Deloitte.

January 2018
For Private circulation only

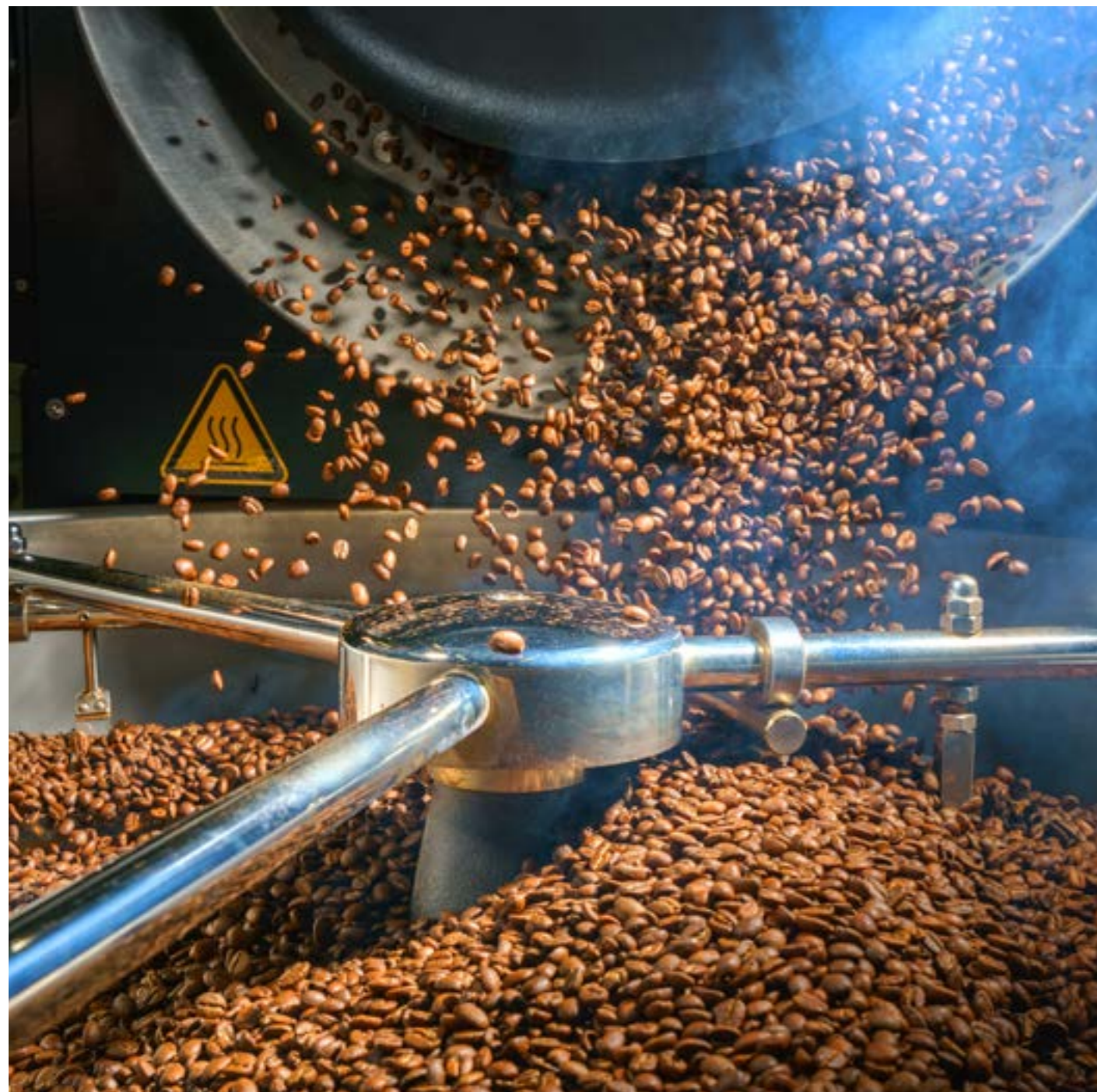# Industry 4.0 in Food Industry
India Food Report

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Contents

Introduction

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[1].

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[2].
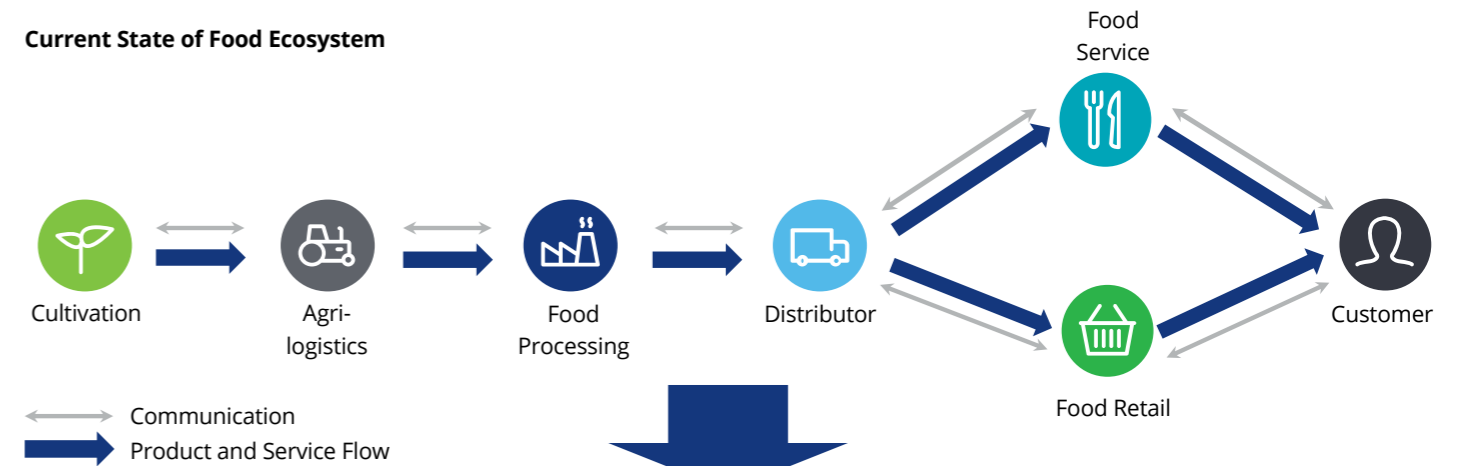
Government of India's drive to augment processing levels through Make in India campaign; and Industry 4.0 playing a major role in elevating the manufacturing as well as supply chain landscape by usage of technologies including Internet of Things (IoT), Blockchain, Predictive Analytics, the food industry 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.
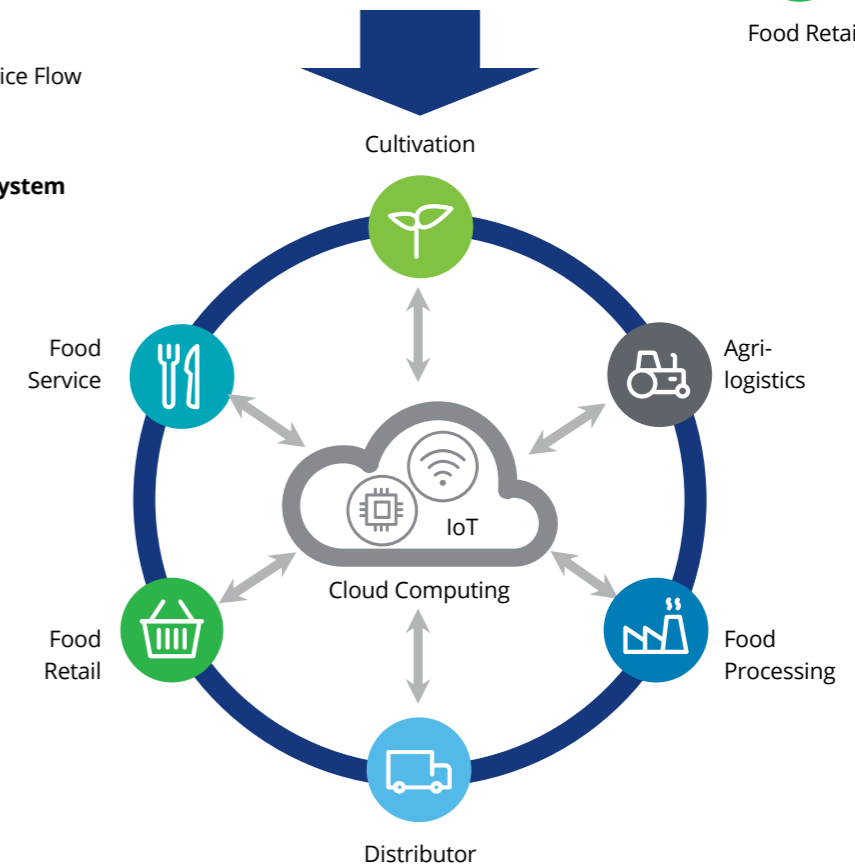
For the purpose of this article, we have focused on 3 key trends that are shaping up the food industry in India:-
01. Consumption Trends
02. Supply Trends
03. Regulatory Developments

