Industry 4.0 in Food Industry
India Food Report
January 2018
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Food is considered to be an inherent factor and a strong backbone of economic growth for any country. In India, the food industry is estimated to be USD 448 Bn in FY 16. This industry is growing at ~10% and contributes to 9-10% of manufacturing GDP in FY17. The diversity in Indian culture and changing needs of customers create further complexity in the food production and distribution system in the country. A number of changes are shaping the Indian food landscape with disruptions in business models of companies, in terms of their interaction with consumers and responsiveness to their needs. While packaged food is the fastest growing segment posting a double digit growth yoy, currently only ~10% of agri-produce is being processed in India.

Government of India’s drive to augment processing levels through Make in India campaign; and Industry 4.0 playing a major role in elevating the manufacturing as well as supply chain landscape by usage of technologies including Internet of Things (IoT), Blockchain, Predictive Analytics, the food industry in India is expected to witness a radical shift.

The complete ecosystem is expected to evolve from being a linear model to a more complex dynamic chain with multiple inter-linkages enabled by technology interventions.

For the purpose of this article, we have focused on 3 key trends that are shaping up the food industry in India:

01. Consumption Trends
02. Supply Trends
03. Regulatory Developments

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1 News articles, Industry Reports, Deloitte Analysis
2 Ministry of Food Processing Industries Annual Report 2015-16
India is the 7th largest country\(^3\) with an area of 31.7 Mn square kms, the 2nd most populous country and the 2nd largest producer of food in the world\(^3\). The task of ensuring that the food produced reaches 1.2 Bn Indians is complex and involves a number of stakeholders. About 210 Mn farmers and agriculture labourers\(^4\) cultivate various crops which they harvest and sell in Agriculture Produce Market Committee (APMC) markets or ‘mandis’. There are 2,477 APMCs and 4,843 sub-market yards\(^5\) regulated by the respective states in India. Multiple levels of value addition activities are undertaken on the agri-produce in a food processing plant, which in turn produces the packaged and processed food products. There were 38,608 registered food processing units\(^6\) in FY 15. Distribution in India involves serving a large fragmented base of kirana shops. There are ~14,000 organized retail outlets concentrated largely in urban areas. Unorganized retail consists of 12-14 Mn\(^7\) stores spread over 5,000 towns and 600,000 villages across India. The diversity in Indian culture and changing needs of customers creates further complexity in the food production and distribution system in the country.

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\(^3\) WorldAtlas.com
\(^4\) EMIS – India Agriculture Sector 2016/2017
\(^5\) http://www.indiabudget.nic.in/es2014-15/echapvol1-08.pdf
\(^6\) EMIS Insights, research reports, Deloitte analysis
\(^7\) News articles
Industry 4.0 in Food Industry  |  India Food Report

Key Segments in the Food Value Chain

- Cultivation
- Agri-logistics
- Food processing
- Distributor
- Food retail
- Food service
- Customer

**Agriculture, Forestry and Fishing**
- In FY 17, contributed to India’s GDP
- India has the 2nd largest arable land in the world with 46 soil types and 20 agri climatic regions
- However, current productivity levels are low mainly due to small farm holding: 67% of land holdings are less than 1 Ha in size
- Rainfall dependence: 50% of the agricultural land is entirely rain fed

**Warehousing**
- In FY 16, growing at 9.9%
- Contributed 9-10% of manufacturing GDP in India in FY 17
- Employment of 1.7 Mn people in 2012-13
- Package food is the fastest growing food segment with double digit growth
- Only ~10% of agri-produce is being processed in India

**Retail**
- India’s large geographical spread combined with 68% rural population and past tax laws led to a requirement for a multi-layer distribution network to reach customers
- FMCG companies, both regional and national, have developed distribution networks comprising superstockists and distributors. Parle, a biscuits major, has one of the largest distribution network in India and reaches 4.5 Mn outlets

**Food retail**
- India is the 6th largest grocery market in the world and is expected to reach USD 900 Bn by 2020
- Online grocery retail penetration is currently low and estimated to be USD 1 Bn. However, the market is growing at ~40%
- While the overall penetration of modern retail is ~10%, the penetration remains low in grocery retail with current levels ranging from 2-3%. This is expected to increase to 6-9% by 2025

**Food service**
- India has a young population with 65% of the population born after 1980
- 31% of income spend is on food, much higher than 1% (94%), China (25%) and Brazil (17%)
- Cereals and pulses account for 24% of average household spend
- Growth in per capita income at 7% between FY 07-16

**Industry 4.0 in Food Industry**
- Contribution of carbonates in India with people shifting towards natural juices and low sugar beverages. Increasing influence of global cuisine and culture has led to emergence of niche segments like cold press juice, vitamin infused water, condiments like oregano etc in the country.

