Feeding a Billion: Role of the Food Processing Industry

As India’s population soars past one billion, the challenge of feeding its people also grows. The food processing industry is positioned to be a vital part of the solution.
Feeding a Billion: Role of the Food Processing Industry

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Our Vision

To be the thought leader for industry, its voice for policy change and its guardian for effective implementation.

Our Mission

To carry forward our initiatives in support of rapid, inclusive and sustainable growth that encompass health, education, livelihood, governance and skill development.

To enhance efficiency and global competitiveness of Indian industry and to expand business opportunities both in domestic and foreign markets through a range of specialised services and global linkages.
Message from Ministry of Food Processing Industries

Mr. Siraj Hussain
Secretary

MESSAGE

Food processing industry is playing a central role in linking producers with the consumers and hence has an important role in influencing the farming as well as distribution practices. It is major source of employment and income generation for rural areas. It holds the key to reduce wastages in supply chain of perishables with increasing incomes the demand for nutritious fruits and vegetables is increasing every year. Modernisation of supply chain will prove a boon for producers and consumers.

I am happy to note that to further highlight the potential role of this sector in the economy, this report “Feeding a Billion: Role of Food Processing Industry” is being released.

This report identifies challenges and also provides the way forward to concerned stakeholders. I expect the report to help further scale up the sector's growth.

(SIRAJ HUSSAIN)
17-9-13

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Message from FICCI

Dr. A. Didar Singh
Secretary General

The food processing industry in India has been hailed as one of the sunrise sectors for 25 years now. Although the potential has never been in doubt, its importance as a key growth driver is being realized only of late.

The food processing industry is estimated to be around USD 180 billion (INR 8 Lakh Crore), and contributes about 1.3-1.5% to India’s GDP. Nevertheless, given India’s billion plus population, the food processing industry has a wider role to play in the coming years. Besides its core role of increasing shelf life of food, preserving food nutrients in the supply chain and providing fortified products targeted at micronutrient deficiencies, it needs to provide benefits to other areas in the value chain by providing farm extension services, improving price realization for the farmers by reducing intermediaries and strengthening supply chain through its forward and backward linkages. In other words the food processing industry needs to be “Agriculture Plus”.

This year’s theme for the Food World is “Feeding a Billion”. In consonance with the theme, this report aims to look at the various gaps that exist in the areas of production, food security, nutritional deficiency, quality, safety and enhancing consumer awareness. With immense supply strength in agriculture the food processing industry is expected to play a key role across the food value chain in addressing these.

The country today requires a fresh look at the existing initiatives that are led by government and private players to enhance effectiveness of these initiatives as well as remove impediments in implementation.

I am confident that this joint effort by FICCI & AT Kearney will be instrumental in highlighting the business potential in agri-food sector.

Dr. A. Didar Singh
Message from A.T. Kearney

“There are people in the world so hungry, that God cannot appear to them except in the form of bread.”
— Mahatma Gandhi

Over the past decade, India has made phenomenal progress in terms of GDP growth and along with it, growth in several indices that one could possibly measure overall progress in terms of income, aspirations, consumption patterns, lifestyles and so on. Much has been already been said, and rightly so, in terms of our solidity in terms of the consumption driven growth, fuelled on the back of strong growth in the services sector. However, we are today standing at a point where the “bowl” which has been feeding the hearts and minds of the billion plus population driving the growth needs to be urgently replenished. Hence the topic of this paper “Feeding a Billion” couldn’t have been more opportune.

Food as a sector has several available commentaries on this subject – however, we have strived to add value in three ways:

♦ Argued the case that the Food Processing sector needs to be central to the transformation across the food value chain, because it is the first organized linkage between the farm and shelf and several creative means are available to key stakeholders such as government and / or policy bodies to work through a win-win partnership model with industry. In fact, the Food Industry is an important contributor to the Indian GDP -economically and socially and all the more reason to take drive this transformation seriously

♦ Taking a holistic view to “food” – this is not only about Packaged Foods & calories (hunger). This report covers the challenges / solution themes holistically for the whole food industry from farm to fork AND from a balanced nutrition perspective (not just macro availability of calories).

♦ Bring to bear a holistic framework for market creation in Food, which all stakeholders can use to calibrate their imperatives and well as prioritized set of action points

♦ Uniquely brought together several primary / empirical research in multiple food value chains to establish a robust / fact based case for action

We hope the case for action and now will come across clearly, thereby driving greater urgency and clarity in policy and its implementation. Finally, this report should be treated as a start of a series of initiatives that need to be debated, perhaps even detailed further, providing further impetus to the recognition of these challenges and solution themes.

Debashish Mukherjee

Partner, A.T. Kearney
Foreword

Siraj A. Chaudhry
Chairperson, FICCI Food Processing Committee & Chairman, Cargill India

Sangeeta Pendurkar
Co-Chairperson, FICCI Food Processing Committee & Managing Director, Kellogg India

The food processing industry—with output of USD 180 billion, employing more than 3.1 million people in organized and MSME processing and playing a crucial role in local economies—is an important contributor to India’s economic and social growth. Being the first “organized” stage of the value chain, food processing provides the vital linkage between agriculture and final food consumption. Accordingly it has key role to play in driving productivity improvements across the value chain and increasing availability of affordable, nutritious and safe food.

The role of food processing industry becomes extremely critical considering the immense and immediate challenge of feeding nutritional food to the over billion population of India. Over the past decade, India’s unsatisfactory progress in health and nutrition improvement has been in stark contrast to unprecedented levels of GDP growth and poverty reduction. For example, the National Family Health Survey, showed that at the current rate of progress, India will not reach its millennium development goal target—to halve the proportion of underweight children by 2015—until 2043.

Within this context, the FICCI - A.T. Kearney paper on “Feeding a Billion: Role of the Food Processing Industry” provides a perspective on the role and impact of Food Processing in providing high quality, safe foods for end-consumption, while being a growth catalyst in our economy through employment generation, providing a fillip to the agriculture industry and attracting capital. It also talks about major food segments where focus is needed to address the country’s calorie and nutrition needs over the next 10 to 15 years, prioritizes key challenges and proposes a way forward for key stakeholders.

Several insights in this whitepaper stem from discussions with industry leaders across various Indian companies in the food processing business. We gratefully acknowledge their valuable inputs as well as the valuable data sources, including industry reports and publications, databases and company websites that have been used for the purpose of this whitepaper. We also appreciate the efforts of the A.T. Kearney team comprising Debashish Mukherjee, Himanshu Bajaj, Namit Garg and Joshua Abraham who led the development of this report.

We are grateful to Mr. Siraj Hussain, Secretary, Ministry of Food Processing Industries for his valuable guidance on the report. We are also grateful to the following people for their valuable inputs during development of this report: Mr. Arnab Hazra (Director, CIFTI), Mr. Chris Buckthorpe (Chief SCM Manager, Gati), Mr. K. Radhakrishnan (President, Future Fresh Foods), Ms. Rachna Chhachhi (Director and CSO, ChhHealth), Mr. R.S. Sodhi (MD, Amul), Mr. Sanjay Khajuria (Senior Vice President, Nestlé), Mr. Siva Nagarajan (MD, Mother Dairy), Dr. S.K. Ranjhan (Director, Hind Agro Industries) and Mr. Varun Berry (COO, Britannia).

