

A Systematic Analysis Of The Food Processing Sector In India

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Abstract

This study provides a systematic analysis of food processing industry in India. Food is one of the basic necessities of human life.¹ The objective is to provide a systematic review of the food processing industry in India. This study is divided into four folds: 1. to understand the current status of the food processing sector worldwide; 2. to analyze the area/scope of the food processing industry in India; 3. to know the key challenges in the food processing industry and lastly to understand the benefits of the food processing industry. At the end of the study the future key sectors of the research are explained.

Key Words: Systematic analysis, food processing, industry, global ranking

1. INTRODUCTION

Food processing is a growing science and technology in the current scenario in India. While in its simplest form food processing may be as old as the discovery of fire, modern technology driven food processing has a relatively short and recent history of evolution, possibly dating back to the middle of the 20th century. The main focus of the food processing is to provide food during the scarcity. In the past three decades demand for the processed food in the Indian society has increased due to key drivers of enhancement in the personal income, construction and increasing urbanization and changed eating habits of the people.² Food processing industry also facilitates the commercialization of agriculture and enhancement of factor income.³ Food processing is a series of converting the unprocessed food into foodstuffs with prolonged shelf life. In developing countries the aim of the food processing is to enhance the taste, nutritional value and aroma of the food.⁴ Employment opportunities, prevention of the wastage of food and effective storage for the security of food are also provided by the food processing industry. Approximately 25 to 30 percent of monetary loss caused by the inadequate facilities of the storage, transportation and processing.⁵ Food processing and storage help in the proper utilization and make availability of the food during off season also by enhancing the shelf life of the food.

Food processing has been defined as a 'synergic application of different physical processes to transform raw animal or plant materials into consumer-ready products'. Food processing and food business in general is currently promoted as an economic policy in various countries for different reasons such as for meeting consumer tastes, convenience and nutrition demands as well as for

achieving food security of the poor. As agricultural activities get diversified by strong food processing industry and also create support for export of the processed food.⁶ Food processing industry is the largest industry in India including fruits and vegetables processing, poultry processing, dairy, fisheries and many more.⁷ However, bakery industry among the food processing industry in India is the major and secures second place. Bakery products are demanded because of the ready to eat convenience and better shelf life.⁸ Furthermore, fruits and vegetable farming for food processing is not only provide employment, but also raises the profit of the farmers.⁹ Agriculture is one of the important sectors in Indian economy. Its contribution in GDP is 14% and in the export is 11%¹⁰. Agriculture is the major source of income for about 50 percent of the Indian population.

Major states engaged in food processing are Andhra Pradesh specializing in fruits, vegetables and grains, Gujarat leading in oil and dairy, Maharashtra with fruits vegetables, grains and beverages being strong points. The level of processing however is considered low in relation to the quantum and variety of items produced by India's agriculture.

Moreover, there has been crisis in the food supply that leads to poverty, hunger and food insecurity since the outbreak of COVID-19. In spite of this the problem of transportation of goods during the lockdown was on its peak globally¹¹.

The present study is designed to highlight the major trends, themes and the current status of the food processing industry in India via the systematic review of literature and systematic mapping of the number of articles considered for this study.

1.1 Why this area of study

Food processing sector is emerging as a sun rise sector and ranks fifth among the Indian industries in terms of production, consumption, and exports and promote the entrepreneurial activities to a greater extent. It is also believed to present the largest employment opportunity per unit of investment. India's share in global processed food trade is only 1.6% but is expected to increase to 3% by 2015 (NSDC, 2010). India's FPI is estimated to be at USD 67 billion (Rs 3600 billion) and the entire food industry at USD 180 billion (KPMG-ASSOCHAM, 2009).

As per the records of 2005-06 to 2009-10, the share of food processing in GDP was on continuous rise with a CAGR of 8.40%¹² and its share in the total GDP of the India was 1.5%¹³. Food processing sector is one of the largest sector in India, it ranks fifth in the terms of production, consumption, export and expected growth.¹⁴ Majority of the sector was occupied by the small sized industries contributing more than 70% of the output in volume terms and 50% in value terms.¹⁵ Small and medium-sized enterprises (SMEs) play an important role in this sector in terms of innovation technologies. Gupta & Subramanian, 2016 worked on the medium sized enterprises Based in Kerala and found major factors namely: technology, financial resources, top management and also the customer and supplier relationship responsible for the innovation practices.¹⁶ India is well known for its availability of raw material and appropriate fiscal policies.¹⁷ In spite of the next to China in producing the food India accounts only 1.5% of the total worldwide trade in food industry.¹⁸

1.2 Research questions of the study

This research seeks to achieve the following comprehensive research questions:

1. What are the major trends and current status of the food processing industry in India in the existing literature?
2. What are the major themes in the area of food processing industry in India?