**Major Food Segments in India – FY 17**

<table>
<thead>
<tr>
<th>Other Packaged Food, 17</th>
<th>Item</th>
<th>USD</th>
<th>CAGR 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Savoury snacks</td>
<td>5</td>
<td>30%</td>
<td></td>
</tr>
<tr>
<td>Biscuits</td>
<td>4</td>
<td>20%</td>
<td></td>
</tr>
<tr>
<td>Confectionaries*</td>
<td>3</td>
<td>18%</td>
<td></td>
</tr>
<tr>
<td>Baked Goods</td>
<td>2</td>
<td>10%</td>
<td></td>
</tr>
<tr>
<td>Pasta, Noodles &amp; Soup</td>
<td>1</td>
<td>9%</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>2</td>
<td>18%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sugar, Salt and Spices, 27</th>
<th>Item</th>
<th>USD</th>
<th>CAGR 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugar</td>
<td>14</td>
<td>2%</td>
<td></td>
</tr>
<tr>
<td>Salt</td>
<td>1</td>
<td>2%</td>
<td></td>
</tr>
<tr>
<td>Spices</td>
<td>10</td>
<td>17%</td>
<td></td>
</tr>
<tr>
<td>Pickles/ingredients</td>
<td>2</td>
<td>20%</td>
<td></td>
</tr>
<tr>
<td>Pasta, Noodles &amp; Soup</td>
<td>1</td>
<td>9%</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>2</td>
<td>18%</td>
<td></td>
</tr>
</tbody>
</table>

**Sugar, Salt and Spices, 27**
- Other Packaged Food, 17
- Edible Oil, 18
- Pulses, 44
- Vegetables, 68
- Animal Protein, 56
- Beverages, 12
- Dairy, 95
- Cereals, 85

Source: News Articles, EMIS,Dun&Bradstreet, Industry Reports, Deloitte Analysis

Dairy and cereals constitute 40% of the food consumed in India. However, changing consumption pattern and health consciousness is driving growth in consumption of protein over carbohydrates in the country. Health consciousness has also moderated growth of carbonates in India with people shifting towards natural juices and low sugar beverages. Increasing influence of global cuisine and culture has led to emergence of niche segments like cold press juice, vitamin infused water, condiments like oregano etc in the country.

Note: *Agriculture, Forestry and Fishing is estimated to be USD 350 Bn in FY 17, contributing to ~17% to India’s GDP.

Stay tuned for the next page in the series on Industry 4.0 in Food Industry.
A number of changes are shaping the Indian Food landscape affecting how companies function, how companies interact with consumers, and what consumers are seeking.

Key Trends in the Indian Market

**Trends in consumption**
- Health in Food
- Convenience
- Digitally active consumers

**Trends in supply**
- Make in India to support supply
- Regional to National brands
- Unorganized to Organized
- Product to services
- Sustainable supply chain

**Regulatory trends**
- GST
- SAMPADA
- FSSAI regulations

**Trends in consumption**
**Health in Food**
Changing demographics, fast paced lifestyle, low work-life balance and changing consumption pattern has led to growth of lifestyle diseases in India. Close to two thirds of the disease burden in India is due to lifestyle diseases with National Health Policy 2017 for the first time recognizing the shift in epidemiology of diseases. With 30 Mn diabetes patients, India is known as the diabetes capital of the world. India has 61 Mn patients suffering from cardio-vascular diseases and recording an increase in number of people suffering from thyroid problems, obesity, hypertension etc.

Increase in awareness has led to people looking for prevention of these diseases. People are increasingly looking for healthier alternatives in food to incorporate health in daily consumption.

The consumer health market is estimated to be USD 4.8 Bn growing at 5%.

**Health Conscious Food Pattern**
- Low sugar desserts
- Premium cold press juice
- Low carb high protein diet
- Multi-grain, high fibre atta

**Occurrence of hypertension in urban areas**
- 25%

**Occurrence of coronary heart disease in urban areas**
- 11%

**CHD patients in India**
- 7%
Saffola's Healthy Heart Foundation

- Saffola launched several campaigns to spread the awareness on role on importance of low cholesterol food for heart health.
- It has brought together stakeholders (doctors, hospitals, citizen groups, etc.) to create partnerships.
- The company leveraged digital media through online health questionnaires like ‘Heart Age Finder’ and videos like ‘Fit Foodie’ etc. in turn promoting its products like low cooking oil and oats.
- The campaign was estimated to reach over 100,000 people spurring them to make healthy choices on oil and oats purchases, enhancing Safola sales.

Convenience

Of the total population of India, 443 Mn people are Millennials and 393 Mn people are Generation Z16. A larger percentage of young population and growth in dual income households and nuclear families has led to changes in consumption pattern in the country. Long and stressful work hours, increasing travel time, need to socialize and high disposable income has created a need for convenient food options.

- **Convenient Format**
  - People are increasingly looking at packaging to provide convenience. Eastern Spices recently launched idly dosa mix in a package which can be easily carried, used and stored in refrigerator without additional hassles of transferring into containers. Paper boat’s packaging is known to increase shelf life and also gives the feeling of squeezing pulp from a fruit.

- **On-the-go consumption**
  - Mintel research states over half of Indian consumers who snack on dairy drinks do so for convenience. This need for on-the-go consumption has changed pack preferences:
    - Sachets over bottles: Rooh Afza
    - Ready to drink formats over powder: Nityam Churan, Pudin Hara
    - Food delivered in disposable plates: Ex. Freshmenu

Health Conscious Food Pattern
• Convenient to Prepare/Order
Among all food categories the Ready To Cook/Ready To Eat and packaged food has grown at the fastest rate (CAGR of 18-20%)
17. The need for convenience has led to growth of e-grocery and food delivery in India. Further, some companies have started providing food kits and semi-prepared food which is gaining popularity with urban women.