(Siraj A. Chaudhry)

(Sangeeta Pendurkar)
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Executive Summary

Economic growth over the past decade has led to significant poverty reduction, raising nearly 20 million people above the poverty line every year. India, however, continues to face significant bottlenecks in feeding nutritious food to over a billion people, leading to issues around chronic undernourishment and malnutrition, lifestyle diseases and micronutrient deficiencies. Resolution of these issues requires improvements on multiple fronts: availability, affordability, consumer awareness, quality, safety and access of food – which therefore needs a cross-value chain approach. We believe the Food Processing industry will need to play a central role in driving improvements in the country’s nutrition situation because it is the first organized linkage between the farm and shelf. The unique conditions of the Indian market, such as consumer preference for ‘fresh’ foods, high local availability of food and low degree of value-chain organization also implies a broader role of food processing sector in Indian context (more than just packaged food). Finally, it is important to note that food processing is an important contributor to economic and social growth – with high outputs (USD 180 billion in 2011), substantial employment generation (over 3.1 million employees in organized and MSME segments) and impact on local economies – and hence deserves a high degree of focus from all key stakeholders (Government and Private Enterprises) associated with this sector.

To feed the currently undernourished population of India would require a 3 to 4 percent increase in food supply. By 2025, two factors will impact the food requirement in the country, driven primarily by increasing incomes, rapid urbanization and more inclusive growth.

- India’s food mix will continue to move away from grains and pulses, and toward more dairy, fruits and vegetables, meat and edible oils.
- Aggregate energy intake levels are likely to increase

We believe there are significant risks to availability that need to be bridged by the food industry especially for grains and pulses, edible oils and dairy products:

- Despite the decrease in share of energy intake, the grains and pulses segment will essentially need to replicate production growth achieved from 2001-2011 until 2025 in order to reach the necessary supply levels. However, a meager increase in land under production coupled with plateauing yield growth will be major challenges to achieving this. Inability to effect quantum improvements in yields could see a shortfall of as much as 11 million tons of food grains by 2025.

- Rising incomes will drive higher consumption of edible oil, which is expected to substantially increase in share of energy intake. While India is one of the largest producers of oilseeds in the world, it imports around 55 to 60 percent of domestic edible oil consumption requirements. This poses a major challenge as high import dependence means an uncertainty in supply and potential for significant variability in prices.

- While the dairy segment has been one of India’s success stories, sustaining production growth will require significant investments to ensure the sector meets demand requirements by 2025. In addition, substantial gaps in availability of livestock feed supply and competition for acreage from food crops pose fundamental threats to necessary dairy production.
While fruits and vegetables, meat and poultry segments have seen rapid growth over the last two decades, this is expected to stagnate with increased competition for usable land. In addition, the threat of the more lucrative export markets could also divert food supply away from domestic food availability, or more critically, land away from segments such as food grains, edible oils and dairy products, which run the risk of shortage by 2025.

Over and above availability, affordability, quality and safety and consumer awareness are the pillars supporting improvement in India’s nutrition future. Issues in each of these areas have been contributing to the various nutritional challenges India currently faces. Availability and affordability limitations for lower income groups have led to persistent undernourishment, a lack of awareness and issues with food quality have driven overconsumption in upper income groups and all four contribute to the high incidence of micronutrient deficiencies. The underlying structural causes of these gaps and limitations in addressing them are explored in detail and will need to be addressed in order to secure India’s nutrition future:

- The slowdown in productivity growth and lack of alignment on production incentives are impacting farm output
- Limited organized presence and poor infrastructure in the procurement and supply chain are leading to wastage, unnecessary price-buildup and poor food quality and safety
- Lack of scale and modern technology limiting nutritional impact and value-add in the processing stage
- Inability to effectively monitor and ensure food quality and safety of food across the value chain
- Gaps in research and training limiting improvement programs across the value chain
- Poor consumer awareness of balanced diet and quality and safety issues with various foods

There are eleven key initiatives for India’s food and nutrition situation, in order to effectively and efficiently drive the goal of feeding a billion people (see figure 1 on page 11):

Across these eleven areas, there are four broad themes that can form the basis of action agenda for private players and government, and are detailed in this report:

- Leverage greater private-public partnerships in areas of production, extension services, supply chain and high nutrition foods
- Simplify regulatory and policies and ensure stronger implementation in areas of integrated planning, implementation and standardization
- Ensure greater transparency in price, volumes and inventory of food produce
- Drive innovation and skill development to drive growth over next decade
### Figure 1
**Expected impact of initiatives on the market for foods**

<table>
<thead>
<tr>
<th>Key initiatives</th>
<th>Availability</th>
<th>Affordability</th>
<th>Quality and safety</th>
<th>Awareness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enhance private participation in production</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leverage private-public partnerships to enhance effectiveness of farm extension services</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enhance commercial viability of organized supply chains</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Enhance focus on high nutrition products</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Develop consolidated policy for food and food processing</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Simplify regulatory environment</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Revamp food safety laws focusing on enforcement</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enhance transparency of price, volume and inventory in wholesale markets</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Invest in R&amp;D to improve yields and reduce wastage/nutrient drop</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Focus on effective implementation of skill development programs</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Create market demand through higher awareness of quality and nutrition</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
</tr>
</tbody>
</table>

- Greater Public Private Partnerships
- Policy and regulatory support
- Higher transparency
- Innovation and skill development
A New Introduction to Food Processing in India

This paper is about bringing fresh perspectives to the challenge of feeding over a billion people – while one can rightfully argue that the onus of such a big ask is / should be spread across the traditionally understood areas of agriculture, food processing and then the downstream storage, logistics and retail services, it is clear even today as India evolves in this space, that the leadership for achieving this goal has to be from the Food Processing sector. And to understand and accept this, we have to first move beyond the traditional understanding (perhaps even bias) of considering Food Processing as the Packaged Foods sector which thrives on a pure buying / selling relationship across the food value chain, in a transactional manner. In fact, it is quite the opposite, where with increasing scale, Food Processors are and will need to invest heavily and drive productivity improvements in the “back end” value chain (i.e. farming) and drive improved, safer consumption choices for the customer. In short, it forms the vital link between the agriculture sector and final food consumption. Hence, in this report on Food Processing, challenges and opportunities across the value chain have been highlighted in a balanced manner, as they are equally pertinent to be discussed and solved for in the context of ‘Feeding a Billion’. The focus of this report is to emphasize the role food processing sector can play in addressing the nutrition needs of the country, while bringing to bear significant economic and social impact facts, which should be considered favorably by all key decision makers considering investments in this sector, as this sector advocates greater congruency and implementation of policies, aimed at bridging the gap of feeding over a billion people, with safe and nutritious food.

Scope and role

The food value chain in India is different from many other markets like U.S. due to unique consumption pattern in the country and presence of both organized and unorganized players. As a result, consumption at the retail level consists largely of non-processed products or food with very limited processing in key categories like fruits and vegetables, meat and poultry, dairy, grains, and pulses (see figure 2).

Figure 2

Share of processing across regions

<table>
<thead>
<tr>
<th>Share of processing in fruits and vegetables across regions</th>
<th>Share of processing in milk and dairy products across regions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong preference of Indian consumers for Fresh products</td>
<td>Large share of milk consumed by producers and local economy</td>
</tr>
<tr>
<td>2% India</td>
<td>35% India</td>
</tr>
<tr>
<td>30% Thailand</td>
<td>&gt;80% Australia</td>
</tr>
<tr>
<td>80% Malaysia</td>
<td></td>
</tr>
</tbody>
</table>

Sources: Vision, Strategy and Action Plan for Food Processing Industries in India 2005, Ministry of Food Processing Industries

Sources: Dairy Australia, Primary Research
The difference in the Indian market is driven by both demand and supply driven factors:

- **Consumption behavior**: Indian consumers prefer to procure food in unprocessed and fresh form and then convert it into a consumable form through the food preparation process either in homes or restaurants. This is distinct from many other countries where consumers prefer to purchase more ready-to-eat foods. The consumption behavior is changing in the urban centers, however, as the younger generation is shifting toward processed foods due to paucity of time.