Current State of Food Ecosystem

Cultivation → Agri-logistics → Food Processing → Distributor → Food Service / Food Retail → Customer

⟷ Communication
⟹ Product and Service Flow

Future State of Food Ecosystem

Cultivation, Agri-logistics, Food Processing, Distributor, Food Retail, Food Service — Cloud Computing / IoT

[1] News articles, Industry Reports, Deloitte Analysis
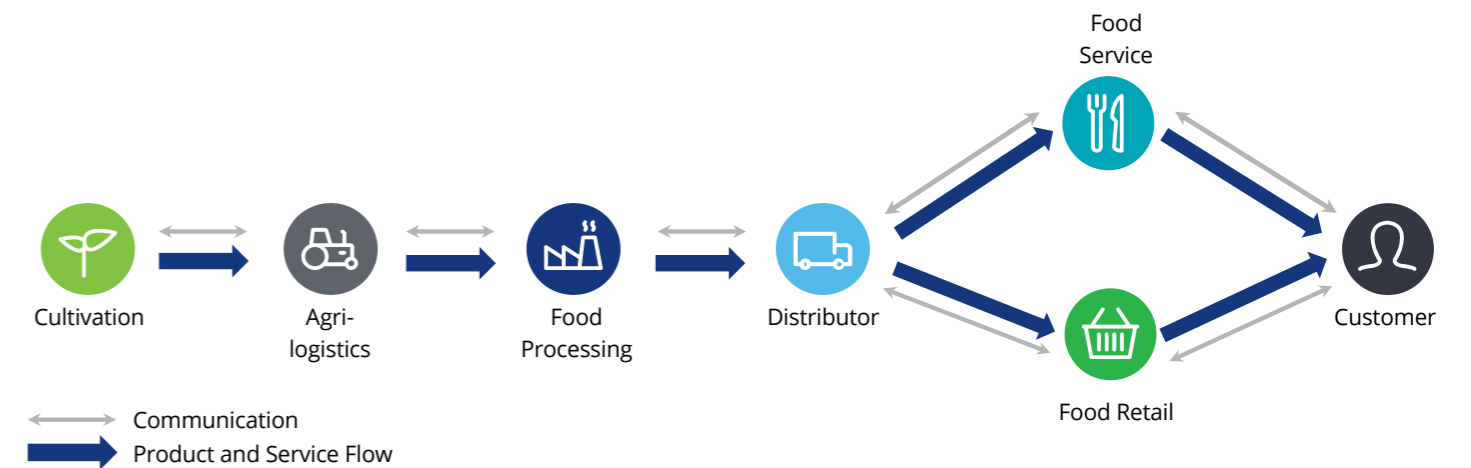[2] Ministry of Food Processing Industries Annual Report 2015-16

Food Ecosystem in India

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 activites 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.

Farm to Fork in India

Cultivation → Agri-logistics → Food Processing → Distributor → Food Service / Food Retail → Customer

Communication
Product and Service Flow

[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

Key Segments in the Food Value Chain

Cultivation
- Agriculture, Forestry and Fishing is estimated to be USD 350 Bn in FY 17[8] , contributing to ~17% to India's GDP
- India has the 2nd largest arable land in the world with 46 soil types and 20 agri climatic regions[9]
- However, current productivity levels are low mainly due to
  − Small farm holding: 67% of land holdings are less than 1 Ha in size[9]
  − Rainfall dependence: 50% of the agricultural land is entirely rain fed[9]

Agri-logistics
- Warehousing market is estimated to be USD 1.5 Bn[10] and growing at 9% CAGR
- 85% of warehouses are used for food grains; Food Corporation of India is the biggest user driven by public distribution of food
- Loss of agri-produce grew at 20% CAGR between FY 12 to FY 17; 6% of food grains and 5-12% of vegetables are lost due to inadequate post-harvest management, transportation and storage infrastructure

Food processing
- Food and Beverage market is estimated to be USD 448 Bn[11] in FY 16 growing at 9.5%
- Contributed 9-10% of manufacturing GDP in India in FY 17[13]
- Employment of 1.7 Mn people in 2012-13
- Packaged food is the fastest growing food segment with double digit growth
- Only ~10% of agri-produce is being processed in India

Distributor
- India's large geographical spread combined with 68%[14] 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[13]
- 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 8-9% by 2025[13]