• Out of home consumption
The food service segment is estimated to be USD 48 Bn growing at 10%24. Less time to prepare food at home, increasingly affordability and disposable income has led to growth of Quick Service Restaurants (QSR) and casual dining at CAGR of 22% between 2013 and 2016.25

Digitally Active
Today's dinner table looks quite different than it did 10 years ago- there is likely a smartphone next to the fork and a laptop or tablet on the dining table. Technology and its awareness among the consumers has changed how people buy, prepare, order, perceive and consume food.

• Online grocery and packaged food shopping
A significant change that we have seen in favour of online shopping is that consumers are increasingly overcoming their biases against purchasing items without inspection and safety of online transactions. The e-FMCG market was estimated to be USD 600 Mn in 2016 and is set to grow at 60% YoY to reach USD 960 Mn by the end of 201726. Many online giants like Amazon and Flipkart, have launched online grocery businesses in 2017.

Bengalure-based Idly and Dosa batter company
• The founder of the company, identified the need for a branded product in the Idly and Dosa batter industry and established the company in 2005
• It provides hygienic and healthy Idly and Dosa batter at competitive prices
• Recognizing the potential of such product segments, Azim Premji Led Premji Invest pumped USD 25 Mn into ID fresh foods in January 2017

Revenue (in INR Cr)

<table>
<thead>
<tr>
<th>Year</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>150</td>
<td>250</td>
</tr>
<tr>
<td>2016</td>
<td>1,000</td>
<td>1,200</td>
</tr>
</tbody>
</table>

Source: News articles

Indian consumer are becoming digitally aware

<table>
<thead>
<tr>
<th>Year</th>
<th>Mobile users</th>
<th>Internet users</th>
<th>Smart phone users</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>1,000 Mn</td>
<td>300 Mn</td>
<td>240 Mn</td>
</tr>
<tr>
<td>2016</td>
<td>1,200 Mn</td>
<td>650 Mn</td>
<td>520 Mn</td>
</tr>
</tbody>
</table>

Source: Industry reports

• Online food ordering and delivery
Changing consumer lifestyle, young population and increasing disposable income have led to a demand for online food delivery players. These food delivery apps provide convenience of scanning menus, prices and peer reviews across the restaurant. Apart from the restaurants, many aggregators like Food Panda, Swiggy, Zomato, etc. and standalone kitchens like Holachef, Frehmenu etc have ventured into online food delivery. Recognizing potential in this space, many global giants like Google and Uber have entered this space with Google Areo and UberEATS respectively.

• Online payments
Payment mechanisms like digital wallets and credit and debit cards have reduced the need of carrying cash. Increased confidence of consumers in security of these mechanisms have largely benifited online transactions of food items. Many apps like paytm, mobikick, etc. have started giving offers and discounts on payments to selected restaurants.

• Social media, blogging, research and discussion forums
Over 168 Mn social media users in India discuss and share ideas for multiple topics including reviews, suggestions, ratings, etc. on social media platforms. Social media websites and apps like Facebook, Twitter, Instagram, Snapchat, Pinterest, etc. are used to read and write reviews, find new places, find new brands of foods and experiment with new cuisines. An industry study suggested that almost 45% of restaurant-goers below the age of 28 years seek at least some review of the restaurant before visiting. More and more consumers are connecting with each other on apps like Zomato, Yelp, etc.

Online food delivery market (in USD Mn)

<table>
<thead>
<tr>
<th>Year</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>300</td>
<td></td>
</tr>
</tbody>
</table>

Source: Industry reports

Zomato's monthly visitors (in Mn)

<table>
<thead>
<tr>
<th>Year</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>35</td>
<td>90</td>
<td></td>
</tr>
</tbody>
</table>

Source: Financial Express

Nestle-Snapdeal exclusive deal21
• Nestle entered into an exclusive deal with e-commerce player Snapdeal
• Conducted a flash sale to re-introduce Maggi Noodles into the market in 2015
• Sold 70,000 packets in 5 minutes due to the buzz created by advertising and social media
• Partnered with Snapdeal to launch Maggi Hot Heads and Sunrise Insta filter on the website

Source: News articles

\[17\] Euromonitor report, The Hindu- Business Line
\[18\] Economic times news article dated 9 June 2017
\[19\] The Hindu Business line news article dated 22 Sept 16
\[20\] Financial Express news article dated 7 April 2017

\[21\] Industry Reports
Supply Trends

Make in India Initiative

Government has given priority sector status to food processing industry under the new manufacturing policy 2011 with the aim to improve processing levels from 10% to 25% by 2025. Several initiatives have been undertaken to support the agri and food sector in India:

