As a responsible company, NESTLÉ India supports initiatives that improve the standard of living in the regions where it works [27].

Nestlé is boosting its data-driven digital transformation in order to fulfil customer requests and drive growth. They recognise that consumers want to acquire goods and services through a variety of channels and want companies to communicate with them directly while also giving transparency about product manufacturing.

The following are some of the important highlights of Nestlé's digital transformation journey:

1. **E-commerce Acceleration:** Nestlé has started an e-commerce acceleration project, with the goal of implementing comprehensive action plans in several areas to increase e-commerce performance. Their goal is to generate 25% of revenues from e-commerce by 2025. They are developing e-commerce abilities by collaborating with a worldwide community of over 3000 employees who exchange best

practises and participate in online webinars and training sessions.

2. **Always-On Analytics:** Data-driven insights are critical for understanding rapidly changing customer wants and optimising demand-generation efforts. Nestlé uses data analytics and artificial intelligence (AI) to simplify business practises, make real-time adjustments, and optimise marketing efforts. Their strategic revenue management programme covers 95% of markets and uses AI to boost customer collaboration and marketing efficacy.
3. **Digitally Enhanced Operations:** Nestlé uses sophisticated operational planning technologies across its value chain to drive agility and resilience in operations and effectively respond to customer demand. Their digital solutions are used in over 275 factories, allowing connected workers to be very productive and make quick choices. Digital twins and artificial intelligence-based optimisation strategies aid in the reconfiguration of supply networks for cost efficiency and robustness.
4. **Sustainability Validation:** Digitalization contributes to Nestlé's sustainability goal, which includes sustainable packaging, responsible sourcing, and emissions reduction. They employ greenhouse gas performance systems to accurately measure carbon footprints and technologies like OpenSC to validate sustainability claims.
5. **Engaging Consumers Online:** Nestlé communicates with consumers via online recipe platforms, gathering information about culinary tastes and increasing product usage. These platforms enable marketers to communicate with consumers directly, conduct lessons, and provide nutritional advice for balanced diets. Nestlé works with communities and influencers to co-create recipes and personalise content in order to reach a wide range of consumers.

To summarise, Nestlé's data-driven digital transformation is redefining operations, improving consumer interaction, and promoting sustainability throughout the company. Nestlé hopes to match customer expectations, enhance operational efficiency, and remain competitive in a dynamic market by integrating digital technology [28].

Table 4: Revenue of food processing companies

Companies	2020	2021	2022
Britannia (In US\$ Million)	1458.1	1651.3	1777
NESTLE India(In US\$ Million)	1554.9	1678.2	1849.1

LT Foods(In US\$ Million)	52	59.6	68.2
Kohinoor Foods(In US\$ Million)	2.7	3.3	1.2

Source: IBEF (2022) [22]

According to Table 4, which depicts food processing firms' income from 2020 to 2022:

1. Britannia's income has consistently climbed throughout the years, rising from \$1458.1 million in 2020 to \$1651.3 million in 2021 and \$1777 million in 2022.
2. NESTLE India's income increased steadily, beginning at \$1554.9 million in 2020, rising to \$1678.2 million in 2021, and reaching \$1849.1 million in 2022.
3. LT Foods' sales increased gradually, beginning at \$52 million in 2020, rising to \$59.6 million in 2021, and reaching \$68.2 million in 2022.
4. Kohinoor Foods, on the other hand, faced revenue volatility. It started at \$2.7 million in 2020, increased to \$3.3 million in 2021, and then fell to \$1.2 million in 2022.

5.5 ICT Tools:

In order to increase productivity, quality, and safety, India's food processing industry has generally embraced a range of ICT (Information and Communication Technology) solutions. The food processing sector in India uses the following ICT tools::

1. **Enterprise Resource Planning (ERP) Systems:**ERP systems are used to connect numerous business operations onto a single platform, such as inventory management, supply chain management, production planning, and financials. They assist food processing firms in streamlining operations and making data-driven choices [29-30].
2. **Quality Management Systems (QMS):**Quality Management Systems (QMS) tools are used to maintain and improve product quality and safety requirements. They allow businesses to comply with regulatory standards and certifications such as ISO 22000 and HACCP [31].
3. **Internet of Things (IoT) Applications:**IoT devices are utilised in the food processing sector to monitor and control numerous operations. They aid in real-time data collecting, temperature monitoring, and quality control, as well as decreasing waste and improving traceability [32].
4. **Big Data Analytics:**Tools for big data analytics are used to handle vast amounts of data collected during food processing activities. They aid in

demand forecasting, supply chain optimisation, and overall efficiency [33].

