Propositions for a High Quality, Affordable and Sustainable Food Basket

Scope of Cooperation between India & Germany in Areas Relating to the Food Processing Industry

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Propositions for a High-quality, Affordable and Sustainable 'Food Basket'

Scope of Cooperation between India & Germany in Areas Relating to Food Processing Industry

BY

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यस्तु सर्वाणि भूतानि आत्मन्येवानुपश्यति ।

सर्वभूतेषु चात्मानं ततो न विजुगुप्सते ॥

ईशावास्य उपनिषद

"A person who sees all living beings and forms in oneself;
and the self in all living beings and forms; feels no hatred for anyone."

(Wisdom from ancient India; sutra attributed to Ishaavaasya Upanishad)

DISCLAIMER

This study was conducted by the author on behalf of the Consulate General of India, Hamburg in an independent manner. Views expressed herein are those of the author and do not necessarily represent the views of the Consulate General of India, Hamburg or the Government of India.

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LIST OF SYMBOLS & ABBREVIATIONS

€	Euro
$	United States Dollar
APEDA	Agricultural and Processed Food Products Export Development Authority
BVE	Bundesvereinigung der Deutschen Ernährungsindustrie (Federation of German Food and Drink Industries)
CAGR	Compound Annual Growth Rate
cf.	Confer
EU	European Union
EUR	Euros
FAO	Food and Agriculture Organization (of the United Nations)
FDI	Foreign Direct Investments
FP	Food Processing
FPI	Food Processing Industry/Industries
GDP	Gross Domestic Product
GVA	Gross Value Added
H&W	Health and Wellness
INR	Indian National Rupees
MOFPI	Ministry of Food Processing Industries (Government of India)
n.a.	Not available
n.d.	Not dated
n.e.c.	Not elsewhere classified
RBI	Reserve Bank of India
SWOT	Strengths, Weaknesses, Opportunities and Threats
USD	United States Dollars
VDMA	Verein Deutscher Maschinen- und Anlagebau (Mechanical Engineering Industry Association)

TECHNICAL NOTES

1. Official fiscal years (FY) in India pertain to the period from April of a given calendar year to March of the following year. For instance, “FY 2015-16” refers to the period from April 2015 to March 2016. This pattern has been followed in the report regarding all official data for India, unless specified otherwise.

2. All monetary values that were originally only available in Indian rupees (INR) have been converted to Euro or US Dollars based on average exchange rates for a given fiscal year as published by the Reserve Bank of India (RBI), unless specified otherwise.

3. Monetary figures available in Indian denominations (such as “lakhs” and “crores”) have been converted to international units (10 lakhs = 1 million; 100 crores = 1 billion) for the sake of better understanding for international readers.

4. Figures have been rounded off to ensure a smooth flow in reading. This may at some places cause a minimal discrepancy in data.

5. All figures in Dollar ($) refer to US Dollars, unless specified otherwise.

FOREWORD BY THE CONSUL GENERAL

India has made steady economic progress since the initiation of economic liberalization in 1991. Significant increase in disposable per-capita income, growing domestic consumption and the demographic dividend that India is endowed with, have propelled the economy into a high-growth orbit. One industry sector in India that holds the promise of a sunrise industry owing to its key relevance to the economy in terms of production, value-addition and employment generation is the food processing industry. This industry has vital linkages to other industry sectors and has deep social relevance in that it ensures food security by converting agricultural and horticultural raw material into consumable products and by increasing the shelf-life of agricultural and horticultural produce.

Nevertheless, this industry has yet to reach its true potential and loss of valuable food products occurs across the value chain of the food processing industry. On the other hand, India has turned into the 12th largest food products exporting nation and the enhanced productivity and efficacy can be utilized by Indian companies to reach out to the world. Germany, which has a well-developed food processing industry, appears to be an ideal partner in this pursuit. Emerging trends of health & wellness foods (e.g. organic, fair trade, vegetarian and vegan products), naturaceuticals and plants-based dietary supplements have complementarity to India's strengths and Indian firms can make use of these avenues. There are also excellent investment opportunities available in both directions and the growing domestic market in India can be attractive for German firms. Finally, this field also offers an avenue for collaboration at institutional level which can help increase food security around the world through the means of frugal innovation and India's function as a "lead market" for them. Both countries can utilize their resources and complement each other's strengths.

In the backdrop of these developments it is my pleasure to present this report which contains certain "Propositions for a High Quality, Affordable and Sustainable Food Basket" and examines the "Scope of Cooperation between India & Germany in Areas Relating to Food Processing Industry". The report has been authored by Dr. Rajnish Tiwari of the Institute for Technology and Innovation Management (TIM) at Hamburg University of Technology

(TUHH). The report is a result of collaboration between TIM-TUHH and the Consulate General of India, Hamburg. The report intends to provide insights into recent developments and market opportunities for the benefit of (a) Indian companies looking to expand their business with Germany or to enhance their collaborations with Germany companies and vice versa; as well as for (b) Chambers of Commerce and Industry as well as other related industry associations; and finally for the benefit of (c) policy makers from both sides.

I would like to thank the author and TIM-TUHH for the efforts towards this fruitful collaboration and look forward to continued partnership. The publication of this report was made possible under the Market Expansion Activities Programme of Investment & Technology Promotion Division of the Ministry of External Affairs.

January 2017

Madan Lal Raigar

Consul General of India, Hamburg

PREFACE BY THE AUTHOR

The food processing Industry is a key industry which has a vital importance for value-addition and employment. In addition, food processing is vital for the increased shelf-life of agricultural and horticultural produce and therefore a key contributor to food security across the globe. Therefore, it has been a personal pleasure for me to investigate the developments in this industry in India, Germany and at a global level.

The study results indicate tremendous scope for bilateral collaboration between India and Germany. While India can be an attractive market and investment destination for German firms, Germany can be a very valuable market for Indian firms due to the excellent synergies between the emerging trends in the German food market and India's inherent strengths in this sector. Moreover, frugal innovations are found to play an increasing role in this industry. India has an inherent advantage in this field and can act as a lead market for them. This bilateral collaboration can, thus, make a valuable contribution to the global fight against food wastage, hunger and poverty.

I would like to take this opportunity to thank Mr. Madan Lal Raigar, Consul General, and Mr. Parminder Singh Bandechha, Commercial Officer, for initiating the idea and enabling us at TIM-TUHH to showcase our research to firms as well as to policy and decision makers in India, Germany and beyond. We look forward to continued cooperation and collaboration with the Consulate General and other representatives of the Govt. of India. For, we are convinced that this collaboration contributes to the deepening of the bilateral relations in all spheres and is in mutual interest of both nations while supporting the greater good.

January 2017 Rajnish Tiwari

EXECUTIVE SUMMARY

The food processing industry in India is a sunrise industry, which has been growing above-average and is expected to grow further. Even though India has a large agricultural sector, the food processing industry has traditionally played a small role and it is only recently that it has been promoted as a measure to increase food security and generate employment.

Germany's food processing industry is a well-developed industry that is globally competitive. Nevertheless, it is faced with saturation in the domestic market, as far as conventional foods are concerned. Emerging, significant trends in Germany are health and wellness-enhancing and disease-preventing food products that are often organically produced, procured through fair trade and are increasingly plant-based (vegetarian/vegan), which coincides with the increasing popularity of Ayurveda and Yoga. These trends can be seen as areas where India has been traditionally strong.

The two countries, thus, have enormous opportunities to collaborate. While German firms can participate in the growing market of India, Indian firms can benefit from the emerging trends in Germany, which play to India's deep-rooted advantages. Indian companies can also benefit from the vocational trainings and other skill development programmes well-entrenched in the German food processing industry. In addition, India and Germany can engage in collaborative technology development efforts to develop frugal innovations in the food processing industry and in related sectors such as food processing and packaging equipment.

Indo-German collaboration in the food processing industry has benefits that go well beyond the geographic limits of the two nations. The joining of forces can enhance the sustainability of the global food security and contribute to the fight against global food wastage & loss, hunger and poverty.

1. Introduction

India's Food Processing industry is often described as a "Sunrise industry" that belongs to one of the top-most industry sectors in India. As per Annual Survey of Industries 2013-14, it ranks first in the total number of factories in operations in the country (16.2%) as well as in the employment (11.7%). In terms of the output (11.8%) it ranks third, while in terms of gross value added (GVA; 6.7%) it scores fifth (cf. GOI, 2016a). According to an estimate by India's Ministry of Food Processing Industries (MOFPI) the contribution of food processing industries to India's gross domestic product (GDP) stood at INR 1,602.2 billion (i.e. around 21 billion euros or 26 billion USD) at the end of FY 2014-15, and constituted about 1.63% of the country's GDP (MOFPI, 2016a). This industry possesses enormous significance for the country's development because of the vital linkages and synergies it enables between the two crucial pillars of India's economy, namely industry and agriculture (CII, 2016).

Even though "over 40 percent of all packaged goods consumed in urban areas are foods and beverages" (DSIR, 2010: 1) and the country "is the world's second largest producer of food", the food processing industry in the country is "still relatively small and its business potential remains untapped" (DSIR, 2010: 2). The extent of the untapped potential of the food processing industry in India can be gauged from the fact that only 2 percent of vegetables and 4 percent of fruits produced in India are processed, while 20-22 percent of them are wasted or lost (Investors' Portal of MOFPI, 2016a). "Though India's horticultural production base is reasonably strong, wastage of horti produce is sizeable. Processing and value addition is the most effective solution to reduce the wastage. Considering the wide-ranging and large raw material base that the country offers, along with a consumer base of over one billion people, the industry holds tremendous opportunities for large investments" (Investors' Portal of MOFPI, 2016a).

A concerted attempt has been initiated by the Government of India to turn into the "food basket" for the world. According to a statement by the Confederation of Indian Industry (CII), "With an overall objective of positioning India as the 'Food Basket' to the world and aligned with the CII National Agriculture Council, both the CII National Committee on Food Processing and the CII National Task Force on Cold Chain development have been working with the objective of promoting investments, Innovations and Best practices, for the Food processing industry, in line with the 'Make in India' initiative of the Government of India." (CII, 2016)

Turning to Germany, we see that Germany had a population of 82.2 million, at year-end 2015. The number of working population at the end of second quarter in 2016 was 43.5 million. Germany's GDP in 2015 stood at €3.0 trillion ($3.3 trillion), and GDP per capita amounted to €36,906 ($40,900), as per IMF (2016) data. The cumulated turnover of the food processing industry in the European Union (EU) was estimated to be about €940 billion in 2014. Germany's share in it stood at about 18 percent (Statista, 2016c). The global export market for processed foods and beverages is estimated to have stood at €1,312 billion in 2014 (BVE, 2016b). Germany ranked 3rd, while India occupied the 12th position in the list of top exporters.

India and Germany have enormous potential to collaborate with benefits that transcend bilateral boundaries and have global implications including social benefits such as global food security. For example, according to Germany's Federal Ministry of Food and Agriculture:

> "India's farming sector plays an important role both at the national and the global level. India focuses on safeguarding self-sufficiency and on exports. This is to be achieved through farm mechanisation, improved infrastructure and investments in food processing. The objectives of cooperation with India include global food security, the promotion of bilateral and multilateral trade and economic cooperation, the improvement of conditions for trade and investments including consumer protection and food safety, and more agricultural research" (BMEL, 2013).

1.1. Global relevance

Globally it has become necessary to achieve a significant reduction in preventable food loss and waste to avoid "agricultural expansion into remaining natural terrestrial ecosystems and relieves pressure on overstrained fisheries" (Lipinski et al, 2013: 3). Food waste, as per Lipinski et al (2013: 4) "refers to food that is of good quality and fit for human consumption but that does not get consumed because it is discarded – either before or after it spoils. Food waste typically, but not exclusively, occurs at the retail and consumption stages in the food value chain and is the result of negligence or a conscious decision to throw food away". Therefore, "sustainable food consumption and production in food and agriculture" is crucial.[1]

[1] Food and Agriculture Organization of the United Nations (FAO) defines sustainable consumption and production in food and agriculture as "a consumer-driven, holistic concept that refers to the integrated implementation of sustainable patterns of food consumption and production, respecting the carrying capacities of natural ecosystems. It requires consideration of all the aspects and phases in the life of a product, from production to consumption, and includes such issues as sustainable lifestyles, sustainable diets, food losses and food waste management and recycling, voluntary sustainability standards, and environmentally friendly behaviours and methods that minimize adverse impacts on the environment and do not jeopardize the needs of present and future generations. Sustainability, climate change, biodiversity, water, food and nutrition security, right to food and diets are all closely connected" (FAO, 2016b).

According to a study published by the Food and Agriculture Organization of the United Nations about (FAO), there is a considerable wastage and loss of food through-out the world (see Figure 1) and there is a need to "improve access to low-cost handling and storage technologies" (Lipinski et al, 2013: 10).