- **Wider availability**: Most food products in India, like fruits and vegetables and milk, have a wide availability across the country, which is very unique to India. This leads to lower need for packaging and preserving food for transportation over longer distances.

- **Limited evolution of food processing sector**: In areas like core processing, warehousing, logistics, and production, the food value chain in India is still nascent with limited use of modern technology and labor-intensive processes as compared to countries like the U.S., which are characterized by large-scale contract farming, extensive cold chains, and advanced warehousing capabilities.

These differences lead to multiple challenges like higher wastage, limited opportunities for food fortification through nutrients and quality and safety risks. The food processing industry thus has a much wider role in Indian context. This role can be split into core activities which involve:

- Primary processing like cutting, cleaning and refrigeration
- Secondary processing like of grain milling, manufacture of fruit pulps, frozen meat and poultry, packaged milk
- Tertiary activities processing like manufacture of fruit jams and juices, biscuits, milk products, ready to eat meals, protein supplements, confectionery

These activities (illustrated in figure 3 for different food categories) help in preserving food nutrients, increasing shelf life of food, improving nutrition levels through fortification and providing wider choices for the consumer.

**Figure 3**

**Segments and examples of food processing**

<table>
<thead>
<tr>
<th>Food Category</th>
<th>Primary processing</th>
<th>Secondary processing</th>
<th>Tertiary Processing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit and vegetable</td>
<td>• Cleaning, cutting, sorting</td>
<td>• Pulps, pastes, slices</td>
<td>• Jams, juices, pickles</td>
</tr>
<tr>
<td>Grains and cereals</td>
<td>• Sorting and grading</td>
<td>• Flour, malt &amp; milling</td>
<td>• Biscuits, noodles, cakes</td>
</tr>
<tr>
<td>Dairy products</td>
<td>• Grading and refrigeration</td>
<td>• Cottage cheese, cream, dried milk</td>
<td>• Yoghurts, spreadable fats</td>
</tr>
<tr>
<td>Meat and poultry</td>
<td>• Sorting and refrigeration</td>
<td>• Cut, fried, frozen</td>
<td>• Ready-to-eat</td>
</tr>
<tr>
<td>Marine products</td>
<td>• Chilling and freezing</td>
<td>• Cut, fried, frozen</td>
<td>• Ready-to-eat</td>
</tr>
<tr>
<td>Edible oil</td>
<td>• Sorting and grading</td>
<td>• Refined oils</td>
<td>• Fortified oils</td>
</tr>
</tbody>
</table>

Sources: Analyst Reports, Primary Interviews
In addition and equally important, the food processing sector can impact the other areas of the value chain through its forward and backward linkages.

- **Farming and other food production:** Increasingly, the food processing companies are strengthening their backward integration through initiatives like agriculture extension services. This will drive higher productivity in the farming sector and improve quality and safety. With higher visibility of demand, food processing companies can also help in improving the crop mix in agriculture, leading to better availability and affordability of food products.

- **Procurement:** Food processing companies can deploy more scientific methods for sorting and grading of produce. Higher involvement in procurement will also help improve price realization for farmers by reducing intermediaries and thus lowering price buildup through elimination of non-value-adding activities.

- **Supply chain:** The increasing role of the food processing industry can help accelerate investment in storage and transport capabilities, thereby lowering wastage levels, improving nutrient retention during storage and transportation, and enhancing shelf life of products.

### Impact on economy and size of industry

The size of the food processing sector in India was around USD 180 billion in 2011. This includes both the organized and unorganized sector where organized forms 50-55% of the overall market. Grains and pulses, beverages and other foods and dairy products make up around 80% of the total processed food market (see figure 4). The sector is expected to grow at around 13 percent on a nominal basis and reach size of USD 530-550 billion by 2020. Within the food processing sector, segments like meat and marine, edible oils, grains and cereals are expected to witness high growth rates.

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**Figure 4**

**Relative share of various food segments in food processing**

(\% share, 2011)

Sources: Analyst Reports, Ministry of Food Processing Industries – Annual report 2012-13, MSME Census, A.T. Kearney
Overall the sector has a significant impact on the economy. This is due to the scale of outputs generation, employment creation and impact on rural economy which relies heavily on agriculture and associated manufacturing and services for income.

- **Scale of outputs**: The food processing industry is significantly larger than many other labor intensive sectors like textile, apparel and leather (see figure 5). In addition, the distributed nature of unorganized food processing across the country leads to wider employment generation across rural and urban regions.

- **Employment generation potential**: The industry has large employment generation potential and currently accounts for direct employment of more than 16 lac workers in factories along with over 14 lac workers in the MSME segment. In addition, the industry potentially impacts over 1.2 crore people across its suppliers and supply chain (see figure 6)\(^1\).

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**Figure 5**

**Output generated across key labor intensive sectors**

(USD billion, 2011)

![Bar chart showing output across food and beverages, textile, apparel, and leather sectors.](chart1)

Sources: Analyst Reports, Ministry of Food Processing Industries – Annual report 2012-13, MSME Census, A.T. Kearney

**Figure 6**

**Employment generation in organized and MSME sectors across select industries**

(Millions of persons, 2011)

![Bar chart showing employment across food and beverages, textile, apparel, and leather sectors.](chart2)

Sources: Ministry of Food Processing Industries – Annual report 2012-13, MSME Census, A.T. Kearney

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\(^1\) Based on employment multipliers as per Press Information Bureau, Government of India
• **Impact on local economy**: Since a large share of this industry is based in rural, semi-urban regions, there is a significant multiplier effect on the local economies as these regions provide both raw material and labor for the industry. This boosts the local economy through generation of income and its cascading effect on the economy. The food processing industry typically has an output multiplier of two to four on GDP as seen in several countries. The output multiplier for a sector defines the additional outputs in an economy generated due to cascading effect of outputs of the primary sector. For example, an USD 1 billion growth in the food processing sector could translate into additional GDP growth of USD 2-4 billion from adjacent sectors in the food value chain as well as the larger ecosystem. Even in India, case studies suggest significant impact of food processing on local ecosystems (see figure 7).

In addition, the food processing industry through its backward and forward linkages has tremendous potential to influence other parts of the food value chain. This can lead to reduction in wastage and improving farm productivity through investments in the supply chain and farm extension services for agriculture.