5. Food Traceability Systems: These systems track and trace food products from farm to fork using technology such as RFID (Radio-Frequency Identification) and barcodes. They improve food safety and allow for prompt recall in the event of contamination [34-35].

6. Mobile Applications: Mobile apps are used for various purposes, including order management, delivery tracking, and customer engagement. They help food processing companies improve their customer service and reach a wider audience[36-37].

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VI. INDUSTRY ANALYSIS OF FOOD PROCESSING INDUSTRY THROUGH ABCD LISTING:

The ABCD analysis was designed by Aithal, P. S. et al. (2015) [38] to identify the business framework Aithal, P. S. et al. (2015) [38] developed the ABCD analysis to identify the business framework and assess its effectiveness in providing value to stakeholders. When these assessments are applied, they generate an ordered list of the company's benefits, advantages, limitations, and drawbacks. It uses the ABCD analysis framework to examine if a notion or idea is applicable in a certain circumstance. For instance, Aithal, P. S., (2017) [39] recently created this analytical method in the context for company analysis. The various Disadvantages, Constraints, Benefits, and Advantages of Novel Research catalogues [40], Global Business and its Settings' study [41], Six Thinking Hats Grounded Analysis [42], Invention in B.TechProgram as B.Tech (Hons) [43], Organising the Unorganised LifeStores [44], and Green Schooling [45] are also listed in other articles. To analyse the advantages, benefits, limits, and downsides of ICT in the food processing business of India, the current study also acquired an ABCD analytical framework..

ADVANTAGES	BENEFITS
<p>1. Higher Efficiency: ICT solutions may simplify and automate numerous food processing operations, resulting in higher efficiency and fewer manual mistakes. This covers inventory management, production planning, and quality control, all of which may be improved with the use of ICT technologies.</p> <p>2. Improved Food Safety: Information and communication technology (ICT) offers real-time monitoring of crucial factors in the food production chain, such as temperature, humidity, and storage conditions. This assists in the identification of possible dangers and ensures that food safety requirements are met, lowering the risk of contamination and spoiling.</p> <p>3. Data-Driven Decision Making: Companies may use ICT to gather and analyse massive volumes of data relating to production, supply chain, and customer preferences. This data-driven strategy enables firms to make better informed decisions, optimise operations, and efficiently adjust to market needs.</p> <p>4. Traceability and Transparency: ICT technologies improve food product traceability across the supply chain. This implies that the route of a food item may be tracked from farm to fork, allowing for the prompt detection and resolution of any concerns relating to quality, safety, or authenticity.</p>	<p>1. Inventory Management: ICT solutions make it easier to keep track of inventory levels, raw materials, and completed goods. This improves supply chain management, cuts waste, and ensures that output matches demand, resulting in cost savings and effective resource utilisation.</p> <p>2. Improved Product Development: ICT enables virtual testing and simulations, which can speed up product development in the food business. This allows businesses to experiment with novel recipes, ingredients, and manufacturing procedures without having to conduct significant physical testing.</p> <p>3. Market Expansion and E-Commerce: ICT allows food processors to access a larger audience via e-commerce platforms and online marketplaces. This growth might result in improved sales and worldwide market access, hence fostering corporate growth.</p> <p>4. Compliance and Regulatory Support: Information and communication technology (ICT) solutions may help with compliance with numerous food industry rules and standards. Businesses may guarantee they satisfy regulatory standards and retain relevant certifications by automating record-keeping and reporting operations.</p>
CONSTRAINTS	DISADVANTAGES
<p>1. Implementation expenditures: Implementing ICT systems can incur large upfront expenditures, such as hardware, software, and training. Small and medium-sized food processors may find it difficult to appropriate money for such expenditures, restricting their capacity to implement cutting-edge technology.</p> <p>2. Infrastructure and access: The availability and dependability of internet access may be restricted in many countries, particularly rural ones. This lack of sturdiness might impede the flawless integration and operation of ICT systems, compromising data transfer and real-time monitoring.</p> <p>3. Technological Complexity: ICT (information and communication technology) solutions for the food processing industry can be challenging to set up and maintain, requiring particular technical knowledge. Businesses may have trouble finding qualified candidates or may need to provide current personnel more training to use these advances effectively.</p> <p>4. Employee Resistance to Change: Employees who are accustomed to old ways may be resistant to</p>	<p>1. Regulatory Compliance Issues: To maintain food safety and quality, the food processing sector is subject to stringent rules and standards. Integrating ICT solutions while adhering to these standards may be difficult and time-consuming.</p> <p>2. Over-Reliance on Automation: While automation can boost productivity, over-reliance on technology may result in less human participation. This may have an impact on general awareness of food processes as well as adaptation to unanticipated events.</p> <p>3. Technological Obsolescence: The ICT sector advances quickly, and cutting-edge technology today may become obsolete in a short period of time. Companies may confront difficulties in keeping up with the newest technological advances and changing their systems accordingly.</p>