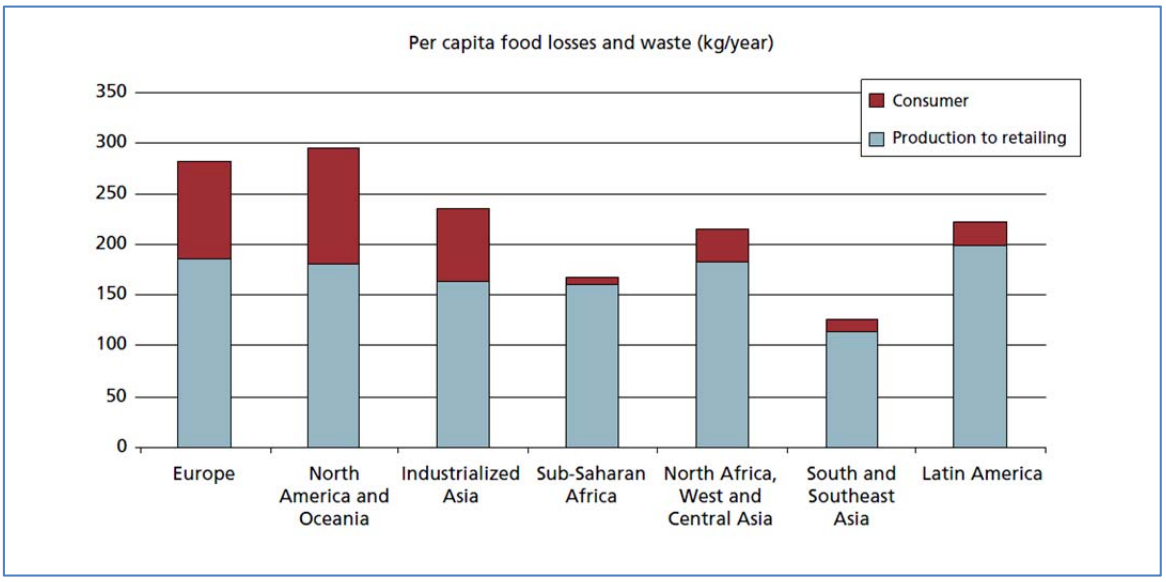

Figure 1: Per-capita food losses and waste in different world regions[2]

Food loss usually takes place "at the production, storage, processing and distribution stages of the food value chain, and is the unintended result of agricultural processes or technical limitations in storage, infrastructure, packaging, and/or marketing" (Lipinski et al, 2013: 4). A study by Kitinoja and Cantwell (2010: 206) in Sub-Saharan Africa and India found that "the total losses for any given lot of produce handled at high temperatures in poor packages can be from 30 to 60%".

1.2. Definition and scope of the study

In a broad sense food processing is concerned with the conversion of raw agricultural produce, milk, meat and fish into a commodity suitable for human consumption (MOFPI, 2016a). It "includes all the processes under filtration, manufacturing and preservation techniques undertaken for bringing value addition to the agricultural or horticultural produce" (Singh, 2016). As per India's Ministry of Food Processing Industries:

> "Food processing includes (a) Manufactured Processes: If any raw product of agriculture, animal husbandry or fishing is transformed through a process [involving employees,

[2] Source: (Gustavsson et al, 2011: 5)

power, machines or money] in such a way that its original physical properties undergo a change and if the transformed product is edible and has commercial value, then it comes within the domain of Food Processing Industries. (b) Other Value-Added Processes: If there is significant value addition (increased shelf life, shelled and ready for consumption etc.) such produce also comes under food processing, even if it does not undergo manufacturing processes" (MOFPI, 2016a: 23).

In more generic terms food processing can be "defined as a process of value addition to the agricultural or horticultural produce by various methods like grading, sorting and packaging. In other words, it is a technique of manufacturing and preserving food substances in an effective manner with a view to enhance their shelf life; improve quality as well as make them functionally more useful. It covers spectrum of products from sub-sectors comprising agriculture, horticulture, plantation, animal husbandry and fisheries" (Meredien, 2013: 4). Figure 2 depicts the value chain of the food processing industry.

Figure 2: Value chain of the food processing Industry[3]

Food and agricultural industry adds value to and increases demand for agricultural outputs, "thereby contributing to poverty reduction and food security in rural areas" (FAO, 2016a). The industry also "provides employment opportunities in off-farm activities such as handling, processing, packaging, storage, transportation and marketing of food and non-food agricultural products" (FAO, 2016a). This sector is, therefore, "indispensable for the overall development of an economy" (Meredien, 2013), especially since it has task of ensuring an "assured supply of healthy and affordable food at all locations in the country" (Meredien, 2013: 5).

1.3. Objectives & key findings

The objective of this study is to showcase the food processing industries in India and Germany by providing the respective sectoral overviews and (mid-term) growth prospects in both domestic and export markets including in terms of foreign direct investments (FDI). Furthermore, opportunities and challenges faced by both countries in this industry would be identified. These steps would enable us to discover the complementarities between the two countries and help identify the scope for enhanced bilateral collaboration with mutual benefit.

[3] Author's illustration; adapted from Lapinski et al (2013: 5)

We observe that highest quality, safety, reliability and customer orientation enjoined with affordable prices characterize the production of foods and beverages today (BVE, 2016a). In this respect, they represent an excellent connection to frugal innovations, which are characterized by “affordable excellence” (Tiwari et al, 2017). “Closely linked to availability, affordability is extremely important for a society with as much income disparity as India” (Mukherjee and Bajaj, 2014). Collaboration with Germany can help Indian firms more easily implement highest standards of food safety, hygiene, and enable an efficient use of resources, which are crucial to food processing (VDMA India, n.d.). This way they can succeed on only in the domestic market but also in places like Germany, where consumers are very much concerned about the safety of the food products that they consume. Especially, genetically engineered products are rejected by a majority in Germany (Statista, 2016c). If these concerns can be addressed by Indian firms while catering to the emerging trends it can be very beneficial for them.

Finally, this study comes to the conclusion that there is a tremendous scope for India and Germany to collaborate on technological innovations that ensure affordability, both in monetary and socio-environmental terms. Frugal innovations can provide a key thrust to such cooperation as they can make use of India’s potential as a lead market. Indian firms can make use of emerging trends in Germany’s processed food market (e.g. organic, fair trade and vegetarian/vegan products with health and wellness components) as India has a traditional advantage in these sectors. Skill development is another field, where both countries can make use of their inherent strengths (demographic developments and available capacities) for mutual and global benefits.

1.4. Structure of the study

The remainder of this report is structured as follows: India’s food processing Industry and its key characteristics are discussed in chapter 2. Since there are conflicting figures and estimates about the actual size of the food processing industry in India, this chapter makes use of various sources to provide the reader with a variety of sources and enable a fair and objective overview. Chapter 3 provides a similar profile of the German food processing industry. Section 3 builds a corner stone of the research as it familiarize the reader with the bilateral context with a brief profile of Indo-German economic partnership and. The study concludes with a summarizing discussion in chapter 5 that juxtaposes the profiles of the two industries and explores the scope for bilateral cooperation at the corporate and institutional levels.

2. Food Processing Industry in India

India's food and grocery market is estimated to be the sixth largest globally (IBEF, 2016b). It is also "one of the largest sectors in India in terms of production, growth, consumption, and export" (APEDA, 2016a). Ministry of Food Processing Industries (MOFPI) lists 18 sub-sectors of this industry in its Annual Report 2015-16 (MOFPI, 2016a). Broadly speaking, these sub-sectors cover areas as diverse as "fruit and vegetables; spices; meat and poultry; milk and milk products, alcoholic beverages, fisheries, plantation, grain processing and other consumer product groups like confectionery, chocolates cocoa product soya-based products, mineral water and high protein foods" (APEDA, 2016a). The food processing industry is estimated to contribute 9 percent to GDP in the manufacturing sector and 11 percent to the agriculture sector, and its annual average growth rate has outperformed the growth in manufacturing and agriculture in the recent years (MOFPI, 2016a).

2.1. Sectoral Overview & Growth Prospects

There are conflicting figures and estimates about the actual size of the food processing industry due to "the limitation of the existing data sources on food processing sector" (MOFPI, n.d.). While some already put it in the range of USD 110-135 billion (Kapoor, 2011; InvestIndia, 2012; Meredien, 2013), other speak of as little as about $14 billion (Business Sweden, 2015). India's Ministry of Food Processing Industries in its Annual Report 2015-16 estimated the size of food processing industries in India conservatively at INR 1,60,224 crores (MOFPI, 2016a), which amounts to approximately USD 26 billion.[4] India Brand Equity Foundation (IBEF)[5], in an update released in November 2016, estimated the size of the food sector in India at $39.7 billion and expected it to grow to $65.4 billion by 2018. The figures provided by MOFPI and IBEF seem to be more accurate given the fact that the percentage of agricultural produce being processed is still low but has been growing consistently in the recent years.

One of the key advantages possessed by India lies in its rich natural resources that create an abundance of raw material. It has a gross cropped area of over 194 million hectares, of which 66 million was irrigated in 2012- 13 (makeinindia.com, 2015). Reportedly a total of 127 agro-

[4] 1 billion = 100 crores; 1 USD = 61.1436 INR as average exchange rate in FY 2014-15 as per RBI data.

[5] IBEF is "a Trust established by the Department of Commerce, Ministry of Commerce and Industry, Government of India. IBEF's primary objective is to promote and create international awareness of the Made in India label in markets overseas and to facilitate dissemination of knowledge of Indian products and services" (IBEF, 2015).

climatic zones exist in India (makeinindia.com, 2015), and the country is also endowed with 46 of the 60 soil types found in the world (IBEF, 2016a). India is a leading producer of many agricultural and horticultural products; see Table 1 for an overview of select items.

Item name	**Global production** (in tonnes)	**India's share** (in percent)	**India's global rank**
Bananas	106,714,205	25.8	1
Chick peas	13,118,699	67.3	1
Mangoes, mangosteens, guavas	43,300,070	41.6	1
Okra	8,689,499	73.1	1
Meat (buffalo)	3,722,800	42.2	1
Milk (whole, fresh, buffalo)	102,041,460	68.6	1
Beans, dry	22,806,139	15.9	2
Sesame seeds	4,847,921	13.1	2
Rapeseed	72,699,608	10.8	3
Oranges	71,445,353	9.0	4

Table 1: India's rank in world production of selected agricultural & food products[6]

India is one of the largest producers of food grains and other agricultural raw material (Business Sweden, 2015). For example, with 25.8 percent of the global production it is the single largest producer of bananas (MOFPI, 2016a). Its food grain production has crossed 251 million tonnes (MT) in FY 2014-15 and the country produced 91 MT of fruits, 163 MT of vegetables and over 137 MT of milk. It is also one of the largest producer of marine products, meat and poultry (IBEF, 2016c).

Total output generated by the food processing industry in 2013-14 amounted to INR 8,345.3 billion ($137.9 billion). Total gross value added (GVA) of the food processing industry – after deducting input costs from the output – in 2013-14 was estimated at INR 859,38 billion ($14.2 billion), as per the Annual Survey of Industries data (MOFPI, 2016b).

[6] Source: (MOFPI, 2016a)

No.	Item	No. of factories	No. of employees	Fixed capital *($ million)*	Total output *($ million)*	GVA *($ million)*
1	Manufacture of grain mill products	18,131	302,934	3,574.7	31,970.3	2,951.7
2	Manufacture of Sugar	859	260,078	8,068.4	18.410.3	1,994.1
3	Manufacture of vegetable & animal oils and fats	3,312	111,218	2,655.8	30,411.7	1,582.4
4	Manufacture of other food products n.e.c.	5,251	412,890	3,197.9	11,071.5	1,306.7
5	Manufacture of dairy products	1,695	135,108	1,950.0	15,155.3	1,246.1
6	Manufacture of malt liquors and malt	154	29,147	1,203.8	2,674.1	1,053.1
7	Manufacture of bakery products	1,519	96,826	931.8	4,063.6	643.3
8	Manufacture of prepared meals and dishes	352	16,220	351.0	356.6	95.6
9	Processing and preserving of fruits and vegetables	1,110	55,090	922.6	2,005.1	454.0
10	Processing and preserving of meat	140	22,130	345.5	3,104.2	259.1
	Total for 18 sub-sectors	***37,175***	***1,689,176***	***29,196.9***	***137,928.9***	***14,842.9***

Table 2: Selected sub-sectors in India's food processing industry in FY 2012-13[7]

Prominent examples of processed food items are "fruit pulps and juices, fruit based ready-to-serve beverages, canned fruits and vegetables, jams, squashes, pickles, chutneys and dehydrated vegetables. More recently, products like frozen pulps and vegetables, frozen dried fruits and vegetables, fruit juice concentrates and vegetable curries in restorable pouches, canned mushroom and mushroom products have been taken up for manufacture by the industry" (Investors' Portal of MOFPI, 2016a); see Table 2 for the industry composition.

The food processing industry in India has had a fixed capital base of INR 1,683.8 billion ($27.8 billion) in FY 2013-14, which in rupee terms was almost 2.5 times higher than in FY 2007-08. Even in USD terms the fixed capital base increased from $17 billion to $28 billion

[7] Based on (MOFPI, 2016a). Updated, theme-wise statistics on India's food processing industry can be accessed on MOFPI website: http://www.mofpi.nic.in/documents/finance/statistics, last accessed: December 6, 2016.

in these 7 years (MOFPI, 2016d). Furthermore, India has a large base of "unincorporated enterprises" in the food processing sector that operate in the informal/unorganized sector of the economy. Value of fixed assets of about 2.25 million unincorporated enterprises in the food processing industry was estimated at INR 607.5 billion ($13.3 billion) in June 2011 (MOFPI, 2016c). The unorganized sector also constitutes a major challenge for India as it is characterized by "widespread use of primitive processing", which not only causes lower value-add in the processing stage but also leads to the loss of valuable nutrients (Mukherjee and Bajaj, 2014). For example, the processing of 15 to 18 million tonnes of wheat into making flour in the unorganized sector ends up destroying 58 percent of iron and 67 percent of folic acid (Mukherjee and Bajaj, 2014).

Nevertheless, the food processing industry in India has grown rapidly in the past and is expected to continue a sustained spell of growth in the face of strong economic development. Annual per capita income of an average Indian stood at around INR 23,000 ($275) when economic reforms were launched in 1991. 25 years later, in 2016, per capita income of an average Indian was estimated at more than INR 122,000 ($2,250) by IMF, which expected it to reach $3650 by 2021 (IMF, 2016). India's population has also grown from 864 million in 1991 to an estimated 1.3 billion in 2015. The increasing prosperity of an ever-larger group of people is leading to growth in total consumer spending, which was estimated at $1 trillion in 2015 and is expected to grow more than three-folds already by 2020 (IBEF, 2016a). While an average Indian consumer spent 56 percent of his disposable income on food, beverages and tobacco in 1995,[8] this share was expected to come down to 34 percent by 2015 and to 25 percent by 2025 (Ablett et al, 2007). We can, therefore, reasonably expect discretionary spending – also on food and beverages, e.g. on health and wellness foods – to grow significantly.