3. What are the key challenges in food processing industry?
4. What are the benefits of the food processing industry in India?

1.3 Objectives of the study

The first objective mainly focused on the summarization and synthesizing of the findings of the existing review of literature published during 2013 to 2022. To achieve this objective systematic review of literature is opted as a review method. The second objective is focused on the areas of the food processing sector in which studies have been considered by the researchers. Mapping of the 269 studies has been done by the researcher to summarize the key themes and contents of the food processing industry in India.

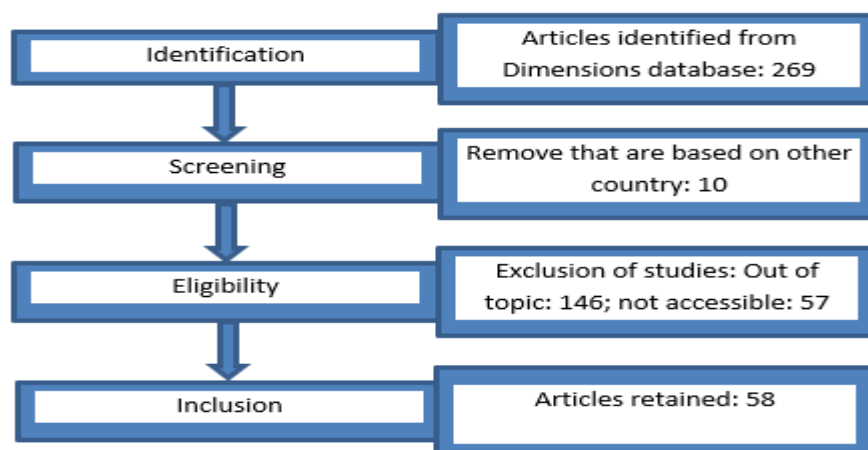
2. RESEARCH METHODOLOGY

The aim of this study is to present an overview of the food processing industry in India. Researcher performed the systematic literature review in order to answer the questions of the research. As no study was found to be performed on the systematic literature review by the researcher on the topic performance of the food processing industry in India Inclusion as well as exclusion criteria were selected by the researcher in order to include and exclude the relevant studies from the all areas namely: Commerce and Management; Human society; Agriculture and Economics to name a few. Abstracts of the 269 research articles were read by the researcher to decide whether study is relevant to the research topic or not. The studies that were not found to be relevant to the research topic, excluded from the research. Figure 1 exhibits the steps of performing literature review.

2.1 Data collection

The data was collected from the dimensions database, one of the most important databases to perform the systematic literature review. Researcher also included the reports that are published Government of India to avoid any research missed related to the food processing industry. The data was collected from 2013 to 2022 to acquire the most recent searches on the food processing industry in India. The total number of articles found from the Dimensions data base was 269 in number from the various sector namely: commerce, management and tourism; human society; agricultural, veterinary and food sciences; developmental studies; food sciences; strategy, management and organizational behavior; engineering; economics and many more. The abstract and conclusions of each and every article were carefully studied to decide on the article that will be included in the final review analysis. The articles that are based on the other country's database were removed by the researcher. To accurate the final analysis the articles were further screened and researcher excluded 202 articles that were not directly related with the topic under study. Finally, 58 articles were published between 2013 to 2022 (from the dimensions data base) were included for the final analysis.

Fig 1: Literature search process (adopted from Elkhwesky & Elkhwesky, 2022)¹⁹



Data analysis

At the review stage the researcher carefully analyze all the 50 articles for the final analysis. At this stage researcher examined the abstract, review of literature, sampling techniques, data interpretation and findings of each and every article selected for the final analysis. The food processing sector, its relevancy in today's scenario, benefits for the society, employment opportunities provided by the industry, contribution in the GDP of India and export and steps taken to avoid the hazardous effect of processing by the industry all were collected and merged in the Microsoft excel sheet by the researcher which was used in the analysis of the literature. Basic information of the food processing sector was taken from the introductory part of the researchers. The contribution made by the food processing sector in GDP and export was included from the analytical part of the research articles.