the introduction of ICT. Adapting to new technology and procedures may need an organisational cultural shift, demanding appropriate change management solutions.

4. Concerns about data privacy: ICT systems retain massive volumes of data relating to manufacturing, supply chain, and customer preferences. Maintaining consumer confidence and preventing unauthorised access requires effective data privacy safeguards and compliance with data protection legislation.

-Compiled by the author

VII. FINDINGS:

The study indicated the following findings:

1. India continues to be a major player in the global food business, contributing considerably to global food production and having a thriving food and grocery retail market.
2. India's food processing sector has grown into a thriving business, producing a diverse range of items such as fruits, vegetables, meat, dairy, cereals, cocoa products, and more.
3. India's agricultural and processed food exports reached an all-time high of \$25.6 billion in fiscal year 22.
4. Export growth rates for several food processing product categories have been exceptional, with fruits and vegetables, cereals, and other processed commodities all exhibiting considerable increase.
5. Britannia Industries Ltd, Amul, Parle Products, and NESTLE India are all well-known names in the Indian food processing business, each with their unique dedication to sustainability and corporate responsibility.
6. These businesses are incorporating information and communication technology (ICT) into their operations to enhance resource management, eco-friendly packaging, expedite procedures, and communicate with customers.
7. Information and communication technology (ICT) solutions such as ERP systems, quality management systems, IoT applications, big data analytics, food traceability systems, and mobile apps are critical in driving efficiency and growth in the food processing sector.
8. R&D operations of Britannia Industries Ltd are strategically linked with sustainability initiatives to achieve a greener and better future.
9. To lower its ecological impact, Amul aggressively promotes ecologically responsible farming practises, waste management, and packaging innovation.
10. Parle Products is a privately held food manufacturing firm with a varied product line that includes well-known trademarks such as Parle-G and Hide & Seek.

11. With a long history in the nation, NESTLE India is concentrating on data-driven digital transformation to meet consumer requests, promote sustainability, and stay competitive in the market.

In the food processing industry, information and communication technology (ICT) provides several benefits, including increased efficiency through automation, improved food safety through real-time monitoring, data-driven decision-making for optimised production, and improved traceability and transparency in the food logistic operation. However, there are barriers to deploying ICT, such as high initial investment costs, technological complexity, data security issues, and employee resistance to change. Regardless of the advantages, careful planning and investment, as well as resolving cyber security risks and providing sufficient training are required to properly exploit ICT's potential in the food processing business.

VIII. RECOMMENDATIONS:

As per the investigation recommendations for the Indian food processing industry include continued government support through policies that encourage investment and ease of doing business, prioritising sustainability practises such as renewable energy and eco-friendly packaging, embracing and investing in ICT solutions for optimised operations and supply chain management, diversifying product offerings to align with changing consumer demands, and expanding export opportunities through e-commerce platforms. By implementing these ideas, the sector may continue to thrive, fulfil customer demands, and contribute to a more sustainable future.