- Loans to food and agro based processing units and cold chains have been classified as priority sector lending
- 100% FDI has been allowed in all processed food segment under automatic route leading to growth in FDI investments in food at 13% between FY 13 to FY 17
- In Union Budget FY 18, government created a fund of USD 1.5 Bn for setting up Dairy processing units over three years
- Animal husbandry and slaughterhouses: Ministry of Food Processing Industries runs a scheme for modernisation of slaughterhouses under the Public Private Partnership mode involving local bodies through Build operate transfer (BOT), build-own-operate (BOO) or joint venture (JV) mode. 52 slaughterhouses have been approved under this scheme which aim to:
  - Set-up new facilities and modernise the existing ones
  - Improve productivity and utilisation of bones, skins etc.
  - Promote scientific and hygienic slaughtering along with effective waste management
  - Facilitate better Chilling facility and retail cold chain management
- Farmer Produce Organisations (FPOs): Rising farmer distress and increased farmer debt has led to an increase in FPOs. FPOs are helping mobilize farmer groups at the village level to help strengthen farmer capacity and increase productivity. FPOs enable access to fair and remunerative markets by linking producer groups to marketing opportunities through market aggregators. FPOs also reduce supply chain complexity for processing companies as they don’t need to deal with large number of traders but one FPO. At present, there are about 350 registered FPOs in India. Further, about 400 FPOs are under registration process and are expected to be active by 2019. A market study suggested increase in per hectare production of up to 10% in 2 years as a result of increase in FPOs.

Rise of regional brands

There are several distinct culinary regions in India with tastes and spices preferences varying greatly between states and within states also. Packaged food brands have realised this varied taste and introduced products catering to these different tastes. Regional brands have exhibited agility in experimenting with new products and launching products to capture these regional palate preferences.

It is estimated that the Indian snack market shall reach USD 5 Bn by 2020 growing from the current USD 2 Bn. This growth is expected to be driven by regional snack companies like Balaji wafers, Prataap snacks, Bikaji foods and DFM foods. Crisil research estimates that the regional packaged food players could grow twice as fast as their multinational rivals by 2020.

Banking on more quantity per pack, smaller value packs and increased marketing spends to win market share, on an average, regional snack brands are offering ~30% higher quantity of snacks in their packs than multinational rivals at similar price points, especially in small packet size categories.

Examples of growing regional brands:

- Haldirams, a leading Indian snack company has become household name by catering to the Indian palate with products like “Aloo Bhujia” and “Bhujia Sev”. This has led MNC’s to launch Indian flavoured snacks, for e.g., Nestle launched Bengali Jhaal, Super Chennai, Amritsari Achari and Mumbaiya Chatak flavours
- Paper Boat led the revival of packaged ethnic drinks which resulted in category leaders Dabur’s Real and PepsiCo’s Tropicana to also launch coconut water, jaljeera and mosambi beverages
- Prataap Foods has launched products like “Aloo Bhujia” and “Bhujia Sev”. This has led MNC’s to launch Indian flavoured snacks, for e.g., Nestle launched Bengali Jhaal, Super Chennai, Amritsari Achari and Mumbaiya Chatak flavours
- Bikaji Foods, owner of Yellow Diamond snacks brand. Currently, the brand has presence in Madhya Pradesh, Delhi, Haryana, Uttar Pradesh, Maharashtra and Rajasthan with the aim of becoming a national player. In line with their growth plans, they are also setting up a plant in Chennai to expand in South India
- Lighthouse Funds invested less than USD 14 Mn in Bikaji Foods in 2014
- WestBridge Capital Partners picked up a 25% stake in DFM Foods in 2016

Unorganised to Organised

Need for seamless experience and better quality food are the two key drivers for people to choose branded products over non-branded variants. This has impacted the industry in the following ways:

- Platform to shift from unorganized to organized
  - Hyperlocal delivery models create a platform for organized players to play in the organized market through collaboration. Further, Goods and Service Tax is driving a shift towards organized suppliers to gain benefits under the new regulations
- Emergence of private labels
  - Modern retailers have introduced private labels which are priced lower than their branded counterparts. Price sensitive customers who preferred to buy non-branded products because of the price discount are now considering buying private labels, thus shifting to branded products without disturbing their household budgets. Future Group plans to launch a new product, brand or category every two weeks to grow share of private labels to about 70% of the store revenue

<table>
<thead>
<tr>
<th>Source: The Hindu</th>
</tr>
</thead>
</table>

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• **Growth of food chains**
  While unorganized food retail is growing at 7%\(^{25}\), standalone organized food chains are expected to grow at 14% and chained food brands at 20% in India. BBQ Nation, a large food chain, grew from 32 outlets\(^{26}\) across 11 states and union territories in FY 13 to 81 outlets covering 19 states and union territories by June 2017.

**Products to Services**
Historically, product companies introduced variants, new product categories and packaging to gain market share. However, we have seen that there is a growing trend of companies launching services to promote captive consumption, increasing share of wallet, creating synergies through ecosystem and hence increasing customer lifetime value.

Diversification into services enables product-oriented companies to bypass retailers and focus on securing consumer loyalty and capturing an increased share of their wallet. Multiple touchpoints with consumers through service models leads to a potentially improved and lasting relationship. It also provides an opportunity for companies to gain insights about their customer preferences and buying behaviour.