Food service
- Indian Food Service Industry is estimated to be USD 47 Bn in FY 17 and has grown at 8% from FY 13-16[12]
- Organized segment accounts for 33% and consists of standalone restaurants, chains and restaurants in hotels
- Unorganized segment consists of dhabas, roadside eateries including street stalls, hawkers, trolleys, and stand-alone sweet shops

Customer
- India has a young population with 65% of the population born after 1980
- 31% of income spend is on food, much higher than US (9%), China (25%) and Brazil (17%)[11]
- Cereals and pulses account for 24% of average household spend[11]
- Growth in per capita income at 7% between FY 07-FY 16

[8] Ministry of Statistics and Program Implementation, GoI, Central Statistics office
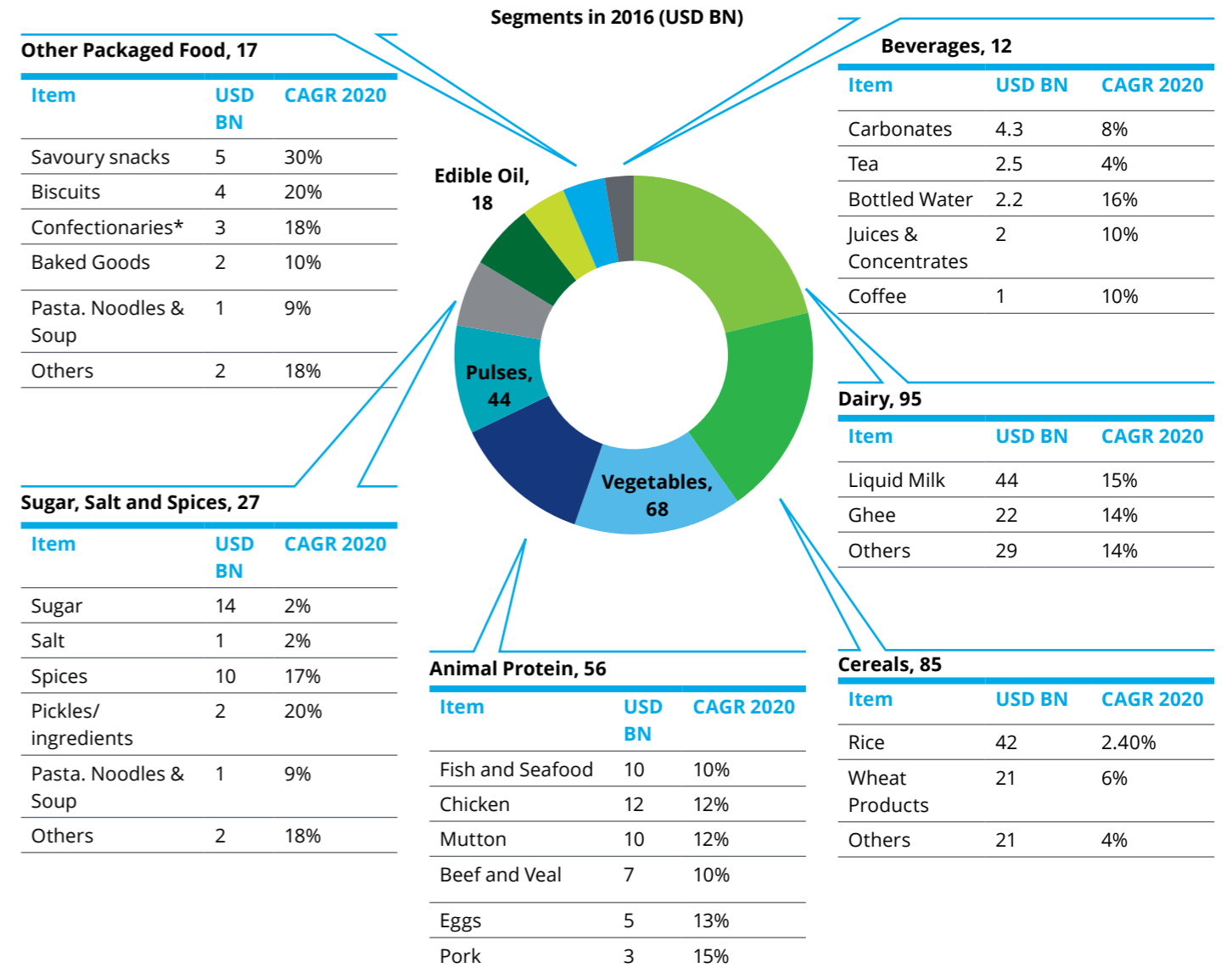[9] World Bank data
[10] CRISIL research
[11] EMIS Insights, research reports, Deloitte analysis
[12] Indian food service report, NRAI
[13] Ministry of Food Processing Industries Annua Report 2015-16
[14] https://www.indexmundi.com/india/demographics_profile.html

Major Food Segments in India – FY 17

Segments in 2016 (USD BN)

Other Packaged Food, 17

Item	USD BN	CAGR 2020
Savoury snacks	5	30%
Biscuits	4	20%
Confectionaries*	3	18%
Baked Goods	2	10%
Pasta. Noodles & Soup	1	9%
Others	2	18%

Sugar, Salt and Spices, 27

Item	USD BN	CAGR 2020
Sugar	14	2%
Salt	1	2%
Spices	10	17%
Pickles/ ingredients	2	20%
Pasta. Noodles & Soup	1	9%
Others	2	18%

Beverages, 12

Item	USD BN	CAGR 2020
Carbonates	4.3	8%
Tea	2.5	4%
Bottled Water	2.2	16%
Juices & Concentrates	2	10%
Coffee	1	10%

Dairy, 95

Item	USD BN	CAGR 2020
Liquid Milk	44	15%
Ghee	22	14%
Others	29	14%

Animal Protein, 56

Item	USD BN	CAGR 2020
Fish and Seafood	10	10%
Chicken	12	12%
Mutton	10	12%
Beef and Veal	7	10%
Eggs	5	13%
Pork	3	15%

Cereals, 85

| Item	USD BN	CAGR 2020
Rice	42	2.40%
Wheat Products	21	6%
Others	21	4%

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.