IX. CONCLUSION:

The study of communication and information technology's (ICT) impact on India's booming food processing industry revealed the extent of its influence and the potential for further growth. The sector's embrace of ICT has resulted in

increased efficiency through automation, improved food safety through real-time monitoring, data-driven decision-making for optimised production, and greater traceability and transparency in the food supply chain. Despite the benefits, ICT deployment is fraught with difficulties, including high initial investment costs, technological complexity, data security issues, and employee reluctance to change. To fully realise the promise of ICT, the government should continue to assist the industry through favourable regulations that stimulate investment and ease of doing business. Sustainability practises, such as renewable energy and eco-friendly packaging, can help to make the food processing industry greener and more responsible. Businesses should invest in ICT solutions to simplify operations and supply chain management, allowing them to more effectively satisfy changing customer needs. Furthermore, broadening product offerings and investigating export potential via e-commerce platforms helps boost the industry's worldwide competitiveness. By following these ideas, India's food processing business may grow, exceed customer expectations, and contribute to a more sustainable future. Overall, the report emphasises the importance of ICT in fostering innovation and growth in the food processing industry. It offers significant insights for governments, entrepreneurs, and stakeholders trying to leverage technology's revolutionary impact in a dynamic and ever-changing sector. With careful planning, investment, and a dedication to sustainability, India's food processing sector is prepared for future success and resilience.

REFERENCES:

- [1] Kachru, R. P. (2010). Agro-processing industries in India: Growth, status and prospects. *Journal Indonesian Agroindustries*, 13(2), 167-181. [Google Scholar](#)
- [2] Singh, G., Daultani, Y., & Sahu, R. (2022). Investigating the barriers to growth in the Indian food processing sector. *OPSEARCH*, 59(2), 441-459. [Google Scholar](#)
- [3] Singh, S. P., Tegegne, F., & Ekanem, E. P. (2012). The food processing industry in India: challenges and opportunities. *Journal of Food Distribution Research*, 43(1), 81-89. [Google Scholar](#)
- [4] Murthy, S., & Yogesh, M. S. (2014). An overview of food processing industry in India-challenges and opportunities. *Online International Interdisciplinary Research Journal*, 4(V), 187-193. [Google Scholar](#)
- [5] Tiwari, B. K., O'donnell, C. P., & Cullen, P. J. (2009). Effect of non thermal processing technologies on the anthocyanin content of fruit juices. *Trends in Food Science & Technology*, 20(3-4), 137-145. [Google Scholar](#)
- [6] Nowosad, K., Sujka, M., Pankiewicz, U., & Kowalski, R. (2021). The application of PEF technology in food processing and human nutrition. *Journal of Food Science and Technology*, 58, 397-411. [Google Scholar](#)
- [7] Rais, M., Acharya, S., & Sharma, N. (2014). Food Processing Industry in India :S&t Capability, Skills and Employment Opportunities. *Journal of Rural Development*, 32(4), 451-478. [Google Scholar](#)
- [8] Singh, R. K., Luthra, S., Mangla, S. K., & Uniyal, S. (2019). Applications of information and communication technology for sustainable growth of SMEs in India food industry. *Resources, Conservation and Recycling*, 147(1), 10-18. [Google Scholar](#)
- [9] Song, M., Wang, J., & Zhao, J. (2018). Coal endowment, resource curse, and high coal-consuming industries location: Analysis based on large-scale data. *Resources, Conservation and Recycling*, 129(1), 333-344. [Google Scholar](#)
- [10] Adjei-Bamfo, P., Maloreh-Nyamekye, T., & Ahenkan, A. (2019). The role of e-government in sustainable public procurement in developing countries: A systematic literature review. *Resources, Conservation and Recycling*, 142, 189-203. [Google Scholar](#)
- [11] Rais, M., Acharya, S., & Vanloon, G. W. (2016). Food processing industry: Opportunities in north east region of India. *Nehru J*, 12(1), 37-51. [Google Scholar](#)
- [12] Mahant, M., Shukla, A., Dixit, S., & Patel, D. (2012). Uses of ICT in Agriculture. *International Journal of Advanced Computer Research*, 2(1), 46-49. [Google Scholar](#)
- [13] Gouvea, R., Kapelianis, D., Li, S., & Terra, B. (2022). Innovation, ICT & food security. *Global Food Security*, 35(12), 1-1. [Google Scholar](#)
- [14] Raja, V., Krishnamoorthy, S., Moses, J. A., & Anandharamakrishnan, C. (2022). ICT applications for the food industry. In *Future Foods* (pp. 613-626). Academic Press. [Google Scholar](#)
- [15] Hassan, M. S., Shaffril, M., Azril, H., & D'Silva, J. L. (2009). Problems and