Coca Cola offers a rented self-serve restaurant soda dispenser with over 100 flavors. The company uses data from sales to improve products. Sula started its own vineyard resort where it conducts wine tastings and teaches consumers about types of wine.

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25 Care Ratings Industry report
26 Forbes India Article dated 21-June-2016
A sustainable supply chain

In the changing consumer landscape, the young consumers hold a significant purchasing share in the market. These consumers are relatively more responsible towards handling environment and social concerns. In order to support this, both international and domestic brands are progressively looking for sustainable products to gain business advantage.

The following concepts are gaining importance to promote a sustainable supply chain:

01. Triple Bottomline (TBL)
   It is an accounting framework with three parts: social, environmental (or ecological) and financial. Some organizations have adopted the TBL framework to evaluate their performance in a broader perspective to create greater business value. Focusing on social and environmental responsibility is perceived to drive long term financial gains, improve brand value and consequently enhance shareholder value.

02. Traceability
   A dynamic regulatory environment with stricter scrutiny on product quality is making it vital for companies to take note of how goods are flowing in the supply chain. The ability to verify the origin and location of products helps identify the source and point of contamination. This helps reduce costs, improved products sourcing and creates a transparent supply chain.

03. Need to shift towards open source sustainability
   Increasing pressure on existing resources like land and water needed for agriculture creates a need to adopt a sustainable model in the food industry. Increasingly consumers have started to correlate sustainability with healthy food habits. With increasing connectivity and open trade, communities across the globe are becoming vulnerable to demand supply fluctuations. Linking highly connected market with resource efficient consumption is likely to increase international cooperation thereby creating a sustainable supply chain.

% of shoppers who prefer sustainably produced products (2017)

<table>
<thead>
<tr>
<th>Country</th>
<th>% Preference</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK</td>
<td>53%</td>
</tr>
<tr>
<td>USA</td>
<td>73%</td>
</tr>
<tr>
<td>Turkey</td>
<td>85%</td>
</tr>
<tr>
<td>Brazil</td>
<td>85%</td>
</tr>
<tr>
<td>India</td>
<td>88%</td>
</tr>
</tbody>
</table>

Source: FICCI Deloitte Report: KONNECTED to consumers, 2017

Shift required to unlock India’s Potential

Source: Deloitte’s report for World Economic Forum
Regulatory Trends

GST:
Goods & Services Tax (GST) implemented by India is perceived to be one of the largest tax reforms in the world and has had a major impact on the food industry.

- Unorganized to Organized: Companies on a look at vendor rationalization and increase share of organized vendors in order to be able to claim tax benefits available under GST.
- Easier Transportation: The removal of octroi and entry tax is likely to significantly reduce the time and hassle of transporting goods across State borders.

SAMPADA
Illustrative Mega Food Park

Allow increased control over procurement operations

Provide a touch point for all stakeholders in the value chain

Mega Food Park (CPC)

Primary Processing Centre

CC

Farmer Producer Organization

CC

CC

Increase quality control, especially for exports

Increased quality control, Prevent wastage by allowing access to greater storage capacity

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In 2017, the GoI launched SAMPADA (Scheme for Agro-Marine Processing and Development of Agro-Processing Clusters) which aims at creation of modern infrastructure with efficient supply chain management from farm to retail outlet.

- Allocation of USD 923 Mn is expected to leverage investment of USD 4,831 Mn.
- Handling of 334 lakh MT agro-produce valuing at USD 16,019 Mn
- Benefit 20 lakh farmers through improvements in supply chain, value addition and food safety standards

It is an umbrella scheme for incorporating ongoing and new schemes:

- Mega Food Parks
  The aim of this scheme is to link agro-processing clusters with key production centers and improve supply chain efficiencies. Mega Food Parks have a hub and spoke architecture with collection centers (CCs) and Primary Processing centers (PPCs) as spokes linked to a central processing center (CPC). CPC is an industrial park in an area of ~50 acres that has processing units of different business houses. 42 projects have been taken-up of which 18 have been made operational (For ex. Patanjali Food and Herbal park in Hardwar, Srin Food Park in Chittoor, North East Mega Food Park) including 3 completed. A sum of USD 230 Mn has been allocated for the remaining 34 through the duration of the scheme.

- Integrated Cold Chain and Value Addition Infrastructure
  The aim of this scheme is to provide integrated cold chain and preservation infrastructure facilities, without any break, from the farm gate to the consumer. There is an allocation of USD 253 Mn and 101 projects have been approved across 20 states which is expected to add capacity of 2.76 lakh tonnes of cold/controlled atmosphere/frozen storage, 56 lakh litres per day of milk processing, 629 refrigerated/insulated vehicles etc.

- Creation / Expansion of Food Processing & Preservation Capacities
  The aim of this scheme is to set up new units and modernization/expansion of existing units. Grants for 35% (50% in north-eastern states and difficult areas) of cost of plant & machinery and technical civil works, maximum of USD 0.77 Mn is proposed to be provided to the promoters of qualifying projects.