Key Trends in the Indian Market
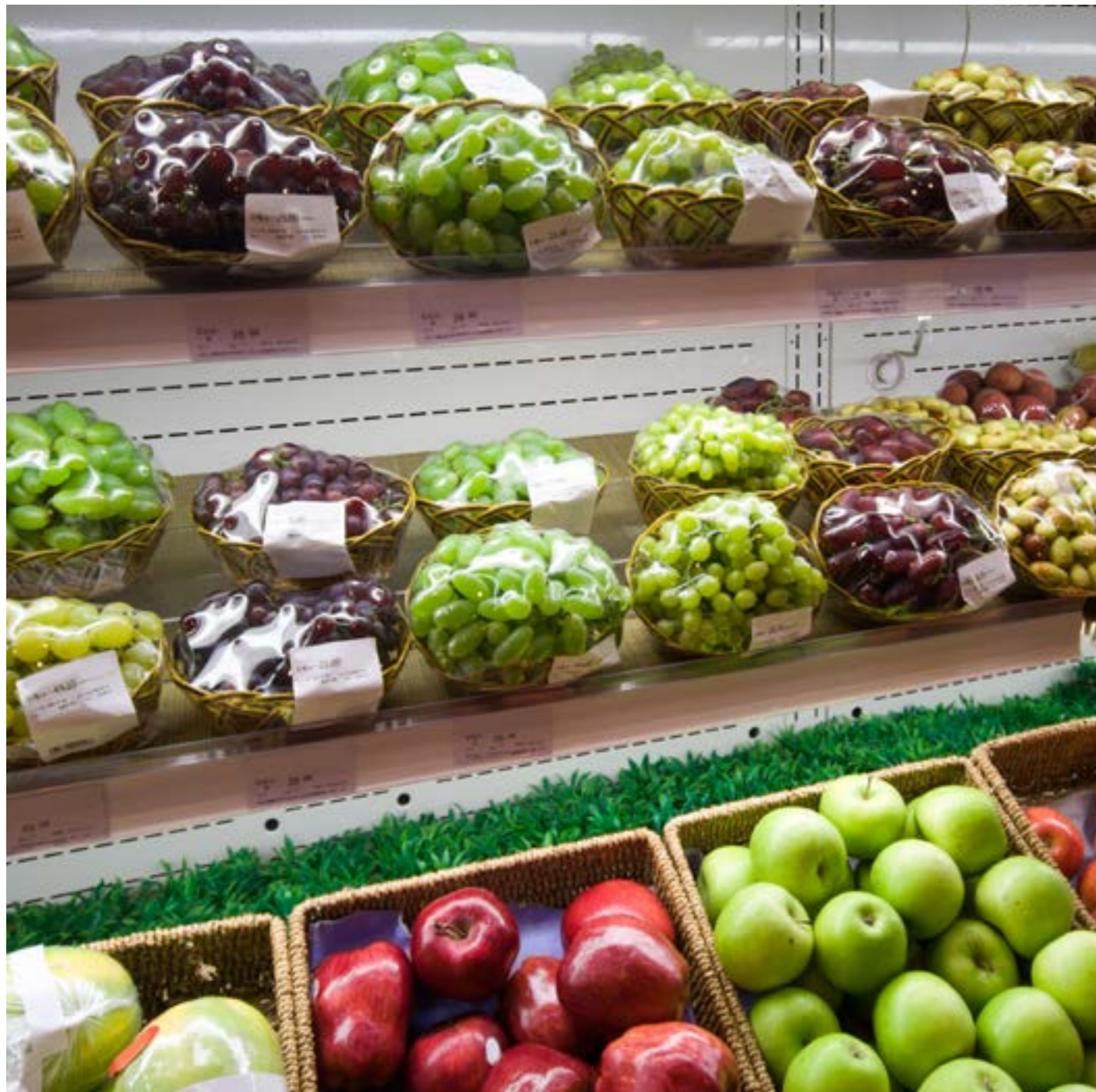
A number of changes are shaping the Indian Food landscape affecting how companies function, how companies interact with consumers, and what consumers are seeking.
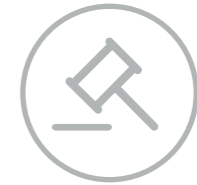

Trends in consumption

- 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 chaging 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 epidemilogy of diseases. With 30 Mn diabetes patients15, India is known as the diabetes capital of the world. India has 61 Mn patients15 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 disease. 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%.

25%
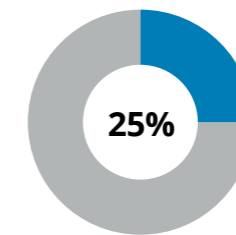
Occurrence of hypertension in urban areas

11%
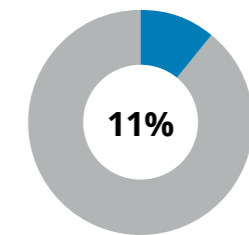
Occurrence of coronary heart disease in urban areas

7%
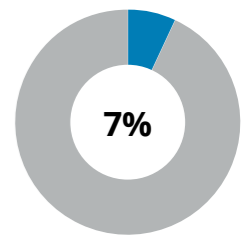
CHD patients in India

Health Conscious Food Pattern

Low sugar desserts

Premium cold press juice

Multi-grain, high fibre atta

Low carb high protein diet
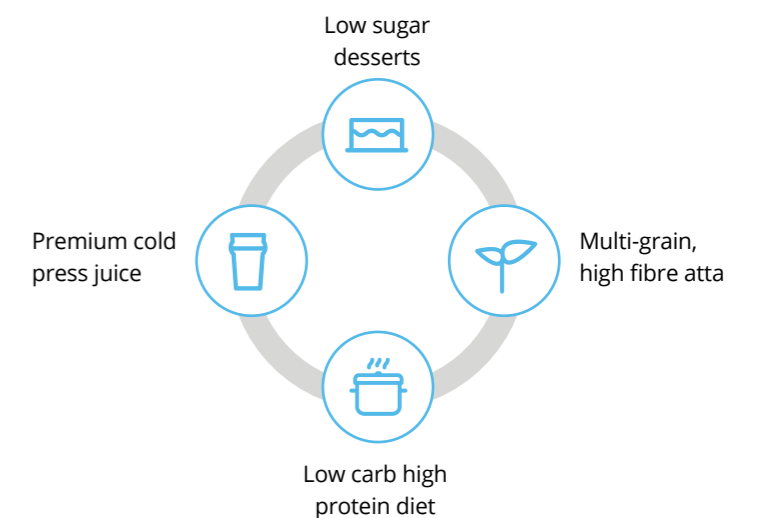
Key Categories in the Consumer Health Market

Note : All Figures in USD Mn

4817	
Consumer Health	
~5%	

Traditional Indian Medicine — 310 — ~3%

- Ayurveda-Based — 208 — 4%
- Chyawan-prash — 102 — 1%

Supplements — 1561 — 7%

- Dietary Supplements — 715 — 5%
- Weight Management — 556 — 14%
- Vitamins & Minerals — 290 — 2%

OTC — 1444 — 4%

- Cough & Cold — 244 — 2%
- Analgesics — 199 — 3%
- GI — 155 — ~2%
- Derma — 128 — ~1%
- Probiotics — 100 — 20%
- Others OTC — 618 — 5%

CH Food & Beverage — 1502 — 5%

- Malt-Based Hot Beverages — 941 — 5%
- Baby Food — 339 — 5%
- Sports Energy — 152 — 7%
- Probiotic-Dairy based — 70 — 21%