2.1.1. **Geographic concentration**

According to Annual Survey of Industries 2013-14, there were total 37,445 factories operating in the registered (organised) sector of the food processing industry in India (MOFPI, 2016b). Andhra Pradesh, Tamil Nadu, Telangana, Maharashtra and Punjab topped the list with a cumulative share of over 55 percent. Figure 3 shows the top-10 states that together accounted for nearly 80 percent of the factories in the registered (formal) sector.

[8] A more recent study by Mukherjee and Bajaj (2014) too suggests that the lowest income group in India spends between 60-65 percent of its total consumer spending on food

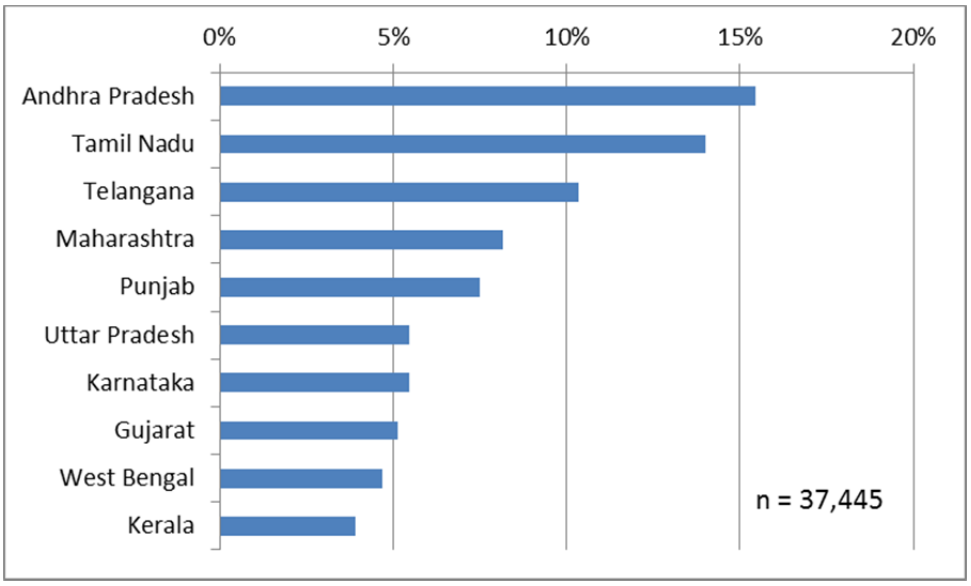

Figure 3: Top-10 states in India in terms of registered food processing units

In addition, there were 2,241,192 unincorporated enterprises with GVA of INR 220.54 billion ($4.8 billion) in June 2011 (MOFPI, 2016c). According to the same report, the largest concentration of unincorporated enterprises was in the states of Uttar Pradesh, Maharashtra, Andhra Pradesh and West Bengal. The unorganised sector is estimated to account for 42 percent of India's overall food processing industry (IBEF, 2016a).

2.1.2. **Domestic Market**

Domestic spending on food and food products is estimated to constitute almost 21 percent of India's gross domestic product (FICCI, 2010). This share is expected grow further as bout 200 million people are likely to move from subsistence foods like cereals and pulses to products that require "more processing like packaged dough and packaged homogenized milk" (DSIR, 2010: 1). According to a study conducted by business consultancy A.T. Kearney and the Federation of Indian Chambers of Commerce and Industry (FICCI) there is a change in consumption pattern of Indian consumers. The study (Mukherjee et al, 2014: 25) suggests that while about 10 years back many Indian consumers ate parathas, vegetables and "puris" for breakfast, these are giving way to noodles, cornflakes, juices and oats; while noodles, pizzas, chips and burgers are replacing traditional items such as "samosas", milk and sweets.

Mukherjee and Bajaj (2014) predict that the food consumption pattern in India will undergo a major shift by 2025, with the share of grains and pulses in the intake of calories getting reduced by 5 percentage points and that of additives (e.g. sugar and edible oils) and fruits and

vegetables increasing. The total domestic demand is projected to increase from 534 MT in 2010 to up to 850 MT in 2025, see Figure 4.

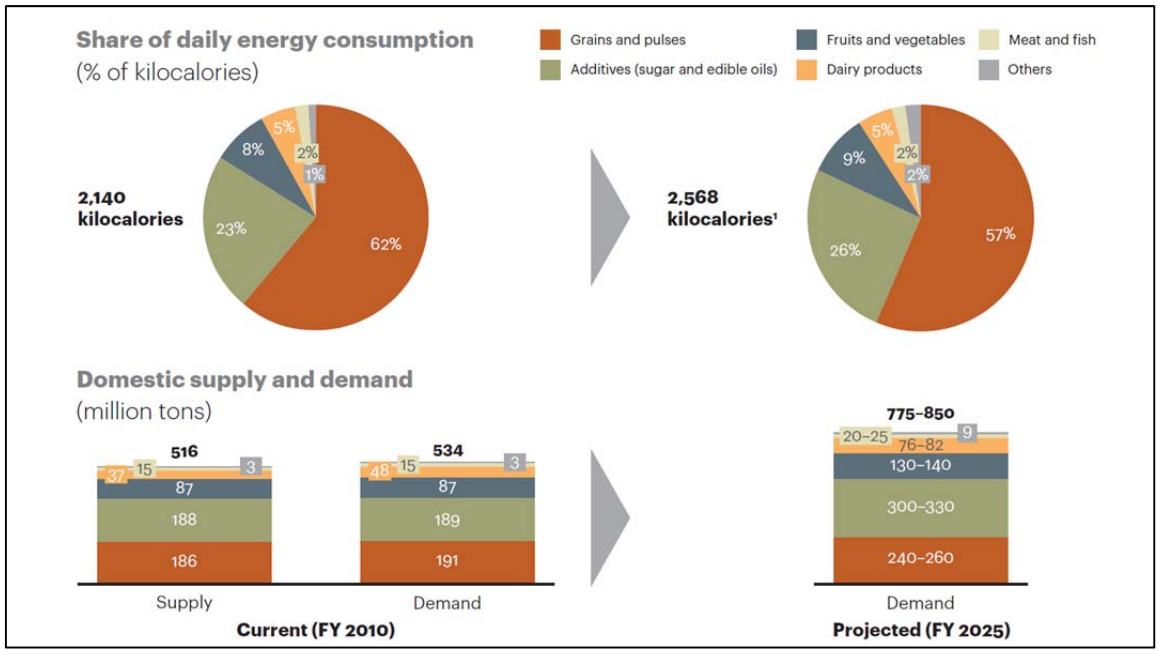

Figure 4: Expected shift in India's consumption pattern[9]

India is facing increasing instances of lifestyle-related diseases, such as obesity. A growing number of the population is "suffering from high cholesterol, heart-related diseases and non-communicable diseases resulted in consumers purchasing more healthy packaged food and beverages" (Euromonitor, 2016b). As a result, "naturally healthy products […] witnessed the highest value growth in 2015" (Euromonitor, 2016b).

Food processing companies are turning to serving Health and Wellness (H&W) "as a new ingredient in processed food, given that health conscious consumers prefer food products with lower carbohydrate content and with low cholesterol edible oils, e.g. zero-percent trans-fat snacks and biscuits, slim milk, whole wheat products, etc." (IBEF, 2016a). So far the H&W food market was dominated by multinational companies (MNCs). However, domestic companies have begun to expand their H&W portfolios and take up the challenge of global players (Euromonitor, 2016b). Such H&W products are targeted at "health-conscious consumers, who are expected to opt for products which reduce cholesterol, help control or avoid diabetes and manage weight, as well as maintain good health" (Euromonitor, 2016b).

In terms of sourcing from overseas, India's total food imports in FY 2015-16 stood at $21.4 billion, up from $19.7 billion in FY 2014-15 and $16.5 billion in FY 2013-14 (MOFPI,

[9] Source: (Mukherjee and Bajaj, 2014: 12)

2016f). The biggest items on India's import list in FY 2015-16 were animal or vegetable fats, edible vegetables and edible fruits and nuts, suggesting a higher demand for less levels of processing for these food items.

2.1.3. **Export market**

India belongs to one of the leading exporters of processed foods. According to one report, it commanded a market share of 2.47 percent in the global export market for processed food and beverages in 2014, nearly doubling its share from 1.26 percent in 2000 (BVE, 2016b). In 2015, India reportedly ranked 12th in terms of global exports of food and food products (makeinindia.com, 2015). At the same time India has reduced its reliance on imports. To illustrate it with an example, India has turned into a net exporter from having been a net importer of dairy products and generated export revenues worth $546 million in 2013-14. Key export destinations for India's dairy products are Saudi Arabia, Bangladesh, United Arab Emirates, Egypt, Nepal, Singapore and Pakistan (Investors' Portal of MOFPI, 2016b).

Exact figures on export data for the industry as a whole are, however, difficult to get and official figures seem to vary to a great extent, due to the lack of an exact and widely-accepted definition of the constituent sub-sectors of the food processing industry. While figures published by Agricultural and Processed Food Products Export Development Authority (APEDA) put India's exports of processed food at INR 26,067.64 crores, or about $4 billion in FY 2015-16 (APEDA, 2016a),[10] figures issued by India Brand Equity Foundation put export volume of "processed food and related items" in FY 2015-16 at $19.3 billion (IBEF, 2016b). Recent data released by Ministry of Food Processing Industries put "India's Total Food Export" at $29.37 billion (MOFPI, 2016e). The MOFPI data also seems to have official backing, as it is also corroborated by a press release issued by the Press Information Bureau of the Govt. of India (cf. GOI, 2016c). An overview of the key items in exports of processed foods in terms of their value in million USD is provided in Figure 5.

[10] 1 billion = 100 crores; 1 USD = 65.4685 INR as average exchange rate in FY 2015-16 as per RBI (2016) data.

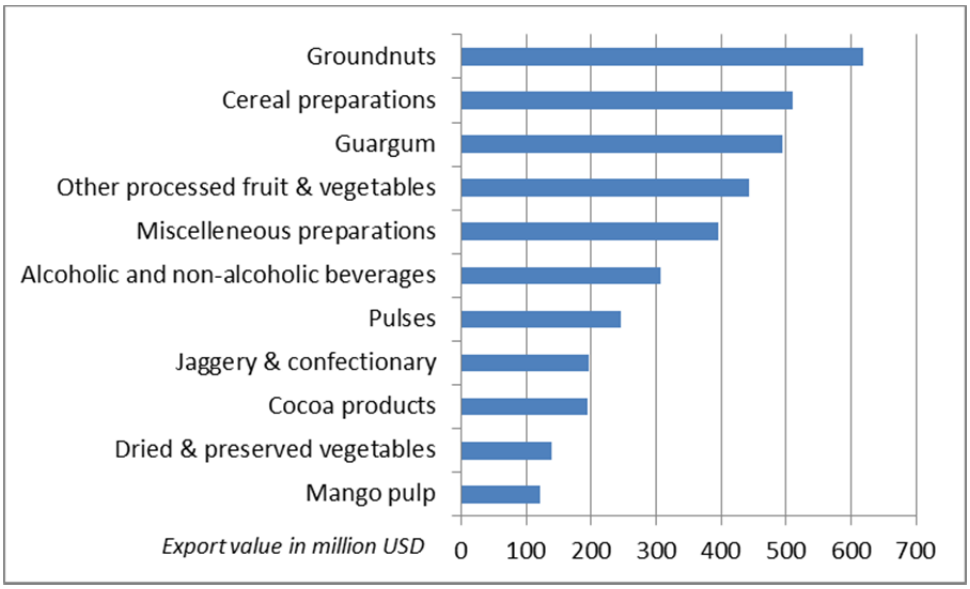

Figure 5: Key items in India's export of processed food and their value in 2015-16[11]

According to APEDA (2016a), "India's geographical situation gives it the unique advantage of connectivity to Europe, Middle East, Japan, Singapore, Thailand, Malaysia and Korea. One such example indicating India's location advantage is the value of trade in agriculture and processed food between India and Gulf region."

2.1.4. **Innovation activities**

Agricultural production and technology constitutes a key area for R&D in India and according to last available figures (FY 2011-12) 14.7 percent of India's total national expenditure on R&D was directed towards this objective, which was second only to R&D expenditure on defence (GOI, 2013). In absolute figures, the R&D expenditure for this expenditure would amount to about $2.23 billion.[12] About 42 percent of this expenditure was borne by the Central Government including public-sector enterprises and institutions of higher education (GOI, 2013).

In general, there is "a need for strengthening R&D activities in food processing sector for innovation of technology which suits local needs, popularization of appropriate technology, skill development and creation of an institutional framework supportive of the industry" (Meredien, 2013: 18). MOFPI has, therefore, initiated a programme to promote R&D in the food processing industry, whose main objective "is the development of new products and new cost effective technologies for preservation and packaging of food products, standardization

[11] Author's calculations and illustration based on APEDA (2016a) data;
[12] 14.7 percent of total R&D expenditure of INR 726.2 billion (approx. $15.2 billion) in the annual average exchange rates ($1 = INR 47.9229) for FY 2011-12.

of various factors such as additives, colouring agents, preservatives, pesticide residue etc." (MOFPI, 2016g). This funding is available to all public and private-funded R&D institutions as well as to all officially recognized R&D units in the private sector. For private sector firms a grant of up to 70 percent is possible (MOFPI, 2016g).