- Infrastructure for Agro-processing Clusters
  This scheme aims to create modern infrastructure for food processing closer to production areas. There are 2 components of the scheme: Basic Infrastructure (roads, water supply, power supply etc.) and Core Infrastructure (sorting, grading, ware houses, cold storages etc.).

- Creation of Backward and Forward Linkages
  The aim is to create effective backward & forward linkages for perishable agriculture and horticulture produce through setting up of primary processing centers/ collection centers, distribution hub and retail outlets at the front end.

- Food Safety and Quality Assurance Infrastructure
  This aims at setting up/ upgradation of quality control/ food testing laboratories. It also aims to motivate food processing industry for adoption of food safety and quality assurance mechanisms such as Total Quality Management, including ISO 9000, ISO 22000, Hazard Analysis and Critical Control Points (HACCP), Good Manufacturing Practices (GMP) and Good Hygiene Practices (GHP).

- Human Resources and Institutions
  This scheme aims to promote Research & Development in food processing sector. It also aims to organize promotional activities (seminars, workshops, fairs & exhibitions), advertisements, studies and surveys.

22 Livemint.com article dated 26-July-2016
23 http://mofpi.nic.in/Schemes/pradhan-mantri-kisan-sampada-yojana
24 http://mofpi.nic.in/Schemes/pradhan-mantri-kisan-sampada-yojana
FSSAI regulations
Food Safety and Standards Authority of India (FSSAI) is an autonomous body established under the Food Safety and Standards Act, 2006 which is a consolidating statute related to food safety and regulation in India. FSSAI is responsible for protecting and promoting public health through the regulation and supervision of food safety. Over the last 2 years, FSSAI has strengthened the regulatory environment as well as improved the compliance of these regulations.

• December 2017, FSSAI to establish a self-regulation platform for food companies, retailers stocking packaged food and fast-food restaurant chains. The Responsible Food Companies Score (ReFoc Score) is proposed to be a publicly accessible online platform for companies to rate themselves against parameters such as compliance with regulations, nutritive content, dealing with consumer grievances, upstream and downstream supply chain capacity and promoting food safety in schools.

• May 2017, FSSAI reported that milk adulteration in more in North India than South India - FSSAI developed testing kits to check quality of milk and is negotiating with investors for mass production and marketing of the kit.

• March 2017, import of food items with balance shelf life of less than 60% was banned. This is expected to result in better quality products arriving in India.

• October 2016, new standards on fortification of food were released. This included increased regulation of fortified foods and Integrated Child Development Schemes to include fortified food.

• 2015 - Impact of the Maggi ban on other companies as compliance levels increased – almost 20 popular brands including Ching’s Secret, Top Ramen and Hindustan Unilever’s Knorr were selling without requisite approvals from FSSAI when the Maggi ban happened. Hindustan Unilever voluntarily decided to recall its Knorr instant noodles from the market till such time as its application was approved by FSSAI.

• 2015, FSSAI banned Maggi over high lead content affecting sales of the entire noodles category. Tamil Nadu banned the sale of Wai Express Noodles, Reliance Select Instant Noodles and Smith & Jones chicken masala noodles.
Impact of Technology

“Industry 4.0” refers to the digitization of manufacturing and the increasing digital connectivity of product, process, and factory. It marks the rise of smart factories in which new manufacturing technologies allow for greater communication between machines, and machine-level processing of data allows them to adapt instantly to new production requirements. It also refers to the connecting of information systems and sharing of data across the supply chain to improve efficiency. Industry 4.0 offers opportunities for greater efficiencies in energy consumption, real-time yield optimization, and other processes that can be mined from the heaps of data it generates.

Food and drink manufacturers are likely to benefit from the implementation of Industry 4.0 more than most industries.

- The interoperability of connecting the production facility with distributors implies the product gets to market more quickly. This enables for “freshness” to be maintained.
- Interconnectedness of various components of the supply chain is likely to enable end-to-end traceability.
- Greater flexibility is likely to enable bespoke production for each customer and rapid adaption to changing product specifications.
- The data mined will help predict consumer demand and benefit from increased efficiencies. This is expected to lead to a reduction in demand-supply mismatches.
- Energy usage could also be monitored and optimised to new levels.

Food Ecosystem of the Future
However, there are challenges with adoption of this revolution:

- **IoT under development**: The technology for linking manufacturing and supply chain is still under development. It requires collaboration and a high level of trust between diverse businesses at the production, processing, wholesale, and retail levels. Sharing that much information does not come naturally to companies. This kind of transparency also requires improvements in Internet security.

- **Capital Costs**: In addition, many food and beverage companies are using processing and packaging equipment that was installed well before the IoT became a reality with a significant capital overlay. Replacing it may not be an immediate possibility. This manufacturing equipment may have years of useful service remaining if companies are able to upgrade the electronics, the drives, and software.

- **Skilled Workforce**: Another concern for many manufacturers is finding the ideal labour force to run their transformed facilities.

### Digital Agriculture

Technology is expected to act as a great enabler in improving farm productivity and reducing losses through **precision farming**. Incorporating latest technology in agriculture is expected to increase farm productivity by as much as 20% by 2025 as per a research by Beecham Research. Innovations in farm monitoring devices, forecasting tools, analytics etc. is expected to help farmers achieve target productivity goals.