Consumer Health market as defined by Deloitte

Revenue (USD Mn)

CAGR (2013-16) (%age)
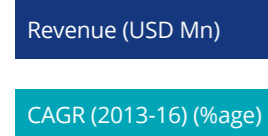
Source: Deloitte Analysis, Euromonitor Consumer Health report, 2016 Nicholas Hall DB, Mintel India OTC reports

[15] Euromonitor Report, News articles, Deloitte Analysis

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 productrs 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 Millenials and 393 Mn people are Generation Z[16]. 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 bottlesEx: Rooh Afza**
  - **Ready to drink formats over powdersEx: Nityam Churan, Pudin Hara**
  - **Food delivered in disposable plates–Ex: Freshmenu**

Health Conscious Food Pattern

Convenient Format

Out of home consumption

On-the go consumption

Convenient to prepare/ order
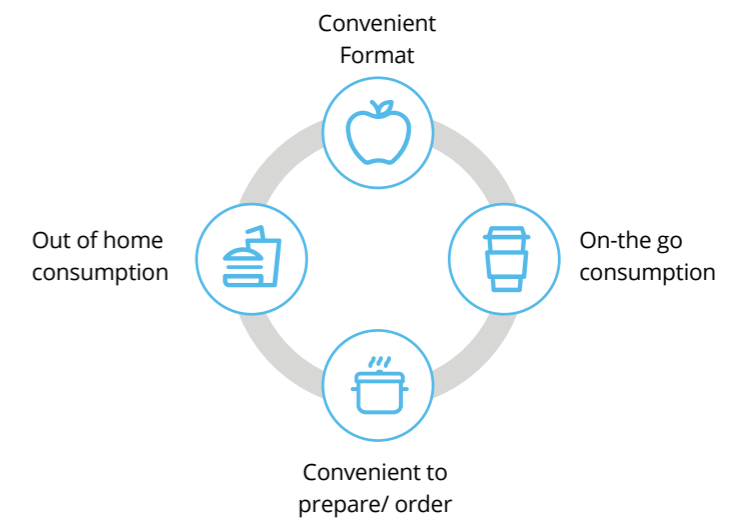
[16] India Consumer Close-up Report dated 1-June-17

- **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 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%[19]. Less time to prepare food at home, increasing affordability and disposable income has led to growth of Quick Service Restaurants (QSR) and casual dining at CAGR of 22% between 2013 and 2016.[18]

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 food 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 2017[20]. Many online giants like Amazon and Flipkart, have launched online grocery businesses in 2017.

Bengalore-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 competetive prices

- Recognizing the potential of such prodct segments, Azim Premji Led Premji Invest pumped USD 25 Mn into iD fresh foods in January 2017

Revenue (In INR Cr)

100	150	250	1000
2016	2017	2018 (P)	2020 (P)
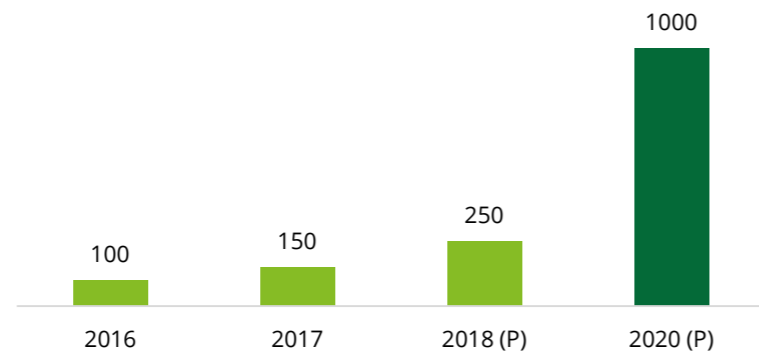
Source: News articles

Indian consumer are becoming digitally aware

	Mobile users	Internet users	Smart phone users
2015	1,000 Mn	300 Mn	240 Mn
2020	1,200 Mn	650 Mn	520 Mn
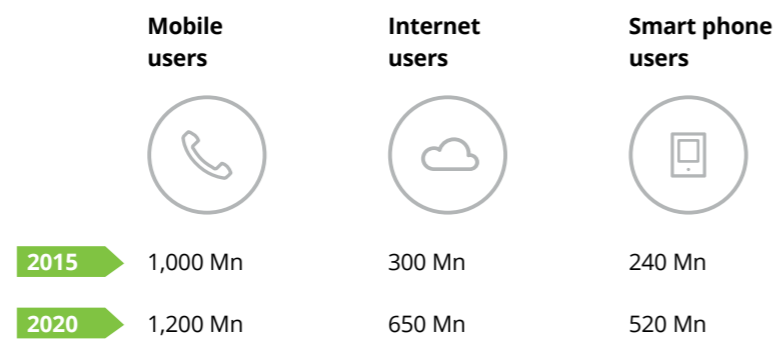
Source: Industry reports

- **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, mobikwick, 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)

~150%

2015	2016
120	300
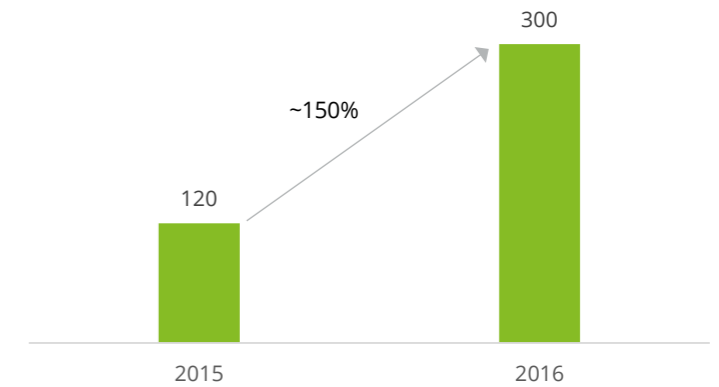
Source: Industry reports

Zomato's monthly visitors (In Mn)

~185%

2013	2014	2016
11	35	90
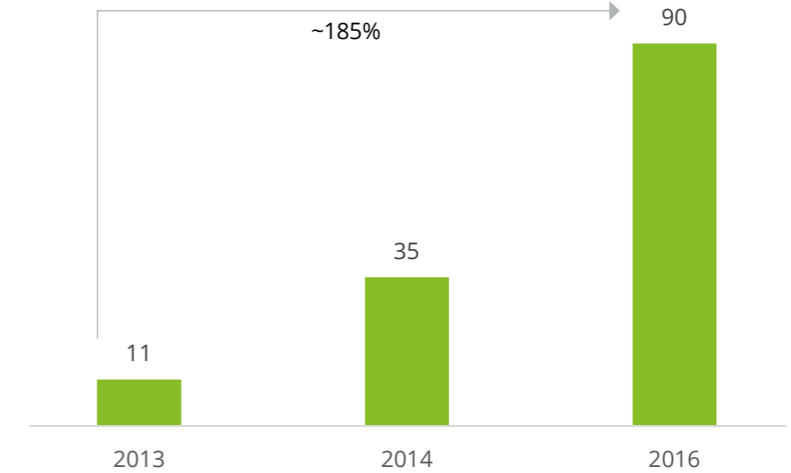
Source: Financial Express

Nestle-Snapdeal exclusive deal[21]

- 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

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[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[21]. 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[22]

- 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 transger (BOT), build-own-operate (BOO) or joint venture (JV) mode. 32 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 hygenic 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[23].