On innovation front, growing health consciousness has been identified as a key driver of demand for H&W food and beverages in India (Euromonitor, 2016b). The trend has also led to "increased uptake of weight control diets", and "manufacturers continued to add new products to their portfolios, which transitioned from niche to larger market segments." (Euromonitor, 2016b). Gupta et al (2014) also report various innovations in sugar-free items, low-calorie foods, health foods and in packaging.[13]

2.1.5. **Human Resources**

As per Annual Survey of Industries 2013-14, there were 1,740,813 persons employed in the registered units of the food processing industry in India (MOFPI, 2016b). Close to 12 percent of all employment generated in India's organised sector in 2013-14 came from the food processing industry (makeinindia.com, 2015). Furthermore, the unorganized sector provided employment to up to 5 times more people (Rao and Dasgupta, 2009).[14]

Availability of skilled manpower has been and continues to remain a key challenge facing the industry (FICCI, 2010; MOFPI, 2016a). There were 207,756 students in FY 2014-15 studying for an academic degree related to the Faculty of Agriculture, amounting to 0.78 percent of all students (UGC, 2015). Apart from this there were also students studying disciplines such as "Agricultural Engineering & Technology" or "Dairy Technology", which were grouped as "Engineering and Technology" subjects. Differentiated figures for this large group comprising over 4.3 million students were, however, not available. Nevertheless, in a country where agriculture and allied occupations provide for the bulk of employment, this mismatch underlines "the need to focus on vocationalisation of education" (UGC, 2015: 57).

To fill this gap a "Food Industry Capacity & Skill Initiative" (FICSI), also known as Food Processing Sector Skill Council, has been started by the Federation of Indian Chambers of Commerce and Industry (FICCI) and is financially supported by National Skill Development Corporation (NSDC). It is aimed "at generating a critical mass of industry-employable-

[13] A detailed description of R&D efforts and the output generated can be found in Kachru (2010).
[14] For an excellent overview of the employment situation and working conditions in the organized and unorganized sectors of India's food processing industry, see Rao (2009).

skilled-persons to meet the skill gap in the Food Processing industry" (FICSI, 2015) and works in close cooperation with MOFPI (GOI, 2016c). The FICSI is entrusted with the development of "National Occupational Standards" for the various sectors of the food processing industry through "identification of job roles and competencies required" for them (MOFPI, 2016a: 118).

MOFPI has established a "National Institute of Food Technology Entrepreneurship and Management" near Sonepat (Haryana) and an "Indian Institute of Crop Processing Technology" at Thanjavur (Tamil Nadu) to "impart training by offering academic programmes i.e. Bachelor's, Master's and Ph.D. degrees in food processing" (GOI, 2016c). These Institutes are also mandated to conduct "courses on skill development and entrepreneurship for the youth, farmers, self-help groups and industry". By February 2016 there were 44 Training Partners and 202 Training Centres affiliated to the FICSI (MOFPI, 2016a). The number of persons trained/skilled by these institutions and/or under other schemes of the Central Government can be found in Table 3.

Fiscal Year	**Number of Persons**
2013-14	7,970
2014-15	9,506
2015-16	3,203
2016-17 (till June 2016)	4,231

Table 3: Number of persons trained/skilled under Central Government schemes[15]

Under its skills development programme India has also introduced an Advanced Diploma in Food Processing, which would be available for students finishing their Higher Secondary education of 12 years (UGC, 2015). It has also collaborated with New Zealand to set up an India-New Zealand Education Council that provides funding for joint research projects, amongst other fields, in the area of food security and agriculture (UGC, 2015).

2.1.6. **Foreign direct investments in India's food sector**

The food processing industry has been accorded high priority by the government with "an overall objective of positioning India as the 'Food Basket' to the world" (CII, 2016). For this purpose 100 percent FDI in food processing sector has been allowed through automatic route.

[15] Based on GOI (2016c). Prior to FY 2015-16 there was a training programme under the National Mission on Food Processing, which was then delinked from Central Government support.

Government has also permitted 100 percent FDI in retail marketing of food products which are produced and manufactured in India through approval route (GOI, 2016c).[16]

The food processing industry has received inbound FDI worth $7.3 billion in the period from April 2000 to September 2016 (MOFPI, 2016h), and accounts for 2.36 percent of total inflows into the country in this period (GOI, 2016b). This industry ranks 13th in terms of attracting FDI into the country and therefore displays a large untapped potential. Figure 6 shows the inflows of FDI into India's food processing sector since the turn of the millennium. For long it moved on a relatively low level. Then the government reviewed its FDI policy to provide clarity on investment guidelines and increase investor confidence, which stimulated "FDI inflows and contributing to accelerated economic growth. As a result, in FY 2013/14 the FDI inflow saw a huge jump in investment proposals being approved for manufacturing in the food processing sector" (Sood, 2014: 4). Since then, the inflows seem to have stabilised around $500 million per fiscal year.

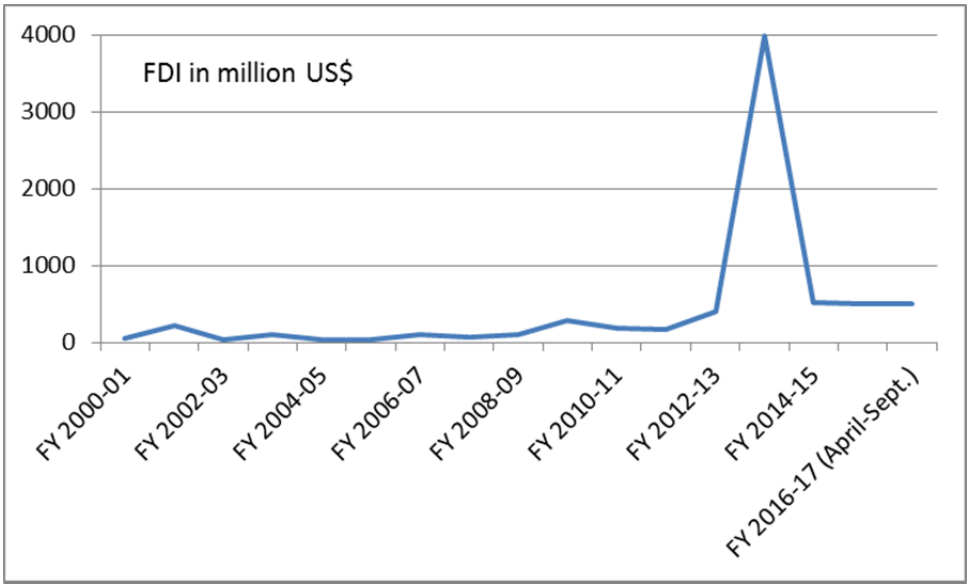

Figure 6: FDI in food processing industry from FY 2000-01[17]

Recent FDI trends are summarized in Table 4 which shows equity inflows from selected key countries between FY 2013-14 and FY 2015-16. In the 3-year period India received FDI worth $5 billion from around 50 nations. While the United Kingdom, Singapore and the Netherlands topped the list, German investments trailed those by some other large EU member states such as France, Italy and Spain (GOI, 2016c).

[16] Further information on FDI policies may be retrieved from the online investment promotion portal of MOFPI: http://foodprocessingindia.co.in/government-policies/india-s-fdi-policy.html, last accessed: December 6, 2016.
[17] Author's illustration based on (MOFPI, 2016h)

Country	Investment volume (million USD)
United Kingdom	3033.19
Singapore	388.96
The Netherlands	288.35
Mauritius	265.40
United States of America	238.22
Belgium	214.31
France	129.69
Japan	52.46
Italy	49.61
Germany	27.44
Grand total for all investing countries	*5004.67*

Table 4: Sectoral FDI inflows from selected countries (FY 2013-14 to FY 2015-16)[18]

2.2. Opportunities & challenges faced

As the previous sections have shown, India's food processing industry is endowed with tremendous growth opportunities and at the same time also beset with some strong challenges. Abundant availability of agricultural and horticultural produce, rising disposable incomes and changing lifestyles (e.g. urbanization, nuclear families and working women) of a large population are expected to provide a long-term and sustained boost to India's food processing industry (Gupta et al, 2014; Business Sweden, 2015). The industry also makes a very significant contribution to the economy in terms of GDP and employment and has been therefore accorded a "high priority" status by the government.

For this reason "various regulatory reliefs with promotional schemes and financial incentives" have been established to attract the investors in this sector (Singh, 2016). For example, the government has reduced excise duty on food processing and packaging machinery from 10 percent to 6 percent. A complete 100 percent income tax exemption on profits has been granted to food processing units for the first five years of operation and a further 25 percent reduction may be availed for the next five years (GOI, 2016c).

[18] Based on (GOI, 2016c)

Apart from these, well-documented opportunities it is also imperative to identify challenges faced by the food processing industry in India. As a first, Indian consumers – private households as well as business entities such as restaurants – have traditionally preferred purchasing fresh und unprocessed food and then to convert it into a consumable form through the process of food preparation (Mukherjee and Bajaj, 2014). The wide availability of fresh food including fruits and vegetable across the country is considered as one of reasons for the food processing industry not being able to take strong roots in India (Mukherjee and Bajaj, 2014). Prohibitive prices of processed foods for specific consumer groups may have also acted as a deterrent in the development of the industry. According to Mukherjee and Bajaj (2014: 24-25), "consumer sensitivity to high prices means that adding value, which would increase the cost of food, is difficult". Khan and Ahmad (2015: 372) too have posited that the demand for environmentally-safe and green food products has been rather low in India, "as the consumers perceive these options to be expensive and not offering much special benefits to them". These factors necessitate frugal innovations in the food processing industry which can ensure "affordable excellence" (cf. Mashelkar, 2014; Hosafci, 2016).

The need for frugal and cost-effective solutions, also on the supply side, is corroborated by a survey conducted by FICCI, in which "processing plants with cost effective technologies" and "cost effective food machinery & packaging technologies" were cited as some of the top-most challenges faced by the food processing industry (FICCI, 2010). Ali et al (2009: 59) also suggest that the growth of the Indian food processing industry is chiefly "constrained due to lack of productivity augmenting technologies and limited resource utilization. Therefore, technology is the key to enhancing growth and efficiency in the food processing sector." The large role of the unorganised sector compounds the problem as there is a vast difference in the labour productivity of the organised and unorganised sectors. The productivity of the unorganised sector is estimated at a mere 6 percent of that in the organised sector (Rao, 2009: xvi).

A very severe challenge facing the food processing industry in India is that of the physical infrastructure, leading to wastage of food products. It is estimated that India lacks about 32 million tonnes of storage capacity at present leading to the loss of food worth almost $7 billion every year (Business Sweden, 2015). Therefore India needs substantial "investments at different points of the supply and value chain, proper research, farm and lab connectivity, upgradation of technology, increase in farm holding, skill and manpower training, backend and front-end integration and cold chain integration" (Meredien, 2013).

Some of core opportunities and challenges as well strengths and weaknesses of India's food processing industry are summarized in the following SWOT analysis (cf. Pickton and Wright, 1998), see Table 5:

Strengths	**Weaknesses**
• Abundant supply of agricultural and horticultural produce • Large population base with increasing disposable incomes • Large and well-established industry, especially in the organized sector • Established position in the global trade of food products	• Wastage & loss of large quantities of agricultural & horticultural produce • Still low purchasing power of large sections of the society • Low productivity & capital utilization especially in the unorganised sector • Relatively small size of the modern retail sector
Opportunities	**Threats**
• Urbanization, changing lifestyles and family/social structure • Growing demand for affordable and natural/healthy products • Geographic proximity to food importing nations • Massive government support for the development of food sector	• Lack of skilled manpower in food engineering and technology • Insufficient focus on new product development & innovation • Insufficient physical and service infrastructure • Inadequate focus on quality and safety standards

Table 5: A SWOT analysis of India's food processing industry[19]

[19] Based on author's own analysis in the preceding sections as well as on (DIBD, 2013; Sood, 2014; Sood and Mani, 2015; MOFPI, 2016a)

3. Food Processing Industry in Germany

The food processing industry in Germany comprises of about 35 individual industry sectors (Umweltbundesamt, 2013). This industry in German is often called the "Nahrungsmittelindustrie" or the "Ernährungsindustrie". These terms, together with some other terms (e.g. "Lebensmittelindustrie" or "Lebensmittelwirtschaft"), are often used interchangeably. Its representative industry association, the Federation of German Food and Drink Industries (BVE)[20] uses the English term "Food and Drink Industries" to characterize the industrial fields its members are active in. As per BVE, the industry saw a turnover of €168.6 billion in 2015, making it Germany's third largest industry (BVE, 2016b). The industry operates in a strongly saturated market leading to stiff competition and limited scope for growth in the domestic sector (PwC, 2014).

3.1. Sectoral Overview & Growth Prospects

According to BVE, the food processing industry in Germany consisted of 5,812 companies (with more than 20 employees) in 2015. These companies employed 569,162 people. The domestic turnover was to the tune of €113.5 billion, while exports stood at €55.3 billion. Of late, the industry has been facing a small downturn in its generated revenues, leading to a consolidation process so that the number of companies has seen a reduction, even as the employment has increased over the years, see Figure 7.

Figure 7: Companies and employees in Germany's food processing industry[21]

[20] BVE stands for "Bundesvereinigung der Deutschen Ernährungsindustrie e.V.".
[21] Source: BVE (2016b)

Most companies active in Germany's food processing industry are small and medium-sized enterprises (SMEs). About 50 percent of companies in 2014 employed between 20-49 employees; 84 percent had less than 250 employees. Only 29 companies (0.5 percent) had 1,000 or more employees (Statista, 2016c).

3.1.1. **Geographic concentration & industry composition**

Manufacturing in the food processing industry in Germany is spread across the country with notable exception of city-states Bremen and Hamburg (see Table 6). Nevertheless, four large federal states (North Rhine Westphalia, Lower Saxony, Bavaria and Baden-Württemberg) control the lion's share: almost 71 percent of the industry turnover is generated by firms based in these states.

Federal State	**Firms**	**Employees**	**Turnover** (in billion euros)
North Rhein Westphalia	945	91,084	34.5
Lower Saxony	627	67,256	28.5
Bavaria	858	106,526	24.0
Baden-Württemberg	786	63,814	14.1
Saxony-Anhalt	166	20,882	6.5
Schleswig-Holstein	244	20,213	6.2
Hesse	310	28,798	5.2
Rhineland-Palatinate	254	18,191	4.6
Mecklenburg-Vorpommern	156	15,515	4.4
Saxony	328	17,806	4.3
Brandenburg	156	11,668	3.8
Thuringia	172	17,547	3.3
Berlin	86	8,245	2.3
Saarland	66	7,550	1.5
Total	**5,154**	**495,095**	**143.3**

Table 6: Manufacturing units in food processing industry in German federal states[22]

[22] Source: (Statistisches Bundesamt, 2016b). City-states of Hamburg and Bremen did not report any such units.