3. RESEARCH ARTICLES USED IN THE STUDY

The number of empirical studies and review studies are approximately equal in this systematic review. 28 research articles used review analysis of the data, whereas, 24 research articles used the empirical research method. 4 research articles are based on the case study method whereas 2 are the books that were reviewed systematically in this analysis. Delphi method, systematic analysis, cluster sampling method, fuzzy interpretive structural modeling and sensitivity analysis are some of the sampling techniques that were used in the research articles. Top Indian food processing firms were gathered during the case study analysis by the researchers. The major themes of the studies were to gather the information employment generated by the food processing industry; impact of foreign direct investment; impact on export industries; methods of food processing (example: Drying); methods of storage (example: Cold storage); food colors added to ready-to-eat and many more. The foods that were found to be processed in most of the studies were potatoes, shrimp, baby food, milk and millets to name a few.

4. REVIEW FINDINGS

To answer the research questions, the research analysis is arranged into four parts. This study exhibits the following: (1) Geographical distribution of the studies in the food processing Industry in India; (2) Scope/Area of the food processing industry in India; (3) Challenges of food processing sector in India and (4) Benefits of food processing sector in India. This research also highlighted the practical implications and future recommendation for food processing sector. In the end this research was ended with the future key sectors of the food processing industry in which study can be explored by the researchers.

4.1 Research question 1: Status of food processing industry

The geographical distribution of the empirical studies that are focused on the food processing industries in India is presented in this section. Majority of the articles published in India followed by United States, Australia, Netherlands and United Kingdom.

Figure 1 classifies the articles based on the countries. The majority of the studies were conducted in India (73%) followed by other countries (23%). Table 1 exhibits the areas of food processing study. Since 2013 the studies were conducted in United Kingdom, Germany followed by India in 2017 and 2018. Currently, the area of the food processing studies is dominant in Malaysia since 2020 as exhibited in the figure 1.

Figure 1: Classification of articles based on the Countries

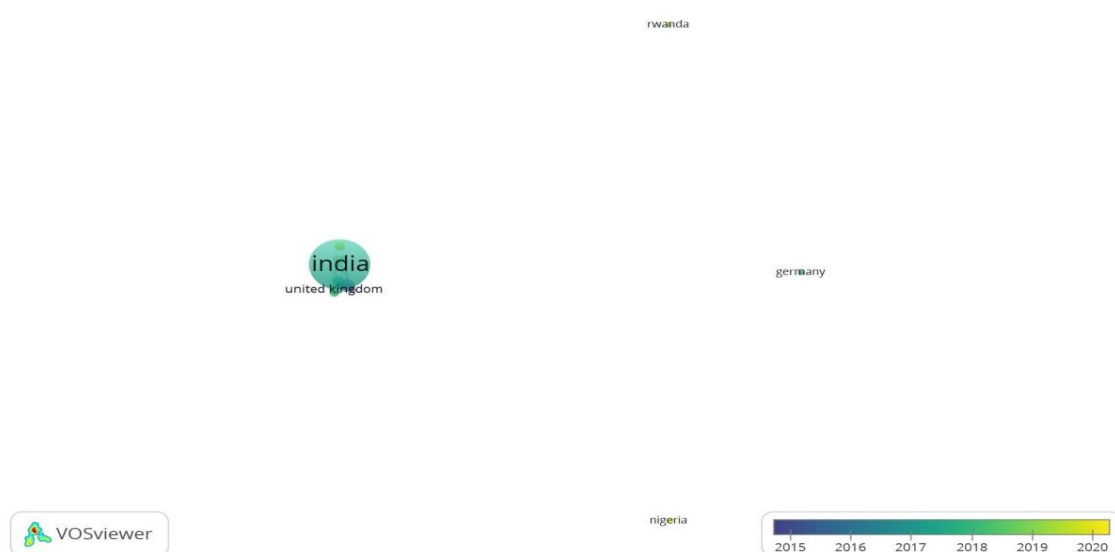


Table 1: Classification of articles based on the countries

Country	Documents	Citations
India	115	1348
United states	8	387
Australia	5	152
Netherlands	2	24
United Kingdom	5	57
Canada	3	17
China	2	235
Indonesia	3	14
Malaysia	4	25
Denmark	2	184
Turkey	3	57
Germany	2	12
Nigeria	2	0
Rwanda	2	3