- obstacles in using information and communication technology (ICT) among Malaysian agro-based entrepreneurs. *European Journal of Scientific Research*, 36(1), 93-101. [Google Scholar](#)
- [16] Yao, C., Peng, X., Kurnia, S., & Rahim, M. (2022). Understanding factors affecting the adoption of ICT-enabled sustainable supply chain management practices, *Proceedings of the 55th Hawaii International Conference on System Sciences*, 1(1), 5090- 5099. [Google Scholar](#)
- [17] Kalaba, M. W., & Lefophane, M. H. (2021). The effects of information communication technology policy alternatives on South Africa's agro-processing industries (Doctoral dissertation, University of Pretoria). [Google Scholar](#)
- [18] Kumar, A., Singh, R.K. & Modgil, S. (2020). Exploring the relationship between ICT, SCM practices and organizational performance in agri-food supply chain, *Benchmarking: An International Journal*, 27(3), 1003-1041. [Google Scholar](#)
- [19] Domenech, J., Martinez-Gomez, V., & Mas-Verdú, F. (2014). Location and adoption of ICT innovations in the agri-food industry. *Applied Economics Letters*, 21(6), 421-424. [Google Scholar](#)
- [20] Khan, S. A., Ahmad, S., & Jamshed, M. (2019). Role of skill India initiative in Indian food processing industries. *Economic Affairs*, 64(1), 77-84. [Google Scholar](#)
- [21] Punjabi, M. (2007, September). Emerging environment for agribusiness and agro industry development in India: key issues in the way forward. In *Asian Workshop on Enabling Environments for Agribusiness and Agro-Industry Development*, Bangkok (pp. 17-19). [Google Scholar](#)
- [22] IBEF (2022). India's Food Processing Industry. Retrieved from: <https://www.ibef.org/research/case-study/india-s-food-processing-industry#:~:text=The%20industry%20produces%20several%20food,items%20and%20high%2Dprotein%20foods.> on 27/07/2023.
- [23] Britannia Ltd. (2022a). Britannia Industries Ltd. Website. Retrieved from: <https://www.britannia.co.in/about-us#!> On 27/07/2023.
- [24] Britannia Ltd. (2022b). Annual Report 2021-22. Retrieved from: <https://www.britannia.co.in/data/Annual Report 2021 22 6eb6f3ae88.pdf> on 27/07/2023.
- [25] Amul (2022). Amul Dairy Sustainability Report (2021-22). Retrieved from: https://amul.com/files/pdf/annual_sustainability_report_2704.pdf on 27/07/2023
- [26] Wikipedia contributors. (2023, July 7). Parle Products. In *Wikipedia, The Free Encyclopedia*. Retrieved 17:10, July 27, 2023, from https://en.wikipedia.org/w/index.php?title=Parle_Products&oldid=1163971134
- [27] NESTLE. (2022). All About NESTLÉ, Retrieved from: <https://www.nestle.in/aboutus/allaboutnestle/C3%A9> on 23/07/2023.
- [28] NESTLE. (2022). Accelerating data-driven digitalization. Retrieved from: <https://www.nestle.com/investors/annual-report/digitalization> on 23/07/2023.
- [29] Singh, T. P., & Ahuja, I. S. (2017). Evaluating manufacturing performance through strategic total productive maintenance implementation in a food processing industry. *International Journal of Productivity and Quality Management*, 21(4), 429-442. [Google Scholar](#)
- [30] Haberli Jr, C., Oliveira, T., & Yanaze, M. (2017). Understanding the determinants of adoption of enterprise resource planning (ERP) technology within the agri-food context: the case of the Midwest of Brazil. *International Food and Agribusiness Management Review*, 20(5), 729-746. [Google Scholar](#)
- [31] Roy, R. (2020). Food Processing Industries: Concept, Issues & Food Safety-Maize & Milk Processing, *YariQualiTech*, 1(1), 1-92. [Google Scholar](#)
- [32] Persis, D. J., Venkatesh, V. G., Sreedharan, V. R., Shi, Y., & Sankaranarayanan, B. (2021). Modelling and analysing the impact of Circular Economy; Internet of Things and ethical business practices in the VUCA world: Evidence from the food processing industry. *Journal of Cleaner Production*, 301(1), 1-13. [Google Scholar](#)
- [33] Sharma, J., Tyagi, M., & Bhardwaj, A. (2020). Parametric review of food supply chain performance implications under different aspects. *Journal of Advances in Management Research*, 17(3), 421-453. [Google Scholar](#)
- [34] Dandage, K., Badia-Melis, R., & Ruiz-García, L. (2017). Indian perspective in food