• **Role in wastage reduction**: Food wastage is a significant issue, especially in perishable segments like fruits and vegetables. Losses in perishables can result from mechanical damage, microbiological agents, or aging of products. These losses can become significant with improper handling during storage and transportation and unsuitable environmental conditions such as high humidity. The inadequate cold storage facilities and lack of a modern warehouse infrastructure, along with a high number of intermediaries in India, lead to high nutrient loss in fruits and vegetables. It is estimated that around 7 to 8 percent of loss occurs

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**Figure 7**

**Direct and indirect impacts of food processing – the case of Nestle’s Moga factory**

**Growth of Moga factory supplier base**

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of farmers supplying to Moga</th>
</tr>
</thead>
<tbody>
<tr>
<td>1961</td>
<td>180</td>
</tr>
<tr>
<td>1983</td>
<td>~45,000</td>
</tr>
<tr>
<td>2011</td>
<td>~86,400</td>
</tr>
</tbody>
</table>

**Direct impact on local ecosystem**

- Direct employment to over 2,400 workers in factory
- Employment to over 86,400 farmers through suppliers; additional indirect employment to 45%-65% of employment generated by suppliers
- Payment of INR 6,120 mn to milk producers, most of which was spent in local economy

**Direct impact on local ecosystem**

- Improving dairy productivity due to farm agriculture extension services like veterinary, animal husbandry, dairying and agricultural advice
- New investments by farmers in better farming and animal husbandry inputs
- CSR initiatives to provide water and basic facilities to local schools benefitting over 40,800 students

Sources: Third world Centre for Water Management (Mexico), Nestle
in fruits and vegetables in India post harvesting\(^2\). However, this does not account for loss of nutrients in fruits and vegetables that leads to lower economic value realization of produce. The food processing industry can play an important role in building the required infrastructure as well as introducing best practices for storage and handling.

- **Role in enhancing farm productivity:** Many farmers in India face the problems of traditional technology and practices, limited bargaining power with input suppliers, inadequate infrastructure, a paucity of market information, and limited access to capital. The food processing sector has the potential to play a critical role in enhancing productivity in categories such as milk and fruits and vegetables by providing farm extension services to their suppliers or through contract farming. For example, in dairy, contract farming led to a 42 percent increase in number of milking animals and 55 percent increase in total milk production\(^3\).

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\(^2\) CIPHET study

\(^3\) Review on contract dairy farming: to boost Indian dairying, Indian Veterinary Research Institute
Requirements for Feeding Over a Billion People – A Holistic Framework

The past decade has seen the Indian economy grow at unprecedented rates. This has led to record-breaking poverty reduction, raising nearly 20 million people above the poverty line every year, for the last decade. However, India continues to face a significant challenge in its goal of feeding its population and keeping it healthy. Despite being one of the fastest-growing global economies, India continues to score poorly on various health and nutrition indicators (see sidebar: UNICEF – Millennium Development Goals for Eradicating Hunger).

India’s nutrition challenges span several fronts. On one hand, a large portion of the lower income classes is undernourished. On the other hand, the more well-off income classes are seeing an increasing rate of lifestyle diseases, such as diabetes, hypertension, and coronary heart disease. In addition, India has a high incidence of diseases such as anemia, goiter, and night-blindness.

- **Chronic undernourishment and malnutrition:** As illustrated in figure 8 on page 19, India has among the highest shares of underweight children among lower middle income countries. With around 44 percent of children less than five years of age underweight, India performs worse than all lower middle income countries and at par with low income countries in sub-Saharan Africa. At an overall level, the share of total population suffering undernourishment (defined as consistent and chronic under nutrition) is also high, with only Pakistan, Sri Lanka and some sub-Saharan countries worse off than India. It is no surprise that India ranks 106th out of 120 countries in the 2012 Global Hunger Index. And this represents a drop from 90th out of 117 countries in 1996. Undernourishment and malnutrition, especially in children, are problems that need to be addressed immediately, as the true economic costs only become apparent when children reach working age. For example, malnourished children may earn up to 20 percent less than healthy children in adulthood, resulting in a global economic cost of USD 125 billion in 2030, when they have reached working age⁴.

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**UNICEF – Millennium Development Goals for Eradicating Hunger**

- **Food and good nutrition are basic human needs, and this is recognized in the first of the Millennium Development Goals (MDGs) defined by UNICEF—the eradication of extreme poverty and hunger. The established target is to reduce the proportion of people living on less than a dollar a day (poverty) and the proportion of people who suffer from hunger by 50 percent by 2015.**

- **India’s performance on key indicators that track progress on these goals has been mixed. While strong GDP growth has enabled record levels of poverty reduction, India’s performance on nutrition improvement, in stark contrast, has been underwhelming. The proportion of underweight children under five years of age was to be halved from the 1993 level of 53 percent to 26 percent by 2015. However, India has only managed to achieve a reduction to 43 percent as of 2006. China and Brazil, among others, have already achieved 2015 MDG targets.**

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⁴ Save the Children analysis, 2013
Lifestyle diseases: As illustrated in figure 9 and 10 on page 20, economic growth is a double-edged sword. While a 10 percent increase in GDP per capita is correlated with a 5 to 6 percent reduction in child stunting, it is also associated with a 6-7% increase in the prevalence of obesity (illustrated for the case of females above 15 years of age). The situation in India is approaching critical levels. Lifestyle diseases, including cardiovascular diseases, diabetes, cancer and chronic respiratory diseases are expected to cost the Indian economy USD 6 trillion, in output losses between 2012 and 2030. This figure is nearly nine times India’s total health expenditure of USD 710 billion from 1993 to 2011. While these diseases are typically associated with the higher income classes and the urban demographic, India is seeing increasing penetration in rural areas as well with a rapid increase in fats and oils in the diet.

Micronutrient deficiencies: A lack of regular intake of micronutrients such as iron, vitamins, calcium and iodine reflects in the high incidence of deficiency diseases in India. Incidence of iron deficiency anemia among women and children is estimated to be 50 to 70 percent; around 30 to 35 percent of men are also estimated to be iron deficient. Iodine deficiency disorders such as goiter affect 5 percent of the population, with only around 50 percent of...
Figure 9
Change with increasing GDP per capita

Change in stunting levels with increasing GDP per capita
(Stunting in children <5 years)

![Graph showing change in stunting levels with GDP per capita]

Note: Data on stunting as per latest available surveys and data year varies from 2004 to 2012
Sources: UN DHS, World Bank, The Lancet Medical Journal

Figure 10
Change with increasing GDP per capita

Change in obesity levels with increasing GDP per capita
(Percentage of overweight females >15 years)

![Graph showing change in obesity levels with GDP per capita]

Note: Data on obesity as per latest available surveys and data year varies from 2004 to 2012
Sources: WHO Core Health Indicators, World Bank, The Lancet Medical Journal
families consistently taking requisite iodine through use of iodized salt. India’s cereal-pulse focused diet is naturally deficient in some of these micronutrients, especially iron, vitamin A and calcium, due to the low intake of vegetables, fruits and animal products. The high income-elasticity of pulses further reduces micronutrient intake for lower income families. Productivity losses due to inadequate micronutrient intake are estimated to be as high as 10 percent of lifetime earnings, which would severely impact GDP if left unchecked.

The challenge of providing balanced nutritional access to the Indian population has five broad dimensions as shown in figure 11. The food industry will need to drive major improvements across all of these areas to support the goal of addressing India’s nutrition problem.

Figure 11

Holistic framework for improving nutrition

- Sufficient average food supply per capita
- Low volatility of food supply
- Strong and dependable agriculture sector (incl. public expenditure on R&D, agri-infrastructure)

- Diet diversification with lower dependence on grains & pulses
- Sufficient micronutrient availability esp. vitamin A and iron
- Strong national nutritional standards, dietary guidelines and monitoring mechanism
- Strong agency/regulations to ensure safety and hygiene of foods

- Strong distribution system reaching all areas
- Public distribution infrastructure to reach vulnerable groups
- Sufficient carrying capacity and quality of distribution infrastructure to enable other aspects such as availability, affordability and quality and safety

- Knowledge of balanced diet and related foods
- Understanding of fundamental gaps in traditional diets esp. in micronutrient deficiencies
- Knowledge of food safety and quality, key risk items and detrimental health impacts of consuming poor quality foods

- High purchasing power of population (low share basic needs such as food in total expenditure)
- Presence of food safety net programs
- Alignment of food demand and supply
- Access to financing for farmers

Source: A.T. Kearney

Availability

Food availability is basic to nutritional well-being and sufficient availability of quality foods that provide the energy, proteins and fats needed for full and balanced nutrition is fundamental to a nourished population. Improved availability can help address India’s energy and micronutrient deficit.