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.

Growth for Indian players in packaged food Revenue in INR Cr
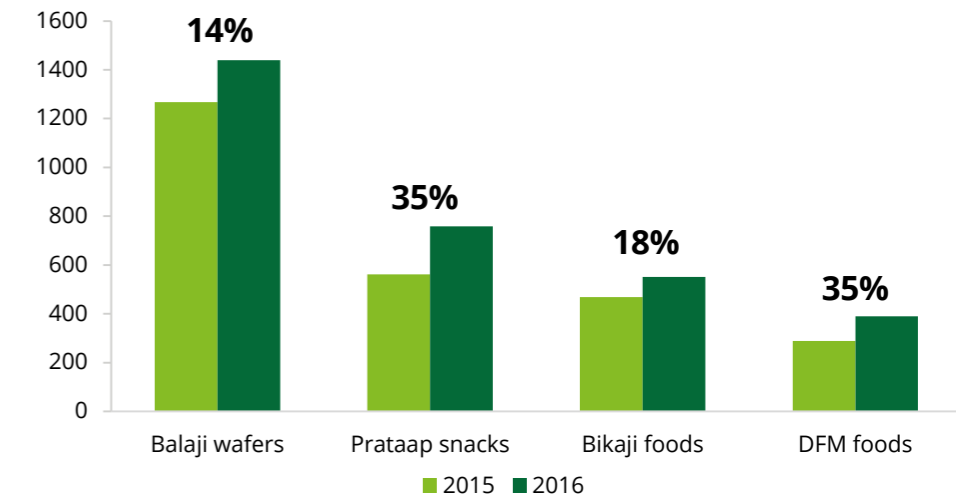
Source: The Hindu

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 falvoured snacks, for e.g., Nestle launched Bengali Jhhaal, 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

Recognizing this change in consumer perception towards regional brands, many private equity funds have invested in domestic regional snacking companies.

- **Sequoia Capital invested** USD 30 Mn in 2011 and USD 3 Mn in 2014[24] in **Prataap Snacks, 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 chosebranded 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 unorganized players to play in the organized market through collaboration. Futher, 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
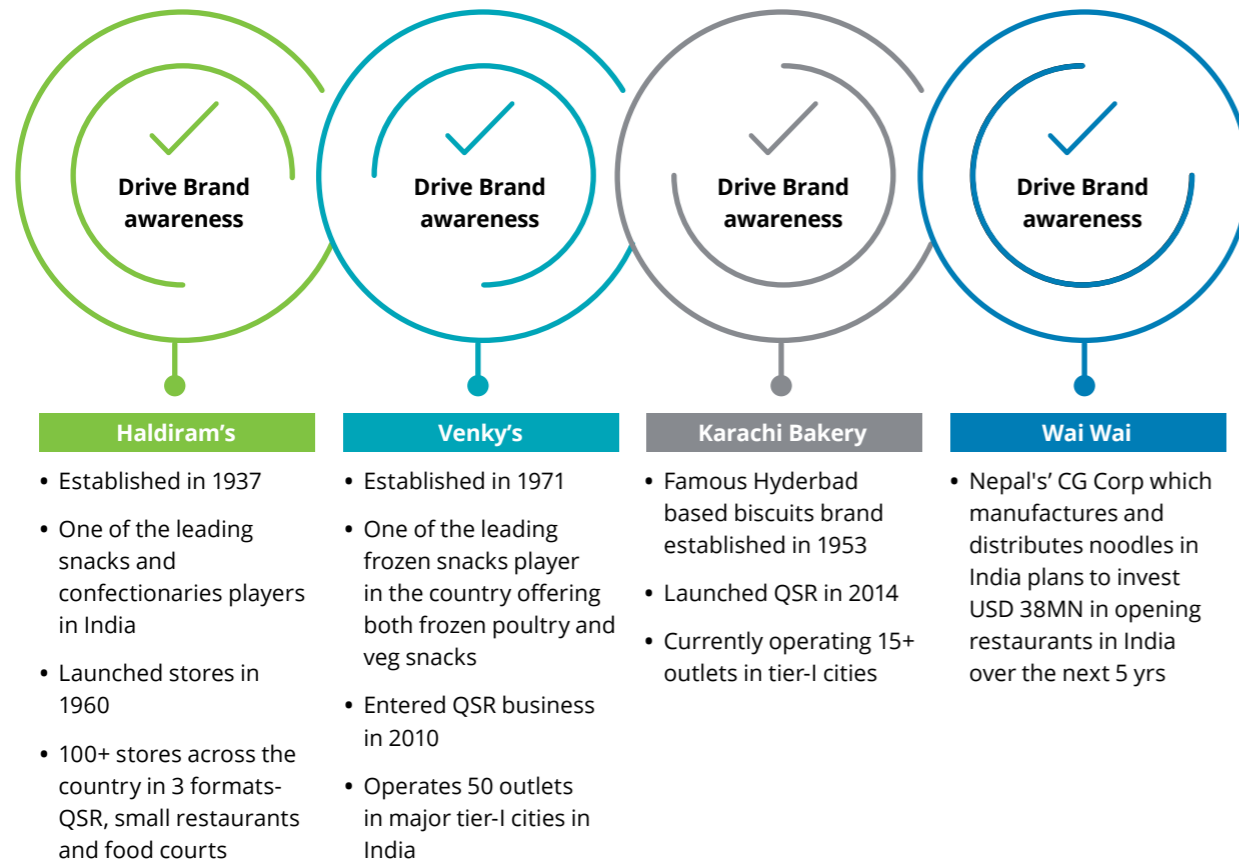
- **Growth of food chains**
  While unorganized food retail is growing at 7%[25], standalone organized food chains are expected to grow at 14% and chained food brands at 20% in India. BBQ Nation a large food chain, grew from 32 outlets[26]across 11 states and union territories in FY 13 to 81 outlets covering 19 states and union terrirotes 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 it's own vinery resort where it conducts wine tastings and teaches consumers about types of wine.