"Meat and meat products" (23.5 percent) and "milk and dairy products" (13.9 percent) constitute the two largest segments within the food processing industry, accounting for 40 percent of its total turnover in 2015. Figure 8 shows 15 top sub-sectors within this industry, accounting for almost 93 percent of the overall turnover.

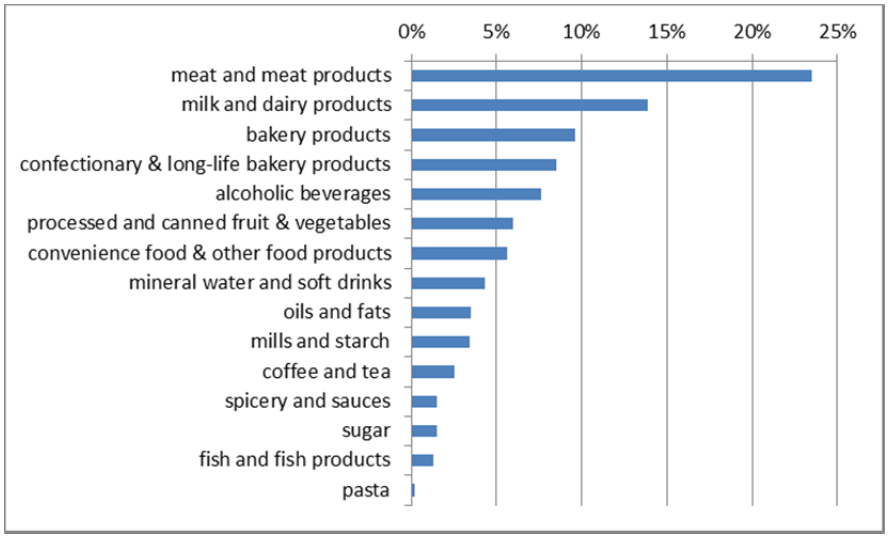

Figure 8: Key sub-sectors within Germany's food processing industry

3.1.2. **Domestic Market**

Turnover of the firms from the food processing industry in the domestic market (including imports) stood at €113.3 billion in 2015.

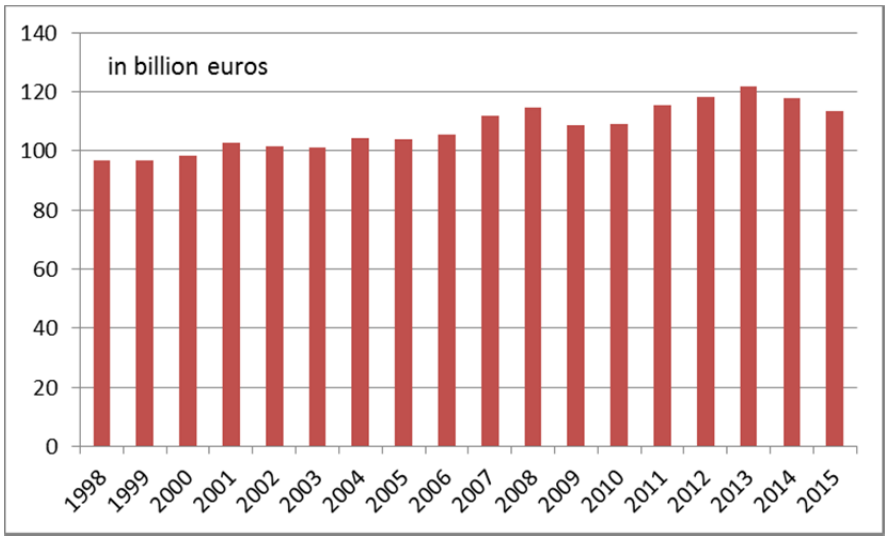

Figure 9: Sales of food and beverages in Germany's domestic market[23]

[23] Author's illustration based on data by BVE and the Federal Statistical Office cited in (BVE, 2016a).

But the growth has been modest (from €96.6 billion in 1998) and the past few years have seen deflationary pressure (see Figure 9). Overall the industry grew by a mere 17 percent in 18 years since 1998 (BVE, 2016b). The compound average growth rate (CAGR) has been only 0.9 percent.

On the other hand, Germany witnessed a growing trend of imports of food and beverages in this period. According to BVE (2016a) data, the imports (including of raw material for food processing) more than doubled from €23.4 billion in 1998 to an estimated €48.1 billion in 2015.[24] The largest exporter of food products for human and animal consumption[25] to Germany was the Netherlands, followed by France, Poland, Italy and Belgium (see Table 8). Figure 10 shows the growth rates of imports and exports by Germany's food processing industry between 1998 and 2015. While Germany was a net importer of food prior to 2007, in the past 9 years it has managed to not only reverse but also consolidate its trade balance.

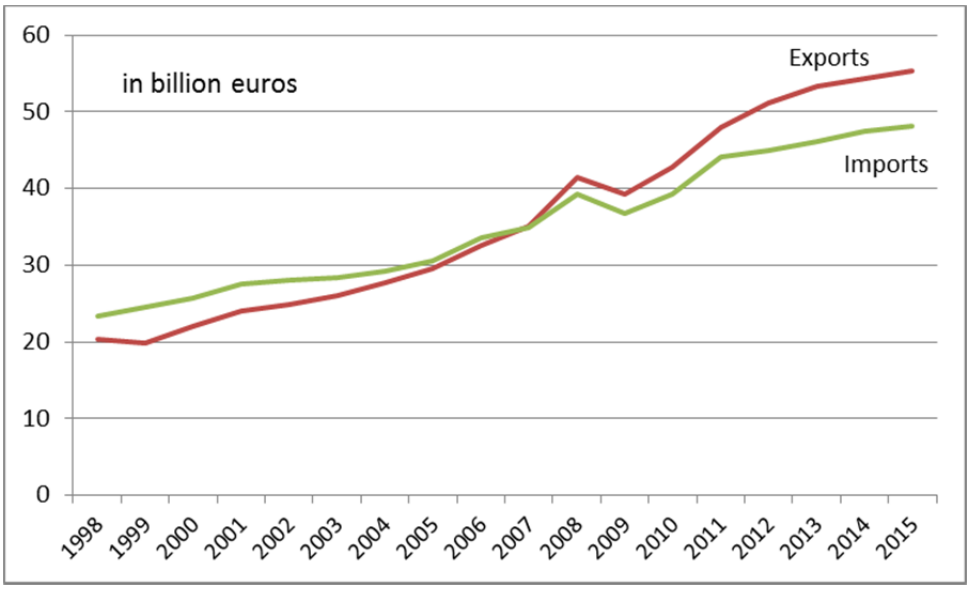

Figure 10: Imports and exports by German food processing industry[26]

Strong competition and the consolidation of players have, apparently, kept a check on consumer prices. Since 1991, prices for food and non-alcoholic beverages have risen more modestly (+41%) than the overall consumer price index (+52%), according to BVE (2016b). A single-person household in Germany, on average, spends €159 per month, and a four-person household €500, for food and beverages (BVE, 2016b). Nevertheless, large chains of retailers (e.g. Edeka and Rewe) and discounters (e.g. Aldi and Lidl, the latter belonging to the

[24] The top-5 sources for imports lie within the EU; see Table 8.
[25] This refers to the statistical product group "GP09-10: Nahrungsmittel und Futttermittel".
[26] Author's illustration based on data by BVE and the Federal Statistical Office cited in (BVE, 2016a).

Schwarz Group) have a dominating control over the market to the end-consumer. These four chains together control two-thirds (67 percent) of the market, so that the bargaining power of such customers (which are not necessarily end-consumers) must be regarded as high.

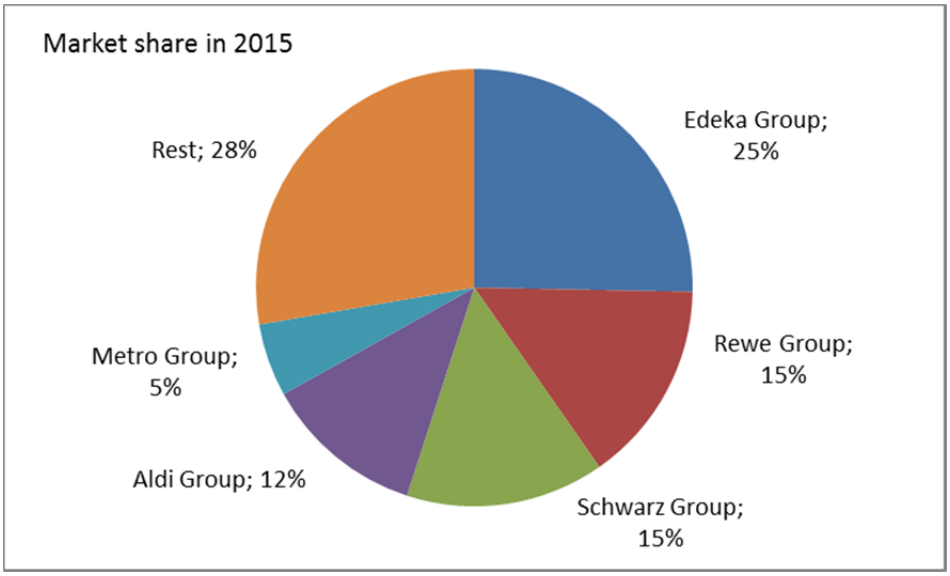

Figure 11: Market share of leading departmental stores chains[27]

In relative terms, German consumers (have to) spend less on food and beverages in comparison to consumers in most other member states of the European Union (EU). Only 10.2 percent of the expenditure on private consumption in Germany was related to food and beverages. Amongst all EU member states consumers only in Austria, Ireland, Luxembourg and the UK spent an even lesser share on food and beverages (BVE, 2016b). This seems to be directly related to the level of disposable incomes. In purely statistical terms, every German citizen had €21,879 at his or her disposal to take care of personal needs and necessities in 2016 (BVE, 2016c). Share of expenditure on food and beverages in the total private consumption is typically higher in economically poorer countries. For example, within the EU, countries in the Eastern Europe and the Baltic States typically spent a much greater share of their private consumption on this score.

The relatively small share of food and beverages in the total expenditure on consumption does not mean less actual consumption or "frugal" dietary habits. According to a report by WWF Deutschland (2015: 5) an average German consumes about 679 kg food per year. Much of this is driven by meat and meat products. An average German reportedly consumes 50 kg of pork, 20 kg of poultry meat and 12 kg of beef in a year. Consumption of protein-rich pulses,

[27] Author's illustration based on BVE (2016c) data.

on the other hand, is as low as 400 g. (!) per person per year on average (WWF Deutschland, 2015: 5). This lifestyle is increasingly considered unhealthy and harmful for the environment, apart from creating social problems in the developing countries of the global south, which engage in virtual (indirect) "export" of arable land.

In the next section, we take a look at some emerging trends in Germany's domestic market, which offer growth potential beyond the largely saturated "mainstream" market.

3.1.2.1. Trend of organic foods, fair trade and regional products

After the United States, Germany is the second-largest consumer of organic food and beverages. In 2015, organic products worth €8.6 billion were sold in the country growing more than four-folds within 15 years (Statista, 2016a).

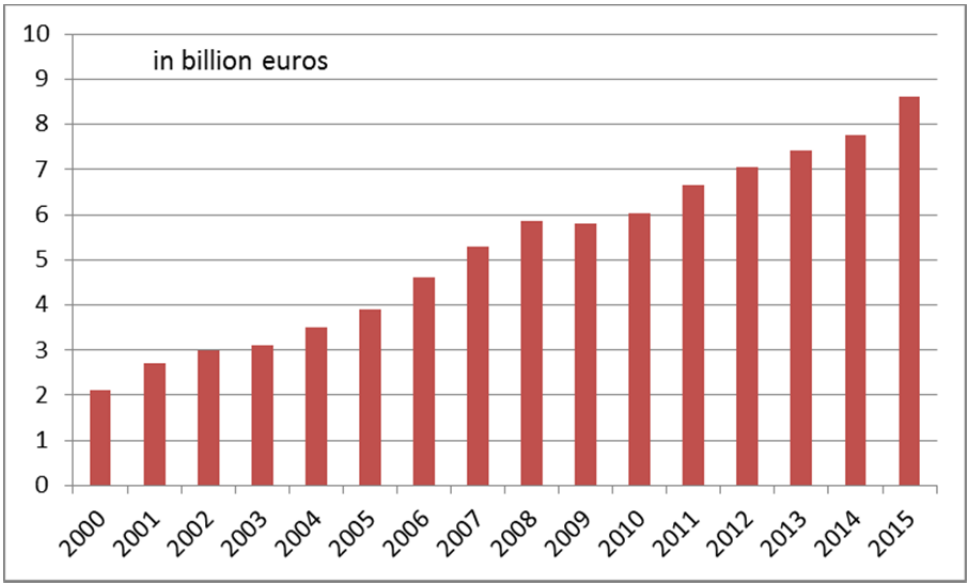

Figure 12: Turnover of organic food products in Germany (2000-2015)[28]

This is a remarkable development for an industry where the growth in general has been rather slow. There are even reports that the demand for organic products is growing faster than the domestic supply can keep pace with (BÖLW, 2015). Therefore, the market is witnessing supply bottlenecks and increased imports.

As of 2016, the share of organic products in all food and beverages sold was estimated to have reached 5.3 percent. Above-average share of organic items was found to be in the following product groups: "cereals & muesli" (14.2 percent), bread spreads (9.8 percent) and "fruits, vegetables and potatoes" (7.8 percent). The number of products with certification of

[28] Author's illustration based on Statista (2016a)

being organic ("Bio-Siegel") has grown consistently and steadily: from 23,931 in 2004 to 71,528 in 2015. While in 2004 only 1,231 firms made use of this certification, this number has also jumped to 4,564 by 2015 (BMELV, 2016).