4.2 Research question 2: Areas/Scope of research in food processing sector in India

Figure 2 exhibits the major areas of the food processing industry in India. The major areas of research are zero hunger followed by decent work and economic growth; industry, innovation and infrastructure; responsible consumption and production; affordable and clean water; climate action

and quality education. Indian economy was severely break due to COVID-19 in effect affect the farmers, supply of food, manpower supply and resulting in poverty, hunger and non-availability of food in many areas of the country²⁰. Since 2019 research in food processing sector and ICT investment is prominent as shown in the figure 3. In India the food processing industry is regarded as one of the important sector in employment generation. The employment rate in food processing industry is about 13 million people directly and 35 million people indirectly²¹. E-commerce adoption in food processing industry is beneficial as it provides a vast number of benefits in terms of cost reduction, convenient entry to global market, enhancer in transaction speed, improvement in relationship with firm's suppliers and customers, and also overall improvement of firm's efficiency and performance²².

Figure 2: Areas of study in the food processing industry

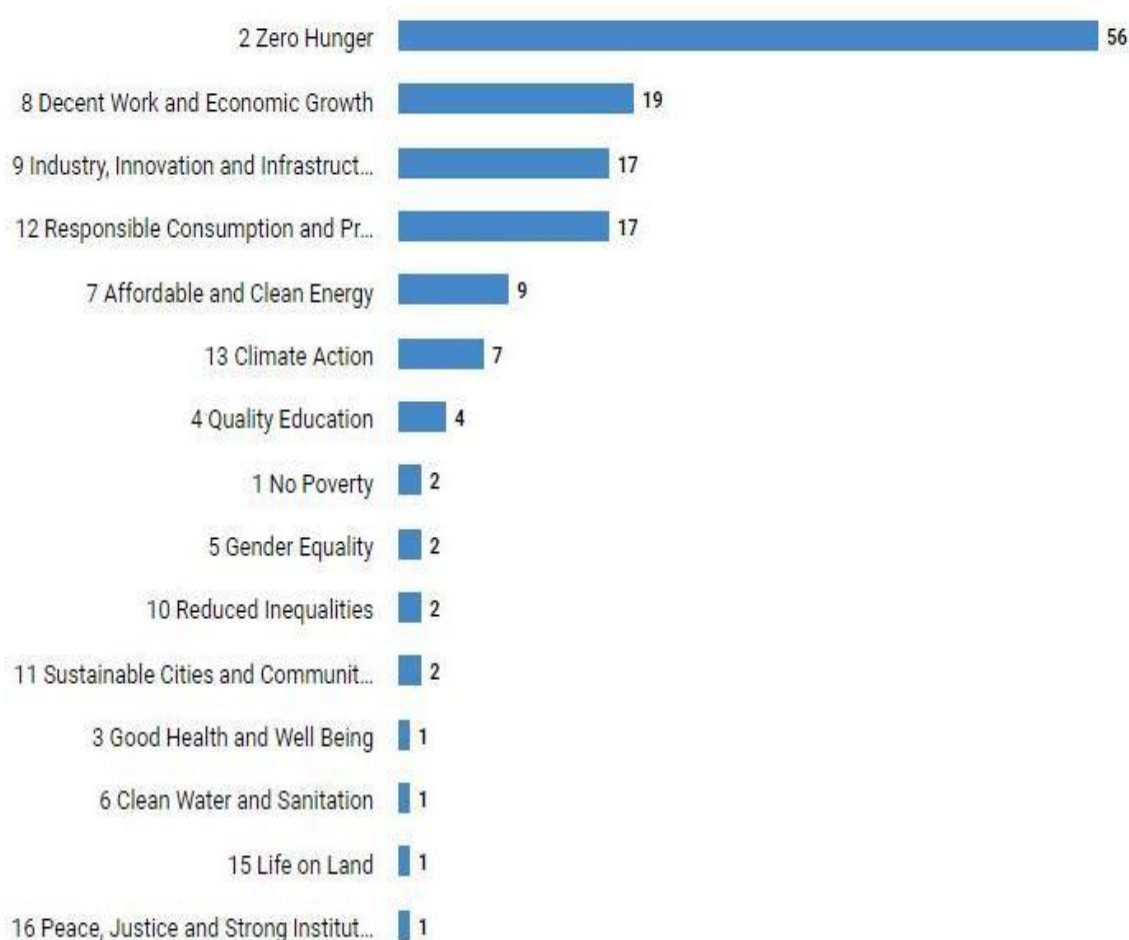
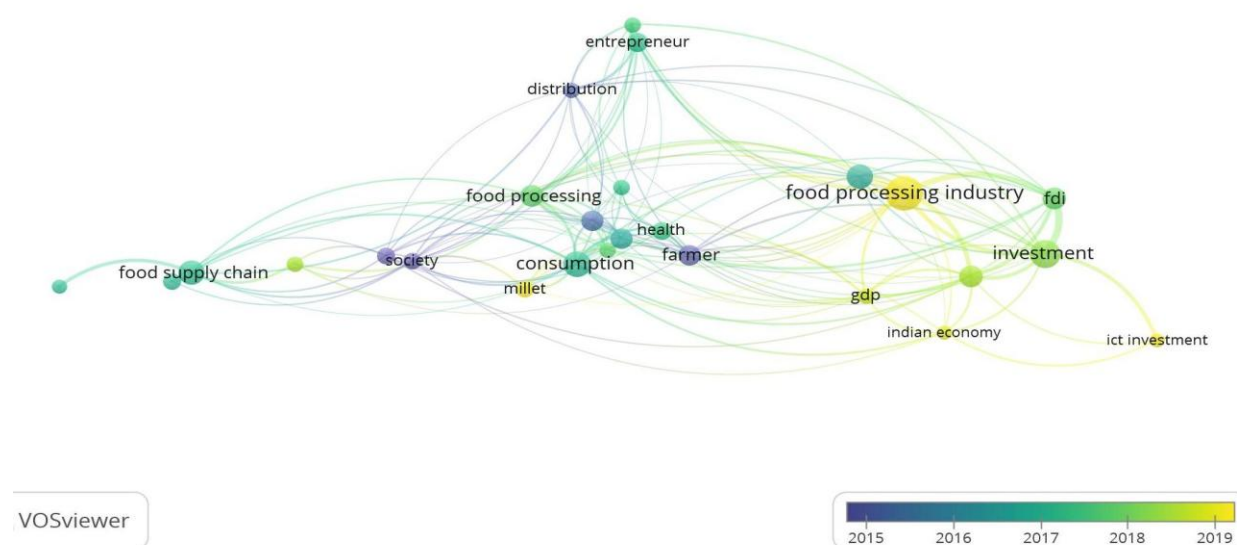


Figure 3: Key areas of research in food processing industry



4.3 Research question 3: Key challenges in food processing industry