To feed the currently undernourished population of India would require a 3 to 4 percent increase in food supply. However the substantial disparity in incomes and consumption limits

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7 National Family Health Survey 3, 2005-06
the real availability of any incremental food supply to the undernourished. As illustrated in figure 12, wealthier income classes have a far higher food intake than middle and lower income classes. In addition to income disparity, interstate and urban-rural disparities also limit real food availability and contribute to a lack of nutrition for specific pockets of people. Consumption disparity drives India’s low level of aggregate calorie consumption. At around 2,140 kilocalories per day, India is roughly 10 percent lower than the median level of the basket of lower middle income countries and around 20 percent lower than the median level for upper middle income countries like Brazil and China.

By 2025, two factors will impact the food requirement in the country, driven primarily by increasing incomes, rapid urbanization and more inclusive growth.

- India’s food mix will continue to move away from grains and pulses, and toward more dairy, fruits and vegetables, meat and edible oils.
- Aggregate energy intake levels are likely to increase

The expected 2025 situation is illustrated in Figure 13 and 14 on page 23. We believe there are significant risks to availability that need to be bridged by the food industry for grains and pulses, edible oils and dairy products.
Figure 13

Expected evolution of energy intake and demand across food segments

Share of daily energy consumption (% of kilocalories)

Current supply and expected evolution of demand (in million tons)

1. ~20% increase in per capita energy levels based on similar experience in developing countries during high growth periods

Sources: FAO Food Balance, NSSO 66th Round data, A.T. Kearney analysis

Figure 14

Projected demand, growth needed and risks to availability in 2025

Note: 1. Historical growth rates for a 20 year period pro-rated to a 15 year period for Fruits & vegetables (FY92 – FY12), Grains & Pulses (FY91 – FY11) and Dairy Products (FY91 – FY12), for a 10 year period for edible oils (FY11 – FY11) and a 5-year period for meat & poultry (FY11 – FY12)

2. Production growth taken as proxy for food availability growth i.e. assuming diversion to non-food uses and exports is roughly unchanged and a share of production

Despite the decrease in share of energy intake, the grains and pulses segment will essentially need to replicate production growth achieved from 2001-2011 until 2025 in order to reach the necessary supply levels. However, a meager increase in land under production coupled with plateauing yield growth will be major challenges to achieving this (see sidebar: Radical Farm Reform Needed to Continue Self-Sufficiency Paradigm). Inability to effect quantum improvements in yields could see a shortfall of as much as 11 million tons of food grains by 2025.

**Radical farm reform needed to continue self-sufficiency paradigm**

**Figure 15**

**Trends in area under production and yield growth for food grains**

(% growth for 10 year period)

As seen in Figure 15, decadal growth of both area under production and yields is declining for wheat and rice, while for pulses these have been highly volatile. In addition, India has seen a loss of about 9 million farmers since 2001 and around 15 million since 1991. If this trend continues, then by 2025, per farmer output will have to increase by more than 70 percent. From 2001 to 2011, increase in farmer productivity was around 30 percent. While there are some benefits of reduced farmer participation, including the increase in average landholding size and hence ability to generate better returns on investments, such a huge increase in productivity will need radical farm level reform. These would potentially include (and covered in detail in the subsequent chapter):

- Improving government’s agricultural extension services or potentially allowing private sector players to play a major role
- Driving investment in agricultural R&D and technology improvements to improve per farmer yields
- Improving farmer access to credit
- Rising incomes will drive higher consumption of edible oil, which is expected to substantially increase in share of energy intake. While India is one of the largest producers of oilseeds in the world, it imports around 55 to 60 percent of domestic edible oil consumption requirements. This poses a major challenge as high import dependence means an uncertainty in supply and potential for significant variability in prices.

- While the dairy segment has been one of India’s success stories, sustaining production growth will require significant investments to ensure the sector meets demand requirements by 2025. In addition, substantial gaps in availability of livestock feed supply and competition for acreage from food crops pose fundamental threats to necessary dairy production.

- While fruits and vegetables, meat and poultry segments have seen rapid growth over the last two decades, this is expected to stagnate with increased competition for usable land. In addition, the threat of the more lucrative export markets could also divert food supply away from domestic food availability, or more critically, away from segments such as food grains, edible oils and dairy products, which run the risk of shortage by 2025.

**Consumer awareness**

Nutritional access is however, only part of the overall nutrition story. To ensure improved nutritional outcomes, consumer awareness is critical. As illustrated in Figure 16, despite having no constraints on availability, affordability or quality and safety, the top 30 percent of urban population consumes more than the recommended dietary guidance of fats. Excess fat intake can be a major driver of higher risk to cardiovascular diseases. Though consumption choices

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**Figure 16**

**Recommended daily energy intake from fat and actual intake across urban income groups**

<table>
<thead>
<tr>
<th></th>
<th>Minimum recommended energy from fat</th>
<th>Bottom 30%</th>
<th>Middle 40%</th>
<th>Maximum recommended energy from fat</th>
<th>Top 30%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recommended</strong></td>
<td>15%</td>
<td>21%</td>
<td>27%</td>
<td>30%</td>
<td>32%</td>
</tr>
<tr>
<td><strong>Actual intake</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Energy density of fat assumed to be 9 kilocalories per gram
Sources: NSSO 66th Round 2009-10, A.T. Kearney analysis
are ultimately in the hands of the consumer, government and industry have a major role to play in communicating nutrition recommendations to the consumer. Improved awareness can help in several ways, including:

- Addressing regional pockets with high micronutrient deficiencies (see sidebar: A Community Strategy for addressing Vitamin A deficiency in Indonesia)
- Enabling consumer avoidance of identified quality and safety issues with foods
- Enabling better decision-making in food choices for daily energy, protein and fat intake, for example improving the balance of consumer diets
- Driving market demand for new products, which enables wider choices, better quality products, and creation of new food segments (see sidebar on page 27: The gradual shift towards packaged foods)

### A Community Strategy for addressing Vitamin A deficiency in Indonesia

Faced with developing a communication strategy for a national vitamin A program covering over 13,000 islands and a range of microclimate and food zones, the SOMAVITA Project in Indonesia realized the importance of catering to the country’s geographical, climatic, and cultural diversity in developing a consumer awareness strategy. A decentralized research and strategy development approach was followed to identify one target food in each region, which was then promoted at a district level, including innovations such as promotion of recipes rich in target foods (see figure 17).

### Figure 17

**Targeted improvement in Vitamin A intake – the case of Indonesia**

- Indonesia has widely differing climates and food habits across islands
- A quantitative survey was conducted to identify, on the basis of availability and price, the best food sources of vitamin A
- Ten foods were identified, including amaranth, cassava leaves, carrots among other vegetables
- 5/10 foods shortlisted through a qualitative study examining the acceptability of each food, looking specifically at availability, consumer preferences and perspectives on use and preparation of the foods and household consumption patterns.
- Insights from the population about potential difficulties in buying or using the identified foods also understood
- Nutritionists, social marketing experts and program managers selected 1 food to promote in each region
- It was also decided to promote a series of recipes as mothers had indicated need to feed children variety of dishes

Source: FAO ‘Preventing Micronutrient Malnutrition’, A.T. Kearney research
The gradual shift towards packaged foods

Fresh or unpackaged foods traditionally been sold loose, are seeing an increasing penetration of packaged products (see figure 18). For mass market penetration beyond upper income households, the greatest challenges will be to ensure affordability of these products and generating awareness around benefits. Greater consumer awareness of the better quality, safety and nutrition impact of these products will drive increased penetration. Consumers need to be convinced to pay a small premium for the intangible, non-monetary benefits.