Even as the share of the "LOHAS" – people leading Lifestyles of Health and Sustainability for environmental and social-ethical concerns – in the society increased from 9.6 percent in 2007 to 15.1 percent in 2015, [29] also interesting to note is the role of the "Fair Trade" movement in this trend.[30] A significant – in case of bananas and tee even an overwhelming – share of products that come via Fair Trade are also organic (Statista, 2016c). The increasing role of ethics in consumer decisions has been also identified in a study by the Otto Group, which found out that the share of people who state to "often" purchase products that have been manufactured in an "ethically correct"[31] way increased from 26 percent in 2009 to 56 percent in 2013. At the same time the share of consumers who stated not or only rarely to care about such things decreased from 33 percent to 11 percent in this period. The reason most cited for this behaviour was the wish to increase the quality of life for other fellow human (and living) beings as well as for oneself (Otto Group, 2013). This is also consistent with the Fair Trade movement, in which "consumers choosing Fair Trade simultaneously buy a product and make a donation to improve the lives of those farmers and workers who produced it. Consumers may perceive a higher price as a good attribute, because they may imagine that the more they pay, the more ethical their economic actions are" (Valkila et al, 2010: 259).

Another related trend is that of favouring products from one's own region: 75 percent respondents in a representative survey conducted on behalf of the Federal Ministry of Food, Agriculture and Consumer Protection in 2013 claimed to be willing to pay more for regional products (BMELV, 2013). Many of them also stated to favour regional products because these, in their opinion, were more likely to be fresh, safe and of organic produce.

[29] Everage (2002) describes LOHAS consumers as following: "When the general population is segmented into consumer groups, the LOHAS consumer group consists of 63 million adults. This consumer group's attitudes, behaviours, and usage of goods and services are affected by their concern for health — the health of their families, the sustainability of the planet, their personal development, and the future of society."

[30] The term "Fair Trade" was introduced as a marketing label in 1988 and is concerned with "creating 'fair' economic benefits to producers in the economic South through access to markets and distribution networks for their goods in the economic North. Economic gains, including a social premium built into price, are then invested by producers in a variety of community economic development projects, such as schools, wells, roads and transportation" (McMurtry, 2009: 27). Valikila et al (2010: 259) characterize Fair Trade products as "ethical luxury goods".

[31] The study defined organic, regionally-produced, Fair Trade or environmental friendly products as "ethically correct" products.

3.1.2.2. Trend of Vegetarian & Vegan Foods

A recent study suggests that "global diets are becoming more plant-based than ever before, with vegetables and heritage grains as the focus" (Hudson, 2015). Germany is no exception to this trend. The share of people living on a vegetarian diet in Germany, which has a traditionally non-vegetarian food culture, is estimated to have grown to 9 percent or about 7.8 million people (Statista, 2016e). A study by GfK published in October 2015 suggests that the number of "flexatarians" (people who say they are deliberately trying to reduce the consumption of meat in their households) is over 25 percent across all age-groups. Especially senior citizens (43% of 60-69 years old and 52% of those 70 years and above in age) are reported to have reduced their consumption of meat and meat products.

This trend is also corroborated by other studies. For example, in a study conducted by Forschungsgruppe g/d/p in June 2015, 59 percent of respondents in the age group of 56 years and above stated to already have reduced their consumption of meat and meat products (Statista, 2016e). A GfK Study suggests that the number of people purchasing meat substitutes (e.g. soya-based products) and vegetable spreads increased from 9.8 million in 2012 to 14.2 million in 2015 (Statista, 2016e). This could be also observed on the innovation front: in 2016 the share of vegetarian meat-substitutes amongst all "meat and meat-like" products stood at 20.4 percent, up from 6.2 percent in 2011, which shows a 3-folds growth within 5 years. On the whole, the share of innovative vegetarian and vegan products amongst all new food items and beverages introduced in the market in 2015 in Germany stood at 10 percent and 6 percent respectively (Statista, 2016e).

These trends are also clearly supported by hard data. Revenues generated by the food processing industry in Germany with vegetarian and vegan products more than doubled between 2010 and 2015, growing from €208 million to €454 million according to a study by IfH Köln (2016).[32] This suggests a CAGR of 16.9 percent for the sales of vegetarian and vegan products in Germany, whereas the food processing industry in Germany registered an overall CAGR of merely 0.8 percent (growing very modestly from €109 billion to €113.3 billion). The corresponding annual growth rates, and the stark contrast between them, based on the data from 2010-2015 can be seen in Figure 13.

[32] A study by market research firm Nielsen puts the revenues generated by vegetarian and vegan products in 2015 at an even higher €552 million (Lebensmittel Zeitung, 2014). In order to rather err on the side of precaution, this study works with the more conservative figures of IfH Köln (2016).

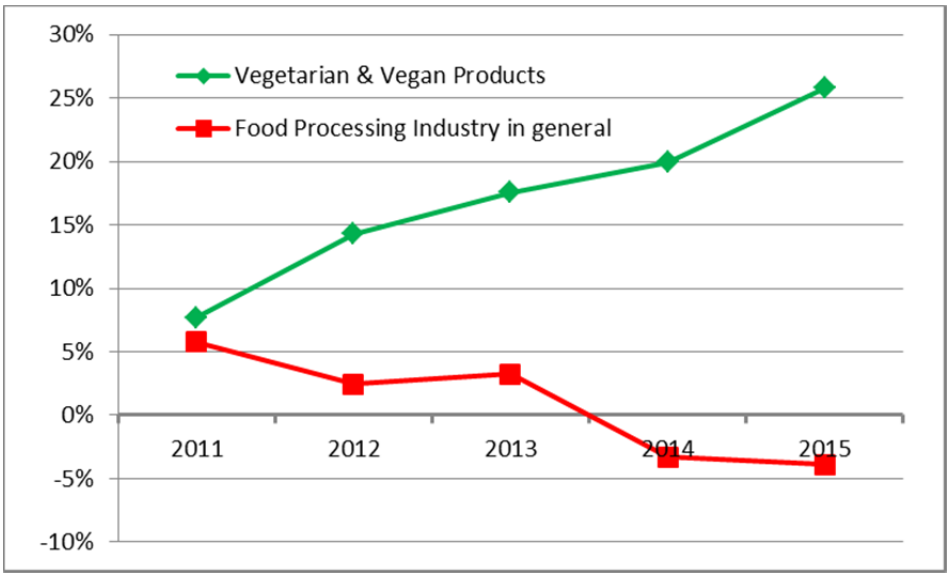

Figure 13: Growth in turnover of vegetarian/vegan products in industry comparison[33]

Health concerns, animal rights, and environment protection are the three most common reasons for people to renounce or reduce consumption of meat and meat products in Germany (Statista, 2016e). According to a survey conducted by Statista in August 2016, 34 percent of German respondents in the age-group 18-69 years had already made experience with Yoga, while 10 percent practiced it currently (Statista, 2016d). A study suggests that 46% of those who practice Yoga do it for healthcare. These health-conscious people could be an attractive target group for vegetarian & vegan products.

On the whole, available data suggest that an increasing number of people across the society prefer to eat more vegetarian & vegan food for varying reasons. Since the number of senior citizens opting for this sort of diet is increasing, it presents a very attractive opportunity. Pensioners constitute an affluent section of the society in Germany and Germany being an "ageing society" their number is set to grow even further (Kohlbacher and Herstatt, 2008).

3.1.2.3. Global trend of Health & Wellness foods and beverages

There is a growing global demand for Health & Wellness (H&W) foods and beverages that support people in prevention of diseases. According to a report by Euromonitor (2012), the global market for H&W food and beverages already stood at $628 billion in 2011. A particularly interesting category in H&W in the context of this study is built by Naturaceuticals that refer to foods and beverages aimed at health promotion and disease prevention. e.g. through dietary supplements. Within the category of Naturaceuticals,

[33] Based on author's calculations from data on turnover of vegetarian and vegan products as per a study of IfH Köln (cf. Statista, 2016e) and from data on domestic sales of foods & beverages (cf. Statista, 2016c).

functional & fortified foods[34] were reported to have a market volume of $199 billion in 2011, whereas vitamins and dietary supplements accounted for another $84 billion (Euromonitor, 2012). Global sales of dietary supplements reportedly grew faster than those of vitamins and were estimated to stand at $52 billion in 2014 (Euromonitor, 2015). Table 7 shows category-wise global sales of H&W foods and beverages across various sub-segments.

No.	Category	Sales (billion $)	Share (%)
1	General well-being	295	49.15%
2	Weight management	144	23.99%
3	Digestive health	63	10.50%
4	Energy boosting	20	3.33%
5	Endurance	18	3.00%
6	Oral health	17	2.83%
7	Bone & joints health	14	2.33%
8	Food intolerance	8	1.33%
9	Cardivasuclar health	7	1.17%
10	Respiratory health	5	0.83%
11	Other prime positioning	5	0.83%
12	Immune support	2	0.33%
13	Brain health & memory	1	0.17%
14	Beauty from within	1	0.17%
15	Urinary tract health	0.141	0.02%
16	Vision health	0.002	0.00%
	Total	**600.143**	**100.00%**

Table 7: Global sales of Health and Wellness foods and beverages in 2010[35]

[34] Functional foods can be defined as "foods enhanced with bioactive ingredients and which have demonstrated health benefits. Examples are probiotic yogurt, or pea fibre-fortified breads and pasta" (AAFC, 2015). They "are designed to have physiological benefits and/or reduce the risk of chronic disease beyond basic nutritional functions, and may be similar in appearance to conventional food and consumed as part of a regular diet" (ARS, 2010). Food fortification refers to "the practice of deliberately increasing the content of an essential micronutrient, i.e. vitamins and minerals (including trace elements) in a food, so as to improve the nutritional quality of the food supply and provide a public health benefit with minimal risk to health" (Allen et al, 2006: xxvii).

[35] Based on Euromonitor (2012)

On the whole "consumer interest in wellness is no longer just about looking good and exercising, but about holistic and preventative health" (Euromonitor, 2012).

The impact of this global trend can also be observed in Germany where gluten-free and lactose-free foods have seen a strong performance by "benefiting from growing awareness of food intolerance issues" (Euromonitor, 2016a). Growth has also been "driven by widening availability, particularly of more affordable options, with discounters such as Aldi and Lidl broadening their ranges" (Euromonitor, 2016a). Germany also has an ageing population (Kohlbacher and Herstatt, 2011), which shows a keen and natural interest in general wellbeing and preventive care and thereby "providing some important pockets of opportunity" (cf. Euromonitor, 2012).

3.1.3. **Export market**

Germany, according to BVE (2016b), "is the third largest exporting nation for food and drink products", with a share of 5.84% in the global market, preceded only by the USA and The Netherlands.[36] In 2015, Germany exported food and beverages worth €55.3 billion, which was almost three-times the amount of its exports in 1998. In this period exports grew at a CAGR of 6.1 percent, in a strong contrast to the industry in general (CAGR: 0.9 percent) or even imports (CAGR: 4.3 percent); see Figure 10. The overall share of exports in the turnover in 2015 stood at 33 percent (BVE, 2016b).

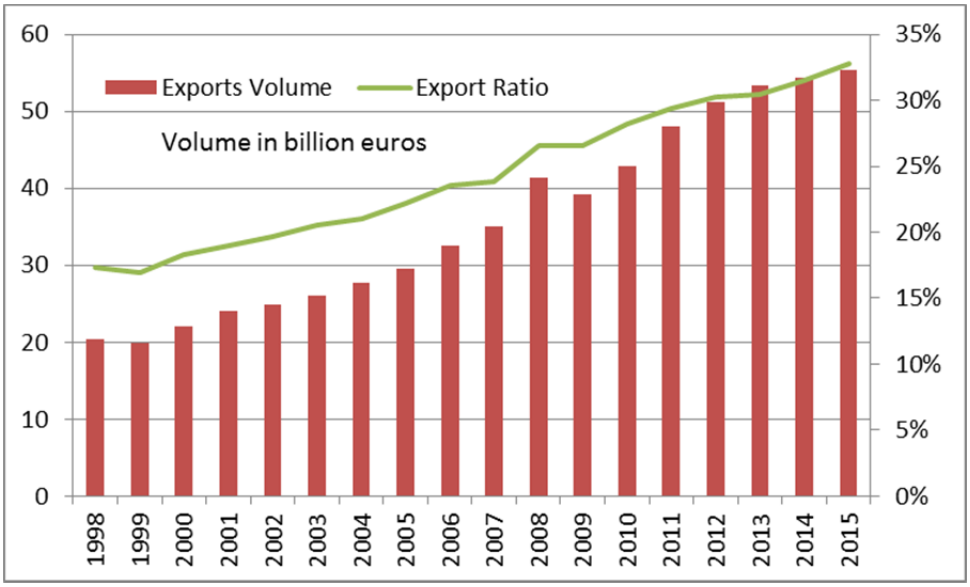

Figure 14: Export trends in Germany's food processing industry

[36] In industries closely related to the Food Processing Industry the picture is similar. For example, export ratio of German manufacturers of food processing and packaging machineries, formally represented by the industry association VDMA, is reported to stand at over 90 percent (Deshpande, 2016).

Most important export items of the German food processing Industry, as per UN Comtrade data for 2014, included – amongst other things – miscellaneous food preparations, dairy products, swine meat and chocolates (APEDA, 2016b). Top-5 destinations of German exports of food and beverages lay within the EU. The Netherlands, France, Italy, the United Kingdom and Austria were the most important markets for German exporters, as can be seen in Table 8. India was placed 73 in the list of exporters with an export volume of about €24 million.