Generally the food processing industry is categorized in two categories namely: processed food and value-added processed food. Processed food category have short to medium shelf life that depends upon the storage and weather conditions. It includes milk, flour, rice, spices, vegetables, fruits, pulses and salt that may be in packed or unpacked condition. Many challenges, for example, wastage of the food and contamination lies in case of food sold without packaging. While, processed food products includes juices, jams, pickles, processed vegetables and fruits, poultry, dairy and chocolates products. These are processed food products using natural or artificial food preservatives before packaging and hence, longer shelf life. The biggest challenge for this food processing sector in today's scenario is to produce minimally processed food i.e. no use of chemical preservatives and minimal compromise on the nutritional value of the food.²³ To increase the shelf life lactobacillus NCDC 291 can be directly added to food. Moreover, food loss is high during the food processing. Carbon emission, environmental degradation and greenhouse gas are some effect of food loss, if they are not disposed to the environment properly. However reverse logistics practices helps to manage the future demand as well as save the environment in the food processing industry.²⁴ Furthermore, during processing the quality of the packaged fruit juice is get affected and it can cause health hazards of the customers due to chemical, biological and physical alternations. Chromatography, spectrophotometry, electrophoresis and titration are some of the standard analytical method that is used to assess the quality of the packaged fruit juices. Also, biosensors are used for the detection of spoilage in packaged fruit juices.²⁵