- **Farm Monitoring Devices**: Using robotics for continuous monitoring of farmlands can substantially reduce reaction time to threats like pest attacks, weed growth etc. Drones can help capture real time images and data to identify origin or spread of problems. Infrared images can help capture crop health. For eg: plants with higher chlorophyll content look red in infrared. This also helps in taking selective actions for crisis management thereby limiting loss of crops.

- **Data Analysis**: Using effective farm management techniques to gather historical data on soil performance, moisture requirement etc. could help create strategies.

- **Advanced farm equipment**: Sensor fitted tractors and harvesters collect crucial data on soil and plant health. This information is likely to further flow into farm management systems which shall help analyze the data and provide effective insights. As per Machina Research, 225 Mn interconnected devices are expected to be used in agriculture across the globe by 2024.

- **Alternate Farming Techniques**: Though Aeroponics, Hydroponics, Soil-less farming, Vertical farming etc. are being practiced in limited scale under controlled environment, it is believed to be the future of farming. With increasing pressure on resources like soil and water, innovation in alternate farming techniques is expected to ensure food security. Temperature controlled environment helps limit use of chemicals and grow seasonal crops throughout the year, thereby improving farmer remuneration and profitability.

The flexibility provided by digital systems ensure that such tools and techniques could be used for both small scale and larger scale operations.

### Blockchain in Food Supply Chain

Blockchain is a protocol for a digital ledger that enables proof of ownership and the transfer of ownership from one entity to another without using a trusted third party intermediary (like a bank). The value that is transferred could also move through an extended supply chain while ensuring that what occurs at each point in the chain could be chronologically recorded. Blockchain, an immutable shared network, provides each participant end-to-end visibility based on their level of permission. Each participant in a supply chain ecosystem can view the progress of goods through the supply chain, understanding where a container is in transit. They can also see the status of customs documents, or view bills of lading and other data. No one party can modify, delete or even append any record without the consensus from others on the network. This level of transparency helps reduce fraud and errors, reduce the time products spend in the transit and shipping process, improve inventory management and ultimately reduce waste and cost.

Key benefits of blockchain in the food supply chain include:

- **Transparency**: Digital tracking and storage of all product information at all stages of supply chain including:
  - Farm origin data, growing / raising conditions
  - Factory/processing data
  - Batch numbers
  - Expiration dates
  - Storage temperatures and conditions
  - Shipping data

Register time, location, price, parties involved, and other relevant information can be updated each time an item changes ownership. Thus, no one party is able to manipulate ledger to their own benefit, thereby improving supply chain traceability.

This strengthens safeguards related to food authenticity, thus avoiding food fraud. Consumer confidence increases because producers and other related parties are held accountable.

- **Efficiency**: Blockchain improves how food is tracked, transported, and sold by:
  - Reducing inaccuracies caused by traditional paper tracking and manual inspection systems
  - Enabling retailers to better manage product shelf-life
  - Streamlining distribution process
  - Cutting costs and reduces food waste: can be the difference between being able to identify a few tainted packages instead of removing the entire stock from hundreds of stores

- **Food safety**: Blockchain could create huge progress in food safety - cutting costs and saving lives
  - Fewer contamination incidents
  - Faster detection of problems
  - Recalls can be addressed more quickly: can be the difference between being able to discover why and when contamination occurred

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8. Bayer Annual Report FY 2016-17

Source: The Better India Article “Gurgaon Adopts Soil-less farming” – July 2017

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Coffee is the world's second-most-traded commodity, after petroleum. According to estimates from the Fairtrade Foundation, ~125 Mn people make a living growing coffee. Most of these farmers are smallholders whose families live on less than USD 2 a day. A Denver based company, Bext Holdings is using a combination of visual assaying and weighing (aka a mobile robot), and blockchain for this problem. It allows buyers of coffee to rapidly analyze the quality and weight of a farmer's product in the field. The robot uses optical sorting to understand what percent of coffee cherries look perfect or spoiled in a batch. A batch, typically a 30-40 lb. bag, will get higher or lower marks, which are revealed to both buyers and farmers on the spot. They then negotiate a fair price through Bext360's mobile app. The combination of a reliable tracing and blockchain technology allows the company to bring in complete transparency to the coffee supply chain, and other commodities like cocoa etc.

Source: News articles

## Industry 4.0 in Food Industry

Growing IoT acceptance is likely to generate more consumer data, helping retailers and consumer companies to deliver more personalized experience to the next-gen shoppers. IoT primarily helps the brands in location-based marketing to target the tech-savvy population. By using IoT, the retailers are enhancing their ability to collect crucial insights, which is helping them to provide an exclusive shopping experience. According to the market sources, the number of IoT connected devices globally are predicted to increase more than two-fold to reach 20.4 Bn in 2020 as compared to 6.4 Bn in 2016. In India, though the adoption of IoT started relatively late, it growing at a fast rate.