Drive Brand awareness	Drive Brand awareness	Drive Brand awareness	Drive Brand awareness
Haldiram's	**Venky's**	**Karachi Bakery**	**Wai Wai**
• Established in 1937	• Established in 1971	• Famous Hyderbad based biscuits brand established in 1953	• Nepal's' CG Corp which manufactures and distributes noodles in India plans to invest USD 38MN in opening restaurants in India over the next 5 yrs
• One of the leading snacks and confectionaries players in India	• One of the leading frozen snacks player in the country offering both frozen poultry and veg snacks	• Launched QSR in 2014	
• Launched stores in 1960	• Entered QSR business in 2010	• Currently operating 15+ outlets in tier-I cities	
• 100+ stores across the country in 3 formats- QSR, small restaurants and food courts	• Operates 50 outlets in major tier-I cities in India		

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. Increasinglyconsumers 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)
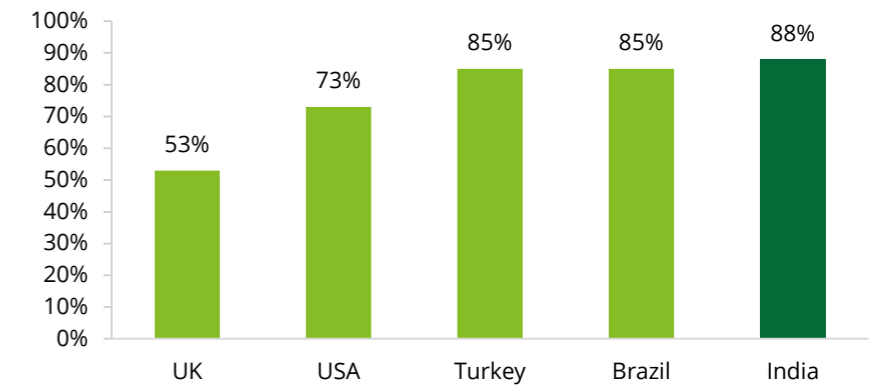
Source: FICCI Deloitte Report: KONNECTED to consumers, 2017

Shift required to unlock India's Potential
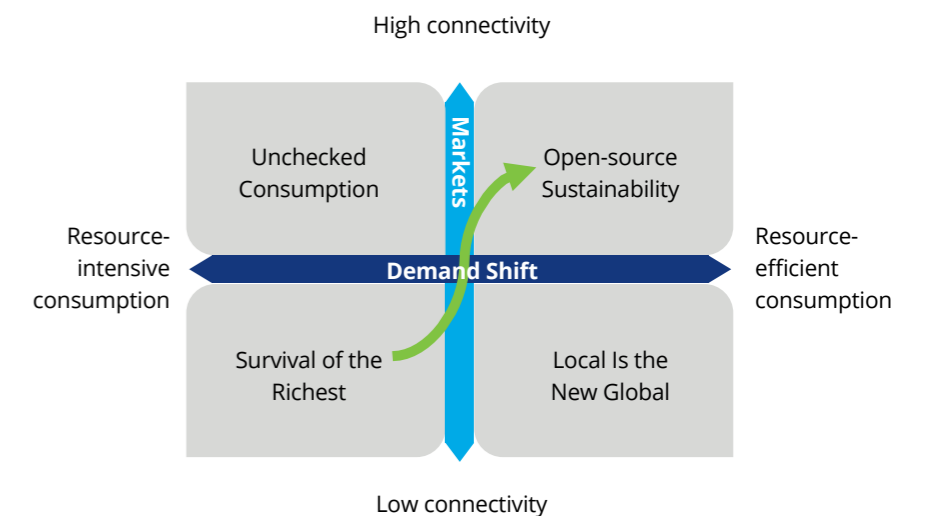
Source: Deloitte's report for World Economic Forum

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 can 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.

- **Logistics Efficiency:** GST implementation is expected to result in efficiencies in warehousing and logistics space, thereby reducing wastage in food industry. GST could reduce the logistics costs of companies producing non-bulk goods by as much as 20%[27], according to an estimate by Crisil Ltd.

- **Government of India (GoI) Support:** The Ministry of Food Processing, GoI has set up a GST facilitation cell for queries in the sector. Recently, GST rates of pasta and noodles have been moved to 12% slab from 18%.

SAMPADA
Illustrative Mega Food Park

Allow increased control over procurement operations

Provide a touch point for all stake-holders in the value chain
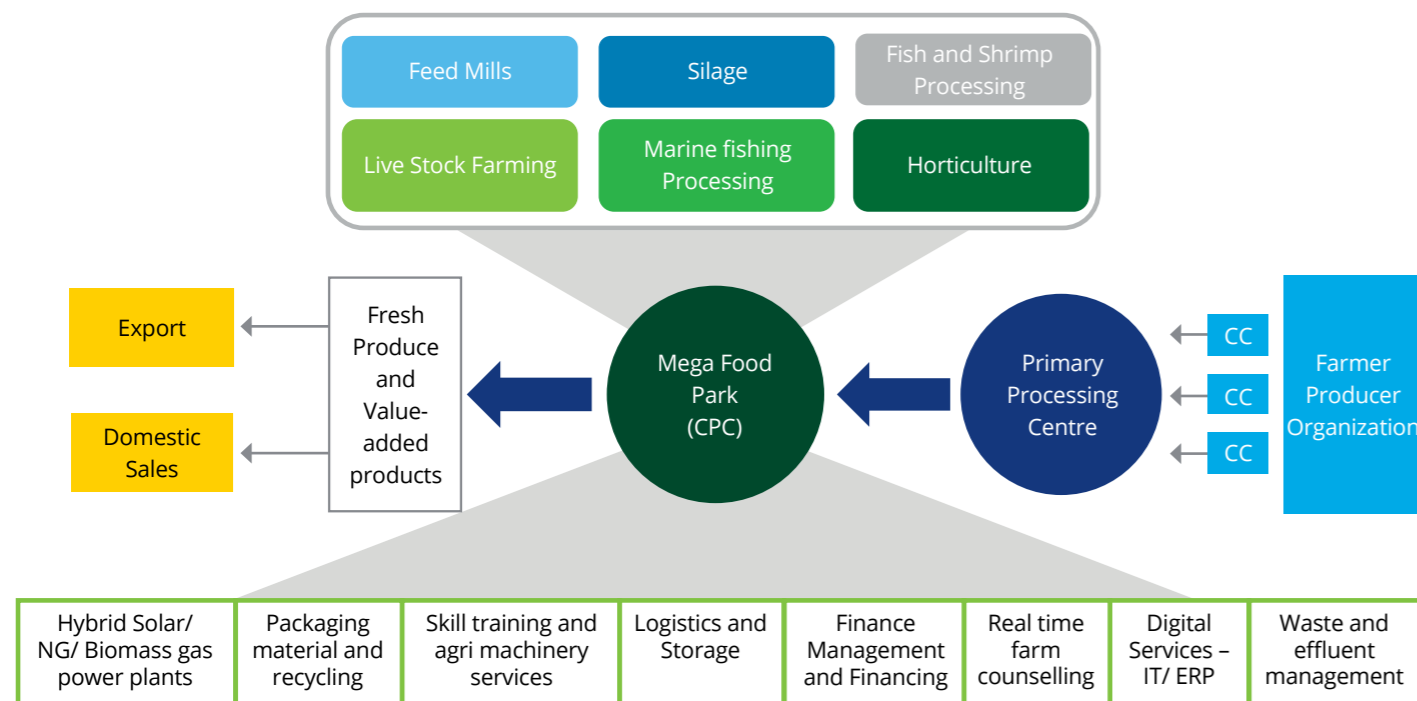
Increased quality control, especially for exports

Prevent wastage by allowing access to greater storage capacity

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[28]

- 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 8 have been made operational (For ex. **Patanjali Food and Herbal park in Hardwar, Srini 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.[29]

- **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 schemen 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 Pactrices (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.