Another big challenge for the food processing industry is to maintain the quality of food for a longer period of time. Consumption of spoiled juice that can be caused by biological, chemical or physical deterioration during the processing or packaging stage of the juice may cause serious health hazards of the consumer²⁶. Packaged food is increasing in India since the last few decades. Health related issues are also come along with the convenience. For example, researchers investigated that colours are blended that are not permitted in the ready to eat food²⁷. For example, some of the food products like savouries and miscellaneous foods viz., sugar coated aniseed and almond milk should not contain colours as per the guidelines of the Prevention of the Food Adulteration Act. However they are found to have colours. Moreover road connectivity, electricity, cold storage, capital, warehousing and proper management and transport are also a challenge for the food processing industry in India.

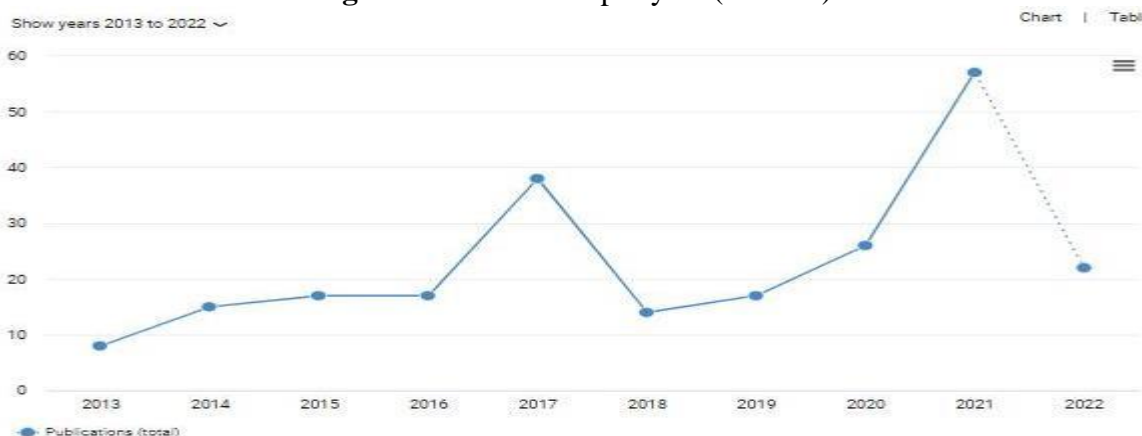
As per researchers²⁸ the major hurdles in the food processing industry of India as per the global ranking includes the following:

- (i) Lack of standardization and quality;
- (ii) Rain dependent farming, Lack of proper cold storage facilities near the farm;
- (iii) High cost of cold chain facilities and Lack of logistics handling facilities