Figure 18
Increasing role of packaged foods in traditional loose food segments

<table>
<thead>
<tr>
<th>Food category</th>
<th>Salt</th>
<th>Tea/Coffee</th>
<th>Pulses</th>
<th>Wheat flour</th>
</tr>
</thead>
</table>
| Benefit/value-addition | • Sufficient content of critical micronutrients esp. iodine — E.g. -72% of packaged crushed salt is sufficiently iodized compared to ~7% of loose crystal salt  
• Low sodium salt options help lower risk of lifestyle diseases | • Better quality and product standardization than loose teas  
• Healthy options such as de-caffeinated, high anti-oxidant levels  
• Wider range of choices for customers, e.g. flavored teas | • Better nutrient retention through alternate processing (e.g. limited polishing or non-water / oil polishing)  
• Modern and scientific sorting / grading for high purity | • Fortification of flour through addition of vitamins, minerals and iron  
• Use of better quality wheat (e.g. whole-wheat)  
• Branded atta now makes up ~3% of total market by value |
| Sample products/brands | • Tata i-shakti salt, Annapurna iodized salt, Aashirvaad iodized salt etc. | • Variety of products from multiple players incl. Nestle, HUL, Tata Beverages etc. | • Tata i-shakti dals, Adani Wilmar Jubilee pulses etc. | • Pillsbury Nutri-soft Chakki Fresh atta, Kisan Annapurna Fortified atta etc. |

Note: 1. International Council for Control of Iodine Deficiency Disorders Survey 2011
Source: A.T. Kearney research
Affordability

Closely linked to availability, affordability is extremely important for a society with as much income disparity as India. As shown in figure 19, the share of food in total consumer spending is as high as 62 to 65 percent for the lowest income classes. On the other hand, it is as low as 30 to 40 percent for the upper income classes. At around half of monthly per capita income spent on food, India ranks 17th in the group of lower middle income countries, behind even Sri Lanka and Pakistan. For countries like Brazil and China, 20 to 40 percent of household budgets are typically spent on food. As illustrated in Figure 19, attempting to feed currently undernourished households will see their food expenditure rise to as high as 82 percent for the lowest income class in rural India and nearly 70 percent for the lowest income class in urban India8, leaving little income for expenditures above that needed for basic subsistence.

Figure 19
Share of Food in consumer spending across income class and additional spend needed for full nutrition

(\% of income spent on food)

\[ \text{Assuming full nutrition}^1 \]

\[ \text{Urban} \]

\[ \text{Income decile of population}^2 \]

\[ \text{Assuming full nutrition}^1 \]

\[ \text{Rural} \]

\[ \text{Income decile of population}^2 \]

1. Full nutrition level assumed to be 2,400 kilocalories for rural and 2,100 kilocalories for urban demographic for an adult male
2. 90-100 represents highest average income level and 0-10 represents lowest
Source: NSSO Survey of Consumer Expenditure 2011-12, Nutrition Intake in India 2009-10, A.T. Kearney analysis

8 For full nutrition, assumption is a per day intake of a minimum of 2,400 kilocalories in rural areas and 2,100 kilocalories in urban areas for an adult male in the 20 – 39 age group
As illustrated in figure 20, cereals are by far the most cost-effective source of dietary energy. As a result, it is the dominant diet component especially for lower income groups. While foods like fruits and vegetables are much more expensive, they are crucial sources of micronutrients widely deficient in the population. The generally observed trend is that increasing incomes lead to diet diversification – away from staple grains and toward higher cost foods like poultry, fruits and vegetables and dairy products. With increasing demand for edible oils, fruits and vegetables, dairy products and meat, it is important to ensure affordability for these segments. This has, however, not been the case for most of these segments in the last few years. As illustrated in figure 21, meat and poultry, vegetables and milk experienced higher inflation rates.

Figure 20

**Estimates of cost per calorie across food segments**

(in INR per 1,000 kilocalories, 2009-10)

<table>
<thead>
<tr>
<th>Food Segment</th>
<th>Cost Range (INR per 1,000 kcal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat and Poultry</td>
<td>65 – 75</td>
</tr>
<tr>
<td>Fruits and Vegetables</td>
<td>28 – 40</td>
</tr>
<tr>
<td>Dairy products</td>
<td>20 – 26</td>
</tr>
<tr>
<td>Pulses</td>
<td>12 – 13</td>
</tr>
<tr>
<td>Additives (sugar, edible oils)</td>
<td>11 – 12</td>
</tr>
<tr>
<td>Cereals</td>
<td>4 – 5</td>
</tr>
</tbody>
</table>

Source: NSSO 66th Round 2009-10

Figure 21

**Price increase for major food segments**

(index figures, FY04-05 = 100)
than staple grains, with the exception of pulses. Price increases in these segments will slow the diet diversification trend and limit improvements in micronutrient and protein deficiency levels. The lack of government involvement in procurement and distribution of these segments means the private sector has a key role to play.

**Access**

A strong distribution system is critical to ensure adequate access to food across the country. India today has a fairly strong distribution network. This includes public distribution system for grains and cereals along with a diverse private distribution system across food segments. Organized players have deep access across urban and non-urban centers. This is complemented by an even wider network of traditional distribution channels across all categories like grains & cereals, fruits & vegetables, milk, meat & marine products. There is however a challenge in ensuring adequate quality and safety in both the public distribution system and other public systems. Schemes like mid-day meals for school children face major challenges in ensuring safety and quality, as seen recently. While this report does not consider all aspects of distribution in detail, some aspects such as safety and quality at the pre-distribution stages of the value-chain are dealt with. The role of FSSAI is also touched upon, which is relevant across the food value-chain.

**Quality and safety**

India's cereal and pulse heavy diet is fundamentally lacking in micronutrients. In addition, a large portion of food nutritive value is lost in India's long unorganized food supply chain due to spoilage and use of poor processing technology. For example, traditional pulse processing (polishing) typically involves water polishing, which adds to pulse weight, decreasing nutrition per gram. While diet diversification will occur gradually with increasing incomes, there is an imminent need to improve the quality of food consumed by the majority population. For example, fortification of flour to replace micronutrients lost in the flour milling process would go a long way toward reducing micronutrient deficiencies among lower income classes. Food fortification, which provides targeted micronutrients to address gaps in typical diets of local populations, is a highly effective way to address deficiencies. It offers greater speed of improvement than diet diversification, which requires a fundamental change in consumer habits or aggressive consumer education programs, and is likely to be more effective than direct micronutrient supplementation programs, which can provide the fastest improvements but may be relatively expensive and highly dependent on good implementation.

Availability of quality foods is also relevant for the other end of the income spectrum, which is exposed to the risks of overconsumption. With increasing global focus on obesity and related lifestyle diseases, availability of a wide variety of quality, healthy food options is essential to provide well-off consumers with better choices. For example the current trend of increasing consumption of organic foods illustrates the importance of quality choices for consumers. This segment has seen a 95 percent increase in spending in the last five years, according to a recent ASSOCHAM survey of high income households.