[27] Livemint.com article dated 26-July-2016

[28] http://mofpi.nic.in/Schemes/pradhan-mantri-kisan-sampada-yojana
[29] 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
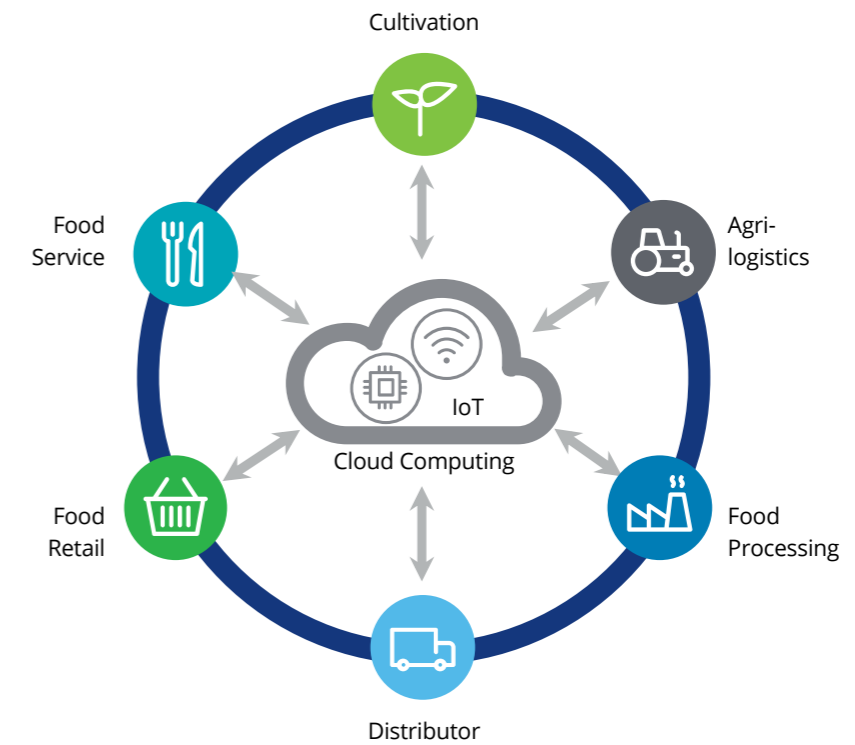
However, there are challenges with adoption of this revolution:

- **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 70% by 2025[30] 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 attack, 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[31]

- **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.

> Panchgaon village in Manesar district in Haryana has launched a project to grow crops in a soil-less environment. The project, commissioned by the Haryana Department of Horticulture, uses coconut fibre instead of soil to grow crops. The fibre is treated with liquid nutrients in a controlled environment to limit use of fertilisers and pesticides. Also, use of LED lights can help crops synthesize in adverse conditions. The crops grown are sold through bulk buyers in Gurgaon and Delhi. The project involved an initial capital investment of USD 90,000 with an annual operating cost of USD 30,000. However, the cost is expected to reduce with increase in scale.
>
> Source: The Better India Article-"Gurguram Adopts Soil-less farming" – July 2017

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 origination 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 a difference of days and minutes in discovering why and when contamination occurred

[30] Bayer Annual Report FY 2016-17
[31] Bayer Annual Report FY 2016-17

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

Things (IoT) in Agriculture and Food Manufacturing

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.

Number of IoT connected devices - Global vs. India (in Bn units)
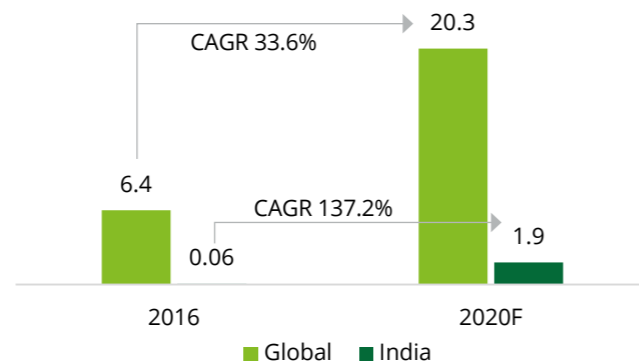
Source 1 KONNECTED to consumers, 2017 by FICCI and Deloitte

Industry	Player	IoT Application
Agriculture	Semios	Sensors to monitor insects and pests and schedule release of pesticides
	John Deere	Sensors installed on farm equipment can communicate sensor data to an app to assist farmers to make adjustments to the mapping layers. Users can set how many seeds are to be planted per acre, how far apart they are to be planted and so on
	Clean Grow	Carbon nanotube sensors to monitor level of nutrients in crops, assisting farmers to assess the maturity of produce
	Observant	Geo-fencing of livestock, along with irrigation scheduling and pump control
	Topcon	Connected equipment with GPS, real-time monitoring, electronic controls and data analysis for smart decision making during every phase of the farming cycle
	OpenIoT	Remote sensors to help farmers monitor vitals such as humidity, air, temperature, soil, etc.
Transport & Logistics	JJ Food Service	Sensors to monitor different temperature bands and quality of the food being delivered
	Purfresh	Sensors to check on the condition of grocery and other consumables supplied

Carrefour, a French supermarket chain, significantly increased the customer engagement through the installation of beacons in the store. The technology enabled customers to navigate in-store promotions through their smartphone or tablet. The retailer was able to increase its digital engagement by 400% and app users by 600%

Source: FICCI Deloitte Report: KONNECTED to consumers, 2017

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[32]. 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

[32] Business Wire Report dated 27-Dec-17

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.

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

Legend:　　● Very high　　◕ High　　◑ Medium　　◔ Low　　○ Very low

Contacts

Anand Ramanathan
Bengaluru
ranand@deloitte.com

Avinash Chandani
Mumbai
achandani@deloitte.com

Deloitte.