- traceability: A review. *Food Control*, 71(1), 217-227. [Google Scholar](#)
- [35] Badia-Melis, R., Mishra, P., & Ruiz-García, L. (2015). Food traceability: New trends and recent advances. A review. *Food control*, 57(1), 393-401. [Google Scholar](#)
- [36] Arora, N., & Manchanda, P. (2023). Investigating consumer intention to use food delivery mobile applications: an Indian perspective. *International Journal of Business Innovation and Research*, 30(3), 407-433. [Google Scholar](#)
- [37] Ghosh, D. (2020). Customer satisfaction towards fast food through online food delivery (OFD) services: an exploratory study. *International Journal of Management (IJM)*, 11(10), 645-658. [Google Scholar](#)
- [38] Reshma., Aithal, P. S., & Acharya, S. (2015). An empirical study on Working from Home: A popular e-business model. *International Journal of Advance and Innovative Research*, 2(2), 12-18. [Google Scholar](#)
- [39] Aithal, P. S., (2017). ABCD Analysis as Research Methodology in Company Case Studies. *International Journal of Management, Technology, and Social Sciences (IJMTS)*, 2(2), 40-54. [Google Scholar](#)
- [40] Aithal, P. S. (2017). ABCD Analysis of Recently Announced New Research Indices. *International Journal of Management, Technology, and Social Sciences (IJMTS)*, 10(10), 65-76. [Google Scholar](#)
- [41] Aithal, P. S. (2017). A critical study on Various Frameworks used to analyse International Business and its Environment. *International Journal of Applied Engineering and Management Letters (IJAEML)*, 1(2), 78-97. [Google Scholar](#)
- [42] Rangji, P. K., & Aithal, P. S. (2020). Academic Institutions Risk Decisions using Six Thinking Hats based Analysis. *International Journal of Case Studies in Business, IT, and Education (IJCSBE)*, 4(2), 270-279. [Google Scholar](#)
- [43] Aithal, P. S., & Aithal, S. (2019). Innovation in B. Tech. Curriculum as B. Tech.(Hons) by integrating STEAM, ESEP & IPR features. *International Journal of Case Studies in Business, IT, and Education (IJCSBE)*, 3(1), 56-71. [Google Scholar](#)
- [44] HR, G., & Aithal, P. S. (2020). Organizing the Unorganized Lifestyle Retailers in India: An Integrated Framework. *International Journal of Applied Engineering and Management Letters (IJAEML)*, 4(1), 257-278. [Google Scholar](#)
- [45] Aithal, P. S., & Rao, P. (2016). Green education concepts & strategies in higher education model. *International Journal of Scientific Research and Modern Education (IJSRME)*, 1(1), 793-802. [Google Scholar](#)