Source: KONNECTED to consumers, 2017 by FICCI and Deloitte

### Number of IoT connected devices - Global vs. India (in Bn units)

<table>
<thead>
<tr>
<th>Year</th>
<th>Global</th>
<th>India</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>6.4 Bn</td>
<td>0.06 Bn</td>
</tr>
<tr>
<td>2020F</td>
<td>20.3 Bn</td>
<td>1.9 Bn</td>
</tr>
</tbody>
</table>

Source: LinkedIn Article

#### Predictive Analytics in Food Retail and Food Service

The global predictive analytics market is likely to grow at a CAGR of 21% to reach ~USD 10 Bn in 2022. In India, e-commerce, retail and consumer companies are increasingly leveraging analytics for various functions and currently constitute about 1/4th of the user market. Predictive analytics continues to be the most preferred approach as compared to other techniques. The data approach helps retailers predict customer needs and consequently increase sales by offering personalized promotional offers to consumers. Retailers are increasingly investing in forecasting techniques to take their complex business decisions more intelligently.

- Demand Shaping and Recommending similar or related products
- Location-based triggers
- Customer targeting

In 2016, Starbucks introduced a feature in the USA that uses the customer's vicinity to receive orders and deliver at the most suitable store, thereby saving a lot of time and improving service delivery. Starbucks has seen an increased loyalty and repeat orders from customers using the "Mobile Order and Pay" app. Orders through this technology account for around 8% of Starbucks' total U.S. transactions.

Source: FICCI Deloitte Report: KONNECTED to consumers, 2017

### Dansk Supermarked Group (DSG) is a Denmark based mass-market retailer that serves up to 1.4 Mn store customers a day.

DSG is using analytics to match its inventory needs to customer preferences, ensuring that there are no stock-outs yet no overstocking. It does so by predicting the types of food consumers will purchase by analysing recent sales data trends. The approach generates accurate and timely insights into each store's overall shopping history. The point-of-sale transactions are rapidly analysed to deliver information-rich, actionable reports to key decision-makers throughout the company. Store managers can view in detail exactly what customers purchased the day before which helps the company make the best possible inventory stocking decisions. At the firm level, DSG has the insights it needs to plan for future growth, including opening additional stores, introducing a new convenience-store format, and pursuing promising e-commerce opportunities.

Source: LinkedIn Article
Conclusion

Industry 4.0 offers the opportunity to be prepared and also to benefit from the changing consumer behavior while helping overcome the resource limitations from the supply side. However, a sustainable partnership model is essential between government, private firms, and industry bodies for promoting Industry 4.0.

<table>
<thead>
<tr>
<th>Food Value Chain</th>
<th>Drivers</th>
<th>Impact of Industry 4.0</th>
<th>Extent of Impact</th>
<th>Ease of Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultivation</td>
<td>Improving Productivity</td>
<td>Precision farming, digital agriculture for efficient use of resources</td>
<td></td>
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<td></td>
<td>Ensuring Supply</td>
<td>Use blockchain to connect demand at commodity exchange to crop planning</td>
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<tr>
<td>Agri-logistics</td>
<td>Quality Control and Loss Reduction</td>
<td>Technologies like blockchain, RFID, IoT allow for traceability across value chain</td>
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<tr>
<td></td>
<td>Efficient storage and distribution</td>
<td>Leveraging technology for implementation of agri-logistics platforms such as e-NAM and e-mandis</td>
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<tr>
<td>Food Processing</td>
<td>Food Safety</td>
<td>Identification and containment of foodborne illness and recall/loss through blockchain</td>
<td></td>
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<tr>
<td></td>
<td>Automation in manufacturing</td>
<td>Exploring automation and predictive maintenance to reduce dependence on manpower and improve efficiency</td>
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<tr>
<td>Regulatory Impetus</td>
<td>FSSAI compliances for label claims, packaging, freshness, along with impetus to processing under Make in India and SAMPADA schemes</td>
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<tr>
<td>Regional to National Brands</td>
<td>Scale up capacity in-line with demand through predictive analytics and use of IoT to be able to react to demand fluctuations</td>
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<tr>
<td>Distributor</td>
<td>Ensuring Supply</td>
<td>IoT allows real-time connectivity between processing facility and distributors which would allow the product to get to market faster and retain “freshness”</td>
<td></td>
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<tr>
<td>Food Retail</td>
<td>Convenience</td>
<td>Integrate online and offline processes to provide consumers seamless browsing and shopping experience</td>
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<td></td>
<td>Customer Engagement</td>
<td>Keep a tab on consumers’ requirements and explore other retail channels and means to appropriately cater to their specific set of requirements</td>
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<tr>
<td>Unorganized to Organized</td>
<td>Leveraging technology to create collaborative and hyperlocal networks</td>
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<tr>
<td>Food Service</td>
<td>Convenience</td>
<td>Predictive analysis to help predict consumer demand and benefit from increased efficiencies</td>
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<tr>
<td></td>
<td>Customer Experience</td>
<td>Dynamic and agile service delivery model</td>
<td></td>
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<tr>
<td>Customer</td>
<td>Digitally Active</td>
<td>Embed IoT sensors and predictive analytics to track in-store movement of consumers and enable data-led decisions</td>
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</tr>
</tbody>
</table>

Legend: Very high, High, Medium, Low, Very low
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