Germany's Imports			**Germany's Exports**		
Rank	**Country**	**Value** (€ million)	**Rank**	**Country**	**Value** (€ million)
1	The Netherlands	8,384.8	1	The Netherlands	6,409.9
2	France	3,426.1	2	France	4,623.1
3	Poland	3,394.6	3	Italy	4,218.0
4	Italy	3,284.0	4	United Kingdom	3,830.9
5	Belgium	3,091.6	5	Austria	3,490.3
24	**India**	**273.2**	**73**	**India**	**24.2**

Table 8: Germany's trade with top-5 international partners and India in food & beverages

3.1.4. **Innovation Activities and Research & Development**

According to one study, the cumulated amount of annual R&D expenditure by firms in the food processing industry in Germany stood at €2.98 billion in 2014 (ZEW, 2016). On average, firms spent 1.4 percent of their turnover on innovation activities and 5% of the turnover was generated by products that had been launched within past 3 years (ZEW, 2016). The industry finds itself in the lower-end of innovation rankings in national comparison. Nevertheless, 27 percent of firms stated to have introduced new products or processes within the past 3 years, which means that the industry does not rely singularly on technology-driven, R&D-intensive innovations.

3.1.5. **Human resources**

The food processing industry in Germany provided employment to 569,162 persons in 2015. The employment-base has thus seen a moderate growth from 531,697 in 2008 (Statista, 2016b). The industry generated, on average, a turnover of close to €300,000 per employee. Average annual gross salaries have increased in the past 20 years significantly; from €23,694 in 1996 to €35,772 in 2015 (Statista, 2016b). However, they vary starkly between individual

industry sectors. For example, in the beverages segment the average annual gross salaries already stood at close to €35,000 and had reached the level of around €48,000 by 2015 as per official data (Statista, 2016b). The above-average rising levels of salaries in a largely stagnating industry might also be connected to the lack of skilled labour which is faced by German firms, especially SMEs (Herstatt et al, 2007; Buse et al, 2010). As Figure 15 shows the number of apprentices, undergoing vocational training, in the German food processing industry has seen a steady decline, going down almost by half between 2007 and 2015 (Statista, 2016b).

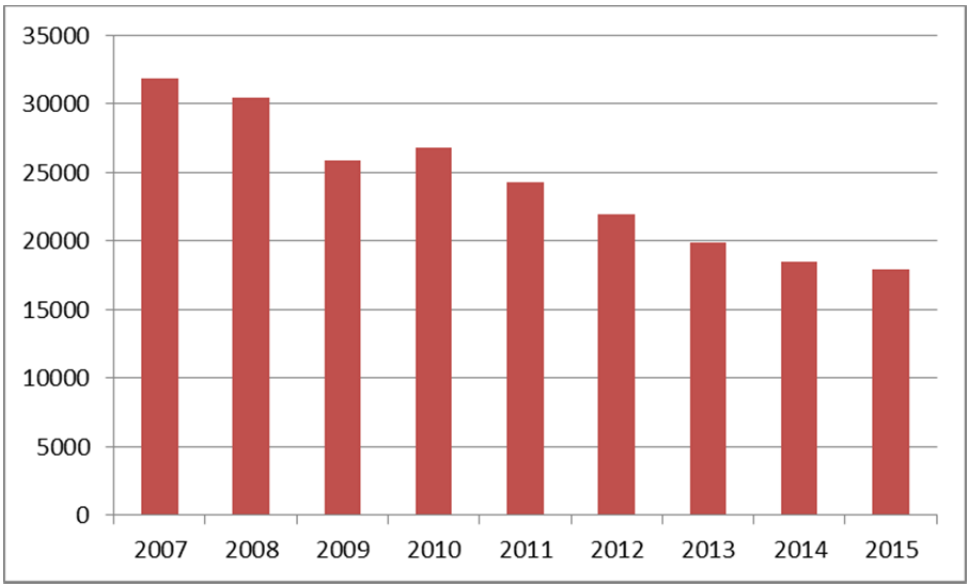

Figure 15: Number of apprentices in Germany's food processing industry[37]

At the same time, the number of students in universities and other institutions of higher education has seen significant growth Table 9.

Degree course	1998/99	2014/15	Growth
Nutritional Science ("Ernährungswissenschaft")	701	2,790	298%
Food Chemistry ("Lebensmittelchemie")	1,757	2,520	43%
Food Technology ("Lebensmitteltechnologie")	2,748	4,644	69%
Milk and Dairy Economy ("Milch- und Molkereiwirtschaft")	98	120	23%
Total	**5,304**	**10,074**	**90%**

Table 9: Number of students of Food Processing subjects in academic institutions[38]

[37] Source: Author's illustration based on data from Federal Statistical Office cited in Statista (2016c)
[38] Author's compilation of official Federal Statistical Office data provided in Statista (2016c)

Especially, “Nutritional Science” and “Food Technology” have turned into attractive academic subjects for young people seeking higher education degrees. This might be an indicator for the growing role of innovation, R&D and other upstream activities in the value chain that necessitates recruitment of highly-qualified personnel.

3.2. Opportunities & Challenges Faced

Based on the discussion in the previous sections of this chapter we can see that the German food industry is a very well-developed industry that is globally successful. It has successfully circumvented restrictions imposed by Germany’s geographic climate that is not conducive for many agricultural and horticultural products. The country excels in technological innovations, is Europe’s largest market in the food sector and a leading exporter of processed foods.

However, the industry is also faced with sustainability issues that are partly rooted in the conventional consumer food behaviour that has been highly biased towards consumption of meat in various forms that is grown in mass animal farming. Many environmentally, socially and/or health-conscious consumers increasingly see this as a grave problem and act in two ways that potentially have significant implications for the food processing industry. Many consumers are turning towards purchasing (a) organic food, (b) regional products that do not have to be transported across national or continental boundaries.

An opportunity lies in meeting the challenge of catering to new trends with affordable prices. For example, many consumers wish to participate in the trend of eating healthy, vegetarian food but are put off by the high prices. In one study almost 70 percent of respondents cited “prohibitive prices” of vegetarian products as a reason for not consuming them more often, while close to half complained about lack of suitable vegetarian products or lack of tasty alternatives (Rügenwalder Mühle, 2015). This is an indicator for the need of implementing frugal innovations that can provide “affordable excellence” (Mashelkar, 2014; Tiwari et al, 2016) and enable food products that fit this criterion (Hosafci, 2016).

A recent study by consultancy firm PwC (2014) has also identified the demographic change as one of the megatrends affecting the German food processing industry. On the one hand, the industry operating in a rapidly ageing society is facing the challenge of finding enough personnel; on the other hand consumption habits are changing leading to a stronger demand for more healthy food products and smaller packings for a growing number of single-person households.

Some of core opportunities and challenges as well strengths and weaknesses of Germany's food processing industry are summarized in the following SWOT analysis (cf. Pickton and Wright, 1998), see Table 10:

Strengths	**Weaknesses**
• Well-developed and globally competitive industry with forward and backward linkages • High share of small and medium-sized enterprises (SMEs) • highly-skilled manpower • Internationally recognized capabilities in food sector R&D and innovation	• Saturation in the domestic market & price-driven competition, especially in the case of convention foods • Dominated by large MNCs with overseas roots • Shortage of young (highly-skilled) recruits due to demographic changes • R&D and innovation deficits in many SMEs due to fiscal difficulties
Opportunities	**Threats**
• High importance of food and nutrition in society • Increasing public awareness for health-enhancing dietary products • Lifestyle changes due to demographic developments and socio-cultural trends favouring organic, fair trade and vegetarian/vegan diets • Emergence of niche markets that cater to the needs of specific groups	• Increasing market concentration in retail and the resultant pressure on prices • Scepticism of many consumes vis-à-vis new products and processes • Increasing costs of (imported) raw material and other resources • Decreasing number of the youth taking vocational courses in the food processing industry

Table 10: A SWOT analysis of Germany's food processing industry[39]

[39] Based on author's analysis in the preceding sections as well as on (Eisner et al, 2010; 2011)

4. Existing levels of bilateral collaboration in the food sector

Having introduced the food processing industries of both India and Germany in detail and having identified their strengths and weaknesses as well as the potential opportunities and threats faced by them, we now turn our attention towards the scope of a mutually beneficial partnership between the two countries in the field of food processing. The chapter is divided into two sections. The first one provides a brief overview of the overall bilateral partnership, whereas the second one documents the existing level of partnership specific to the food processing industry.

4.1. Brief profile of Indo-German Partnership

India and Germany share a long history of economic partnership that dates back to the 16th Century (Kundu, 2005). In 2015, with a trade volume of €17.3 billion, India was Germany's 25th largest trade partner (Statistisches Bundesamt, 2016a).

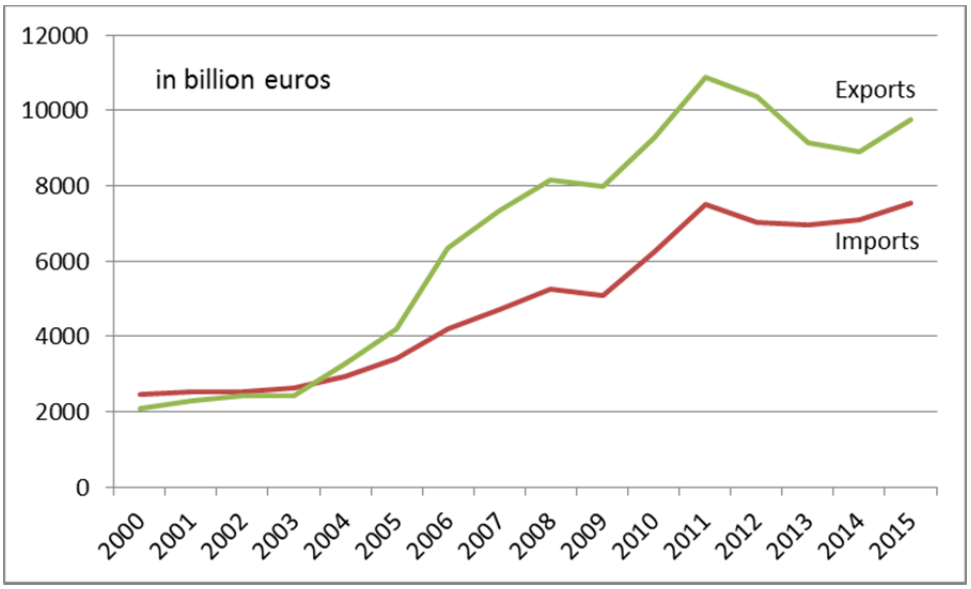

Figure 16: Germany's trade with India[40]

As Figure 16 shows, the bilateral trade has grown tremendously in the post-2000 period and while India had a positive trade balance at the turn of the millennium, Germany's exports to India have grown at a rapid pace. The compound annual growth rate (CAGR) of the bilateral

[40] Author's illustration based on data of Federal Statistical Office.

trade in this period has been 9.3 percent, while for German exports the CAGR has stood at 10.8 percent.[41]

According to official figures from the Govt. of India, Germany was the 7th largest source of foreign direct investments (FDI) into the country. At the end of FY 2015-16, cumulative FDI from Germany since the turn of the millennium stood at $8.6 billion (GOI, 2016b). The official figures from the Bundesbank, Germany's Central Bank, however put the figure of net German FDI in India even higher at €9.2 billion at year-end 2014, the last year for which the data is available (Bundesbank, 2016).

Many Indian firms too have invested to a considerable extent in Germany. As of August 2016, the cumulative amount of Indian FDI in Germany was estimated to stand at €4.1 billion (Tiwari, 2016). However, the food processing industry does not seem to play a significant role in the outbound FDI from India to Germany as yet, since the scenario is largely dominated by firms from information and communication technologies (ICT) and automobile sectors (Tiwari and Herstatt, 2010). More than 150 Indian multinational companies (MNCs) with about 230 registered subsidiaries were estimated to be active in Germany as of August 2016, and provided employment to close to 27,400 persons (Tiwari, 2016).[42]

4.2. Existing levels of bilateral collaboration in the food sector

As per data of the German Federal Statistical Office, Germany imported food items worth €273.2 million from India in 2015.[43] India was placed 24th in the ranking of trade partners in terms of imports of food products. Germany's total volume of import from India was less than what it imported from Indonesia (€582.78 million) or Thailand (€393.44 million). On the other hand, Germany's export of "food products for human and animal consumption" to India was almost dismal: It stood at a meagre €24.2 million in 2015, behind countries like Honduras, Malta or Ghana.

In terms of FDI, investment proposals of German firms related to India's food processing industry worth $268.5 million were approved by Government of India between August 1991

[41] It is a fair assumption that the true level of economic relations is even more extensive since the trade data usually reflects merchandise trade but not that in services. Moreover, many firms are registered locally as a part of their FDI in the partner country, so that their turnover is not reflected in the data on international trade. In addition, firms export sometimes via their production units run by subsidiaries in third countries, which cannot be observed directly in the data on bilateral trade. For a more detailed discussion on this see Tiwari (2012).

[42] Official figures of the Bundesbank (2016) differ considerably from these numbers. A primary reason for this lies in the complex cross-border structures of holdings & ownership of investing firms; for further elaboration see Tiwari (2016).

[43] Product code GP09-10 "Nahrungsmittel und Futtermittel" (food products and fodder)

and March 2015 as per a report published by the Indo-German Chamber of Commerce, (IGCC, 2015). 46 of such approvals concerned financial investments, while 7 related to technical collaborations. On the other hand, no significant FDI activities of Indian firms in Germany have been noticed in the food processing industry so far (Tiwari and Herstatt, 2010; Tiwari, 2015).

One field of collaboration related somewhat indirectly to the food processing industry as such is that of the “food processing and packaging machinery”, since it comes under the ambit of Mechanical Engineering. The food processing equipment sector in Germany contains the following category of equipment (DSIR, 2010: 4-5):

- Packaging machines for foods
- Packaging machines for beverages
- Bakery machines
- Machinery for large kitchens, restaurants and hotels
- Coffee, tea and tobacco processing machines
- Slaughter house and butcher’s machines and equipment
- Beverage processing machines
- Confectionery machines
- Preserving machines
- Mills and grinding plants
- Machines for sugar industry
- Universal sieving and mixing machines
- Sheet metal box manufacturing machines
- Food processing machines
- Dryers
- Other machines
- Components and parts

Germany's export of food processing and packaging machinery to India has grown consistently since 2005. While German firms exported food processing and packaging machinery to India worth €23 million in 2005; the exports reached the peak with €132 million in 2013 and moderated to €94 million in 2014 (Deshpande, 2016); see Figure 17.