4.4 Research question 4: Benefits of food processing industry in India

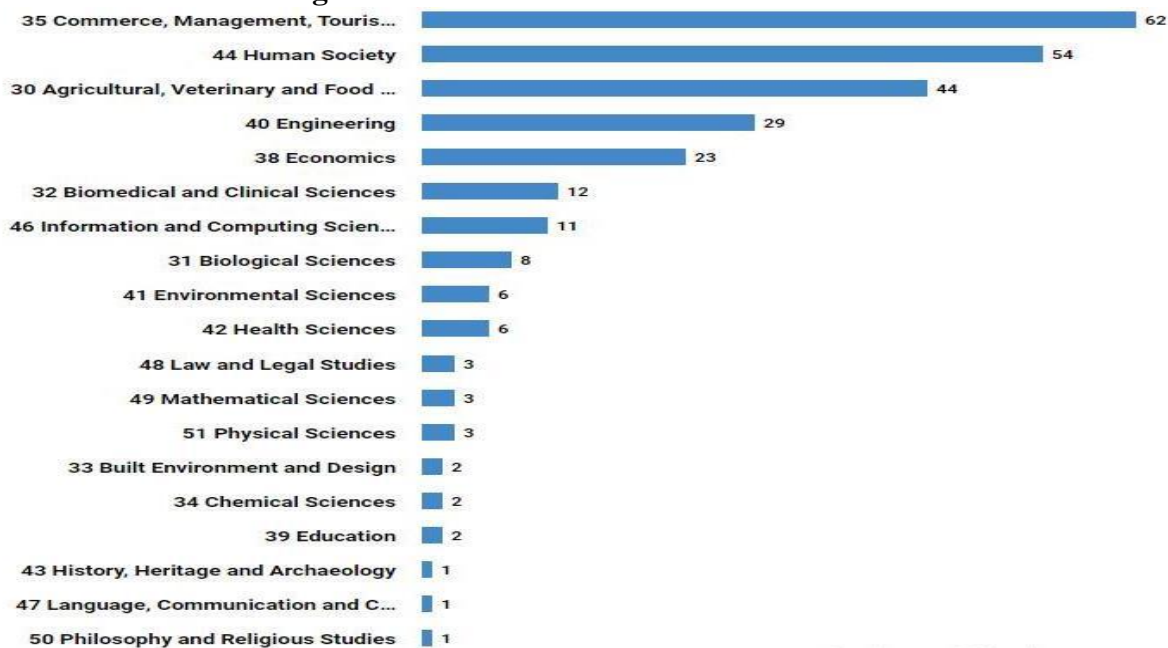
Food processing industry contributes 5.86 % of the income and 11.95 % of the profit respectively in India. Moreover only 2 percent of the total agriculture production in India is processed via food processing industry²⁹. Enormous amount of food wastage aggravate the need of food processing industry. In most medium- and high-income countries, food wastage mainly occurs at the consumer end. However, in lower-income countries, food wastage primarily occurs within the supply chain. Lack of infrastructure for transportation, warehousing and refrigeration in developing countries cause significant post-harvest losses. While research shows that developments in food supply chains can reduce food wastage, no systematic research has been done so far to show the possible relationship between the use of technology in food supply chains and food losses³⁰. Figure 4 summarizes the publication per year in the food processing industry. Since 2013 the publications have increased per year.

Figure 4: Publication per year (n = 269)



5. FUTURE KEY SECTORS OF THE FOOD PROCESSING INDUSTRY

Research and development organizations in India are adopting new innovative technologies for the food processing industries resulting in the enhancement of the number of patents in the food processing sector. Researchers studied the intellectual assets generated by ICAR and other organizations in the food processing industries in India³¹. On the basis of the publications in the food processing industry, the author presents the key sectors of the food processing industry. Moreover figure 5 classifies the publications based on the sectors of research. The majority of the studies were performed in commerce, management and tourism sector (62%), followed by research in human society (54%), agricultural, veterinary and food science (44%), engineering (29%) and economics (23%). Good manufacturing practices (GMPs) are employed to maintain the safety during processing. GMPs include people, machinery, process and the basic environment involved during the production process.³² The size and growth of this industry highlighted by the employment generation capacity and the Upgradation in technology used in this industry. Although the employment opportunities in the industry is huge, but in industry is yet to work at its full potential. However, the employees of the industry are highly unskilled.³³

Figure 5: Sector wise distribution of research

6. DISCUSSION OF THE STUDY

This study refines our understanding related to the status of the food processing industry in India; its performance; its relevancy in the Indian economy and benefits to the society as well as entrepreneurs using the systematic literature review. Furthermore, for systematic mapping, analysis with the VOS viewer software was performed by the researcher to get in depth knowledge of the status; area; benefits and challenges of the food processing industry in India. In the first objective, systematic analysis of the 279 research articles on the basis of inclusion and exclusion criteria was performed. Moreover, to achieve the second objective, VOS viewer software was used by the researcher to get the mapping of the scope /area of the food processing industry in India. Ministerial Reports on food processing sector were also included in this study to minimize the biasness of the study. In the analysis it was found that India is the prominent country with 115 documents in this area of study followed by United states, Australia and so on. Zero hunger was the area that was researched more in the food processing sector followed by the decent work, industry innovation and many more. The main challenges that were found in this study were: 1. To maintain the quality of the product for a longer period of time; 2. To minimize the health hazards; and 3. To maximize the shelf life of the products. Food processing industry contributes 5.86% of the income and 11.95% of the profit respectively in India. Hence, it is the emerging sector in the field of research as well as for the entrepreneurship as it is providing employment opportunities and minimizes the wastage of agricultural produce so that poor people can get maximum benefits via this industry.

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