In addition to the basic nutrition quality of food, India faces several other quality and safety challenges, most notably
High adulteration: This is most notable in the case of milk. A study by the FSSAI in 2011 identified non-conformity to food safety standards in more than 68 percent of samples tested. Similarly around 20 percent of food samples randomly tested in a recent government study were found to be substandard or adulterated.

Abuse of substances: Given India’s large unorganized sector and value-chains with several levels of intermediaries, quality control of foods is extremely difficult. For example the recent trend has been to use calcium carbide, a carcinogenic agent, for accelerating ripening of fruits.

Poor hygiene and safety practices: The large presence of unorganized sector also limits oversight into the standards of processes followed from agricultural production to processing and distribution. For example, municipal slaughterhouses in India, are widely known to follow unhygienic floor slaughter processes. They also have limited safety processes such as ante- and post-mortem inspections by veterinarians.

While the presence of the FSSAI has been instrumental in licensing, regulation and consumer awareness, it faces significant challenges in the form of inadequate resources (software, hardware and manpower), poor infrastructure and the gap between existing products and international standards. Of around INR 5,000 crore estimated as necessary to upgrade infrastructure and manpower, around INR 2,000 crore has been allocated as part of the 12th five-year plan. This will enable FSSAI to reach targeted levels of one lab for every 20 districts in India and handle the nearly 50 million licenses currently pending with it.

A summary of the high-level imperatives across the various food categories is provided in figure 22.

Availability, affordability, quality and safety and consumer awareness are the four pillars supporting an improvement in India's nutrition future. Issues in each of these areas have been contributing to the various nutritional challenges India currently faces. Availability and affordability limitations for lower income groups have led to persistent undernourishment, a lack of awareness and issues with food quality have driven overconsumption in upper income groups and all four contribute to the high incidence of micronutrient deficiencies. The underlying structural causes of these gaps and limitations in addressing them are explored in some detail and will need to be addressed in order to secure India's nutrition future.

Figure 22

Summary of key nutrition access imperatives across food segments

<table>
<thead>
<tr>
<th>Food segment</th>
<th>Availability</th>
<th>Awareness</th>
<th>Affordability</th>
<th>Quality and safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grains and pulses</td>
<td>✓</td>
<td>✓</td>
<td>✓ (esp. pulses)</td>
<td>✓ (micronutrients)</td>
</tr>
<tr>
<td>Dairy and dairy products</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Fruits and vegetables</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Meat and poultry</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Edible oils</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Source: A.T. Kearney
Challenges for the Food Industry

There are several challenges that need to be addressed in order for the food industry to be able to achieve the availability, affordability, awareness, quality and safety goals necessary to feed India’s population of over a billion. These challenges span the food value-chain from production and farming to retailing and consumption and have differing relevance for each food segment, as illustrated in figure 23.

**Figure 23**

**Key challenges for the food industry and relevance across food segments**

<table>
<thead>
<tr>
<th>Key challenges</th>
<th>Grains and pulses</th>
<th>Dairy products</th>
<th>Fruits and vegetables</th>
<th>Meat and poultry</th>
<th>Edible oils</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Slowdown in farm production growth</td>
<td>●●●●●</td>
<td>●●●●●</td>
<td>●●●●●</td>
<td>●●●●●</td>
<td>●●●●●</td>
</tr>
<tr>
<td>2 Limited alignment/clarity in production incentives</td>
<td>●●●●●</td>
<td>●●●●●</td>
<td>●●●●●</td>
<td>●●●●●</td>
<td>●●●●●</td>
</tr>
<tr>
<td>3 Low coverage of organized procurement</td>
<td>●●●</td>
<td>●●●</td>
<td>●●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>4 Poor procurement and supply chain infrastructure</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>5 Low value-added in processing</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>6 Limited ability to control quality and safety</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>7 Limited availability of skilled resources</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

Source: A.T. Kearney analysis

1 **Slowdown in production growth:** India’s highly fragmented farming landscape with low average farm sizes is a major challenge in quantum improvements in farm-level productivity. India has among the lowest average farm sizes globally. Low farm size leads to an inability to invest in improving productivity. As illustrated in figure 24 on page 33, a 1 hectare farm has a mere INR 9,000 – 10,000 of income above the poverty line. A size of 0.6 – 0.8 hectares is the minimum break-even size of land holding for farmers. With around 67 percent of landholdings being marginal (<1 hectare), with an average size of 0.4 hectares, more than half of marginal farmers are likely to not have any excess income to spare beyond subsistence. However, the bottleneck of small landholdings can be overcome, as illustrated by other Asian countries, which have even smaller average sizes but higher yields of major crops (see figure 25). South Korea, for example, witnessed an explosion in mechanization due to training, the establishment of farm machinery service centers in rural areas, the promotion of co-operative machinery ownership and utilization, and government programs ensuring access to credit.
Figure 24
Estimate of per hectare farm income and break-even farm-size

Average per hectare farm income (in INR, average over FY08 and FY09)

<table>
<thead>
<tr>
<th>Output</th>
<th>Cost of inputs and labour</th>
<th>Average household income</th>
<th>Excess income over poverty line</th>
<th>Poverty Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>52,191</td>
<td>18,914</td>
<td>33,277</td>
<td>9,187 (18%)</td>
<td>24,090</td>
</tr>
</tbody>
</table>

Break-even farm size (in hectares)

<table>
<thead>
<tr>
<th>Break-even farm size</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.65 – 0.8</td>
</tr>
</tbody>
</table>

Sources: Economic and Political Weekly Review of Agriculture, National Account Statistics, CSO, NSSO 2005

Figure 25
Average landholding size in Asian economies and comparison of yields for major crops

Average landholding size for Asian economies (in hectares)

<table>
<thead>
<tr>
<th>Japan</th>
<th>India</th>
<th>South Korea</th>
<th>China</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.20</td>
<td>1.16</td>
<td>1.00</td>
<td>0.60</td>
</tr>
</tbody>
</table>

Average yields for major crops (in tons per hectare)

<table>
<thead>
<tr>
<th>Japan</th>
<th>India</th>
<th>South Korea</th>
<th>China</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>3.5</td>
<td>4.8</td>
<td>4.8</td>
</tr>
<tr>
<td>3.5</td>
<td>2.6</td>
<td>4.9</td>
<td>5.0</td>
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<td>2.4</td>
<td>2.4</td>
<td>1.8</td>
<td>5.7</td>
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<tr>
<td>1.7</td>
<td>1.2</td>
<td>1.1</td>
<td>3.5</td>
</tr>
<tr>
<td>1.1</td>
<td>1.1</td>
<td>1.6</td>
<td>1.8</td>
</tr>
</tbody>
</table>

Sources: FAO Production Yearbook, FAOSTAT, India Agriculture Census 2011, A.T. Kearney analysis

1. Landholding size for India as per Agriculture Census 2011, for other countries estimates are from 1995 to 2000
In addition, increasing levels of contract farming led to large-scale de-facto consolidation of land holdings (without transfer of land title) enabling greater farm investment. The challenge in India lies in the lack of success of agricultural extension services, limited implementation of better farming techniques, limited R&D spending, limited farmer access to credit and the inability to leverage scale through consolidation of demand for inputs.