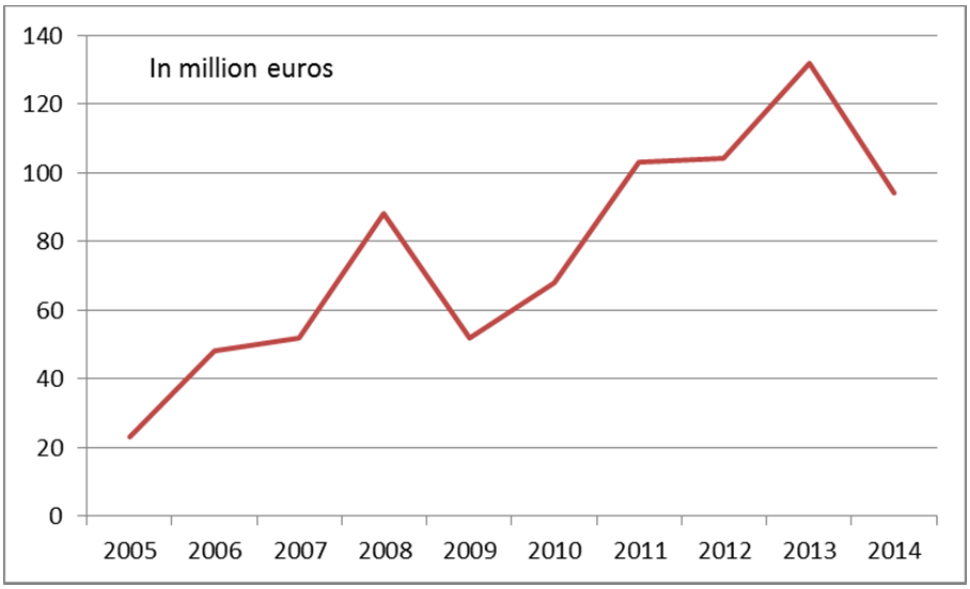

Figure 17: Germany's export of food processing and packaging machinery to India[44]

This also points to the increasing need for sophisticated machinery and equipment in India as its food processing industry grows and the business environment becomes more demanding. According to one report of the Department of Scientific and Industrial Research of the Govt. of India, "The technology available in India in the agro-food processing equipment sector is not much advanced when compared to the developed countries. In India, the major thrust in research and development in the agri-food sector has been on the processing of food rather on developing equipments in this sector. Most of the technologies available in the equipment sector which could be considered as globally competitive fall in the category of pre-harvest technologies" (DSIR, 2010: 2).

Apart from the export of such equipment, many German firms from the field of Mechanical Engineering have also created local production capabilities in India. According to Mechanical Engineering Industry Association ("Verein Deutscher Maschinen- und Anlagebau"; in short: VDMA), "Our member companies do not only supply their food processing and packaging machinery to India but invest in the country itself. Many of them can look back on a long tradition in the country. They have recognized the considerable potential of India and established own production facilities to serve the local market. With this they have created lots of jobs. In addition some of our member companies are represented in the Indian market by Joint Ventures, own sales offices or via Indian sales agencies" (VDMA India, n.d.). According to Richard Clemens, Managing Director, Process Plant Equipment and Food Processing & Packaging Machinery at VDMA, the growing population and steady increase in

[44] Author's illustration based on VDMA India and Federal Statistical Office data cited in Deshpande (2016).

disposable incomes make “the climate favorable for German manufacturers who wish to start or expand their businesses in India” (Deshpande, 2016).

In short, the bilateral collaboration between the two nations goes beyond the known data sources such as trade and FDI directly related to the food processing industries.

5. Conclusions

The previous sections have showcased the profiles as well as the opportunities and challenges faced by Indian and German food processing industries. This analysis has brought to fore that the food processing industries in both countries have complementary strengths and both can benefit from the synergies that can be better exploited through intensified cooperation across a variety of fields. In the following, we highlight fours such potential fields of interaction and cooperation involving the corporate and institutional sectors.

First, India has an abundant supply of agricultural and horticultural produce but is confronted with high wastage & loss of large quantities of this produce. At the same time Germany has a very well-developed physical infrastructure and the technologies required to prevent such unnecessary losses. This opportunity can be exploited in two ways creating mutual benefit in commercial and social respects. While German firms can invest in India in the relevant fields and/or partner with Indian firms to create localized solutions, Indian firms can also invest in Germany to gain access to the requisite expertise and technology. Outbound FDI by Indian firms can also provide them with an opportunity to create R&D capabilities in a lead market.[45] Overall, "India has a strong backlog demand for modern food processing and packaging technology" (Deshpande, 2016) and technological upgradation will help Indian firms to increase productivity & capital utilization including in the unorganised sector. A collaboration that allows joint technological development and/or access to existing and emerging technologies can be in mutual interest, as "many companies across the world today consider it to be rather unwise to attempt for self-sufficiency in technology development, particularly in an era, where the R&D costs are increasing rapidly" (Mashelkar and Chinchure, 2016: 30). This collaboration does not only have commercial ramifications but also has broader social implications at a global level. Increased food security in India and reduction in unnecessary wastages and losses of food products would help the global fight against hunger and poverty for which sustainable food consumption and production in food and agriculture is absolutely crucial. According to CII (2016), "even marginal reductions in these losses are bound to give us better returns and thereby improve the income level of the farmers."

[45] A lead market possesses critical technological and demand-side advantages (Beise and Gemünden, 2004; Tiwari and Herstatt, 2014). It can provide significant impetus to R&D and is considered a driving force for the internationalization of R&D (Gerybadze and Reger, 1999).

Lessons learned in the Indian lead market can be then utilized elsewhere in countries faced with similar problems.[46] According to Clemens, "In recent years, we have recognized that subsidiaries are specifically established for the needs of the local production, meaning that machinery is directly built in India. Those machines are not only manufactured for the local market, but they are also exported" (Deshpande, 2016).

Second, India is faced with the problem of the lack of skilled manpower in food engineering and technology due to the lack of quality training, even though it enjoys an immense demographic dividend in the form of a young and aspiring population. Germany, on the other hand, has plentiful of such institutions imparting quality training and vocational education in all sectors of food processing, but is faced with the shortage of young population in an aging society. Indian institutions and companies can enter into agreements with their German counterparts that enable entry of Indian trainees into German programmes on one hand, and enable German institutions to offer such training locally in India, on the other hand.

Third, German market, even though saturated in terms of convention foods, can be an attractive market for Indian companies that can cater to the emerging trends of organic, fair trade and vegetarian/vegan foods that have health and wellness components. This is in sync with the global trend that sees food choices turning towards plant-based diets like never before: "Breads, pastas and cereals, which were once losing ground in the market are once again being consumed thanks to the focus on heritage grains. The gluten-free fad is also continuing to gain traction with lentils and chickpeas growing in popularity as pasta ingredients" (Hudson, 2015). India is home to the largest percentage of people living on vegetarian food. According to a study by WorldAtlas, 38% of Indians are vegetarians (Statista, 2016e). As documented earlier, there is a growing demand for Ayurveda and Yoga in Germany and many people associate India with health-enhancing (disease-preventing) naturaceuticals. Plants-based dietary supplements and other health products and services can prove to be a market success in Germany's emerging market trends, if such products and services are associated with high quality and certainty over the place of origin and its safety standards (cf. BDI, 2015: 24). German companies that are faced with a saturated market can also attempt to enter Indian market with products that bring Germany's cuisine in sync with India's tastes and flavours to open new channels of revenue generation.

[46] India's emergence as a lead market in certain sectors has been investigated in detail by Tiwari and Herstatt (2014; 2017). It possesses key advantages in the field of affordability-driven innovations that can meet the needs of customers in a resource-efficient and effective manner ("frugal innovations").

Fourth, India and Germany could collaborate on an institutional level to mitigate negative impacts associated with food processing. According to German Environment Agency ("Umweltbundesamt") the food processing industry is responsible for 20-30 percent of environmental effects including but not limited to greenhouse effects, release of acids and chemicals into soil and water, as well as erosion of the Ozone layer (Umweltbundesamt, 2013). Such effects must be taken into consideration when starting off on the endeavour to develop the food processing industry in any country. Experiences made by Germany and the insights generated thereby could be very useful for India (with possible global implications in the long-run) when balancing the interests of economy and ecology, and simultaneously catering to social issues such as food security.

Finally, the theme of frugal innovation, which is driven by slogans such as "less is more", "affordable excellence" or "meet the need" can provide a framework for the Indo-German collaboration in the field of the food processing industry, including in the equipment sector. Since a key driving force in "the global food industry is technological innovation, which concentrates on satisfying consumer demand for more tastes and easy-to prepare foods" (Meredien, 2013), these product and process innovations should be connected with frugality. According to Hosafci (2016), frugal innovations in the food processing industry can refer to "the idea of consumers trying to limit or avoid certain ingredients in their food choices. In a way, it shows our growing desire for simplicity and naturalness. The primary drivers of this trend are health and value for money. […] More concretely, we see a surge in the launch of new food items with fewer ingredients, thinner portions and implicit health benefit […]".[47] This has been also corroborated by studies in the equipment sector of several countries. "Pilot efforts in Benin, Cape Verde, India, and Rwanda have documented reductions of food loss by more than 60 percent during field trials of a variety of low-cost storage techniques and handling practices" (Lipinski et al, 2013). India as a lead market for frugal innovations can act as a bridge for German industry to tap into the global processed food market.

Thus, we see that there is a tremendous scope for collaboration between India and Germany. The gist of the report may be summarized in the words of Gerd Müller, who in his capacity as then Parliamentary State Secretary in the Federal Ministry of Food, Agriculture and Consumer Protection (BMELV) on a visit to Delhi in 2010 stated:

[47] For connecting frugality to various walks of life and its role in different types of innovation (product, process, marketing and organizational) refer to Tiwari et al (2016).

“We believe that our cooperation not only holds huge economic potential for both sides, but also provides an opportunity to focus more strongly on issues relating to world food security together with India, one of the world's most important agricultural producers.” (BMEL, 2010)

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APPENDIX A: TOP-15 GLOBAL EXPORTERS OF PROCESSED FOOD & BEVERAGES

No. (A)	Country (B)	Global share in 2000 (C)	Global share in 2014 (D)	Absolute change (E)	Relative change (F)
1	USA	12.60%	10.03%	-2.57	-20.40%
2	Netherlands	7.66%	6.25%	-1.41	-18.41%
3	Germany	5.76%	5.84%	0.08	1.39%
4	Brazil	2.97%	5.30%	2.33	78.45%
5	France	7.71%	5.00%	-2.71	-35.15%
6	China	3.14%	4.27%	1.13	35.99%
7	Spain	3.67%	3.43%	-0.24	-6.54%
8	Canada	4.09%	3.33%	-0.76	-18.58%
9	Belgium	3.93%	2.95%	-0.98	-24.94%
10	Italy	3.40%	2.94%	-0.46	-13.53%
11	Argentina	2.66%	2.50%	-0.16	-6.02%
12	India	1.26%	2.47%	1.21	96.03%
13	Indonesia	1.28%	0.24%	-1.04	-81.25%
14	Great Britain	3.53%	2.17%	-1.36	-38.53%
15	Australia	2.92%	2.15%	-0.77	-26.37%
	Total	**66.58%**	**58.87%**	**-7.71**	**-11.58%**

Table 11: Top-15 exporting nations of processed food and beverages

USEFUL CONTACTS

In Germany	In India
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Bundesvereinigung der Deutschen Ernährungsindustrie e.V. (BVE) Claire-Waldoff-Straße 7 10117 Berlin Phone: +49 30 200786-0 Fax: +49 30 200786-299 E-Mail: bve@bve-online.de	**Agricultural and Processed Food Products Export Development Authority (APEDA)** NCUI Building 3, Siri Institutional Area, August Kranti Marg, New Delhi – 110 016 Phone: +91 11 26513204, 26514572, 26534186 Fax: +91 11 26526187 E-mail: headq@apeda.com
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Dr. Rajnish Tiwari is Senior Research Fellow and Program Leader at Institute for Technology and Innovation Management (TIM) of Hamburg University of Technology (TUHH). He co-leads the research program on "Global Innovation" that includes work on frugal innovations. He is one of the founding members of Center for Frugal Innovation (CFI) and a part of its management team. Additionally, he advises Germany's Federal Ministry of Education and Research (BMBF) in his capacity as a member of the Advisory Circle ("Beraterkereis") of ITA ("Innovations- und Technikanalysen") programme.

Dr. Tiwari's research is centred in the confluence zone of international business and innovation management. His current research is primarily focused on affordability-driven "frugal innovations" that fulfil high quality standards ("affordable excellence") and are responsible in its usage of resources. A cornerstone of this research is built by economic/business developments in India and Indo-German collaboration. Dr. Tiwari also advises firms on cross-cultural management that includes management trainings in corporate houses. Dr. Tiwari has received several awards in the pursuit of his academic career, e.g. the "Market and Customer Orientation" prize by Vodafone Foundation for Research (2007), "Champion of Indo-German Partnership" by the Indian Academic Society Hannover (2013) and a post-doctorate scholarship by Hamburg-based Claussen Simon Foundation (since 2014).

In 2007, Dr. Tiwari co-initiated the series of India Weeks in Hamburg and continues to be an active member of its steering committee. Since February 2010 he is also leading the Hamburg section of German-Indian Round Table (GIRT) that is dedicated to promoting the bilateral economic relations. He is a member of the Advisory Board ("Beirat") of the German-Indian Society ("Deutsch-Indische Gesellschaft e.V."). Additionally, he is also a member of the Hanseatic India Forum e.V. in Hamburg.

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Image on top: Sugar factory in Wabern ("Waberns Zuckerfabrik"); photo: Oliver Deisenroth; courtesy: creative commons license from Wikimedia (https://commons.wikimedia.org/wiki/File:Wabern_Zuckerfabrik.jpg)