Agricultural extension services in India while able to cover the larger farms, are unable to provide support to the numerous small landholdings, due to the sheer scale needed. Anecdotal evidence indicates that extension officer visits may be as infrequent as once in six months. While India does have one of the largest public agricultural research systems, the spending is lower than levels seen in other countries (see figure 26). Farmer access to credit is also a challenge, with total credit growth showing a declining trend from 2006-2007 onwards. The share of farm holdings up to 2.5 acres was only around 27 percent as of 2008 while such farm holdings cover more than 45 percent of land under cultivation.

Livestock farming is suffering from a specific gap in the area of sufficient feed and fodder supply. As shown in figure 27 on page 35, the gap varies from 35 percent to 57 percent of actual demand. This is one of the crucial gaps in improving farm-level productivity of livestock. For example, as per Planning Commission estimates, around 50 percent of the gap between potential livestock productivity and actual realized productivity is driven by deficiency in feed and fodder availability. However improving feed availability will be difficult with competing pressures on land from cash crops and food grains. Improvements in yield and better utilization of land devoted to feed stock will be needed to address this deficit.

2 Limited alignment and clarity on production incentives: While government involvement in procurement and distribution of non-perishable foods including staple food grains and oilseeds is critical for food security in India, it is also a major source of demand-supply

![Figure 26](image-url)

Public agricultural R&D spending as a percent of agricultural output across countries

Source: IFPRI-ICAR – ASTI Country Note, India 2012
mismatches in food value-chains (see Figure 27). Through the 1990s, Minimum Support Prices (MSP) increases for rice, wheat and other food grains outstripped increases for oilseeds. The high level of government procurement (estimated to be around 30 to 40 percent of total food grain production currently) drove increasingly favorable returns from food grains and resulted in diversion of land away from oilseeds. However this distortion of incentives led to a huge increase in import dependence, with edible oil imports rising from 3 percent in 1992 to around 50 percent by 2000 and 57 percent currently. The huge impact that government price setting and procurement can have on crop patterns highlights the need for an integrated strategy from agricultural production to consumer nutritional demand, in order to ensure sufficient food across income classes. Alternatively, better demand-supply matching can be attempted through the involvement of private players. For example, contract farming, would give an assured market for farmers and hence improve the influence of private sector demand signals on the farmer crop production.

Government also plays a role in other incentive signals that impact production. For example, the reduced import duty on edible oil imports negatively impacts the incentive for farmers to increase local oilseed production due to the cost-competitiveness of imports. A balanced import duty regime that seeks to protect consumers while reducing import dependence could ensure this.

### 3 Low coverage of organized procurement and limited transparency in current setup:

Access to organized procurement can be an important enabler to improving food production and food availability, by providing farmers a better guarantee of volumes and better price realization per unit sale. For example, the dairy co-operative movement was fundamental

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9 There are other factors that drove the increased import dependence, including reduction of duties on imports. However this was done to protect consumers, once it became clear that edible oil production on the country would not be able to meet demand. Import duties were as high as 88% - 99% in 2008, when imports were similarly high at around 50% to 57%
in transforming the fragmented rural milk production industry from self-consumption and local sale to consistent marketable surplus. Even in the case of dairy co-operatives, however, coverage of farmers is still low. As seen in figure 29 – only around 8 percent of milk production in India flows through the organized co-operative route.
In other segments, such as fruits and vegetables, which is regulated by a variety of APMC acts across states, the result of limited organized procurement is a long and inefficient supply chain. Presence of multiple intermediaries between farm and fork leads to high supply-chain wastages, price-buildup from non-value-adding activities and deterioration in quality (see figure 30). Farmers also tend to get lower realizations from unorganized procurement due to a lack of competition and product spoilage. For example, licensing regulations are a major

Figure 30
Price build-up and wastage in the F&V value-chain

Price build-up in value-chain for 5 major vegetables – Tomato, cabbage, brinjal, okra and beans
(In % of final consumer price)

Wastage reduction in value-chain for fresh produce
(% of wastage in supply chain)

Sources: Primary interviews, Agricultural Economics Research Review 2010, A.T. Kearney analysis
entry barrier to private players, who could increase competition and possibly improve realizations for farmers. In addition, a large share of commissioning agents also finance farmers’ production through short-term loans indebting farmers and leading to lower sale prices for farm produce. ICRIER’s study on the impact of organized retail suggests that farmers selling directly to organized retailers can see a 20 to 30 percent improvement price realization and as much as 60 percent improvement in profits relative to the regulated Mandi route.

The current wholesale market format suffers from a major challenge on the issue of transparency. With no data on volumes, prevailing prices or inventory levels, there is little information for either buyers or sellers to make informed decisions. This information gap is a major barrier to the entry of new players and hence increased competition and better price discovery. Improved transparency is crucial to more efficient markets within the current framework.

4 Poor procurement and supply chain infrastructure: Various factors contribute to the poor infrastructure levels in the food supply chain. Primarily these include the high consumer demand for fresh or live-cut produce, the large share of unorganized players in the supply chain and operating commercial viability challenges (see figure 31). As a result, regional imbalances in food production and demand become difficult to address. For example, the high share of ‘wet’ markets for poultry – estimated to be as high as 80 to 90 percent – limits the ability to shift poultry from excess to deficit regions, due to the high mortality and shrinkage associated with transportation of live birds. Limited infrastructure also increases supply chain wastage and reduces quality and nutrition levels of foods. For example, wastage in the fruits and vegetables is estimated to be 6 to 18 percent in the post-harvest portions of

<table>
<thead>
<tr>
<th>Solution themes</th>
<th>Capacity</th>
<th>Gap to demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold storage</td>
<td>24</td>
<td>38</td>
</tr>
<tr>
<td>Warehouses</td>
<td>85</td>
<td>50</td>
</tr>
</tbody>
</table>

Key challenges to improving cold chain infrastructure

- Poor commercial viability for private 3rd party logistics players
- Lack of scale for upstream private players in food value-chain such as modern retailers leading to limited commercial viability
- Constraints of conventional PPP – Viability Gap Funding model
  - Land ownership and inclusion in project costs
  - Need for upfront tariff fixation, and limits on other sources of revenue such as price arbitrage
  - Limits on viability funding up 40% of project costs
  - Limited monopoly benefits

Note: Capacity and gap estimates as estimated in 2010
Source: MOFPI-FICCI Cold Chain Consultation 2015
the value-chain. Similarly, the absence of farm-level infrastructure for measurement, testing, immediate chilling and storage results in a high level of self-consumption or sale in local markets which reduces marketable surpluses.

A good example is the current state of cold-chain infrastructure in the country. The current gap to demand is around 38 million tons, against an installed capacity of around 24 million tons. With wastage in the fruits and vegetables supply chain estimated at INR 44,000 crore, the investment requirement of INR 26,000 crore to install 38 million tons of cold chain storage, would seem plausible. Even with government incentives to invest in cold chain, however, these projects have limited progress. This is especially true for third party logistics operators for whom, market remuneration would not provide suitable returns on investment. Investment in cold storage will most likely require involvement of players already involved in the value-chain, including upstream players such as retailers, and downstream players in production and procurement. However, these players too, the fundamental absence of consumer demand due to preference for fresh produce and the higher cost of frozen food, means that alternative approaches will likely be needed to address this issue in the short-run. These could include, for example, improving government contributions to viability gap funding, allowing for private trading to improve returns and enabling lower cost of frozen foods through lower packaging costs or cold chain operating costs.

Processing and retail players could play an important role in helping address this infrastructure deficit. Being closer to consumers and with better knowledge of demand trends, they would be best placed to invest in infrastructure that might be unviable in the short term but can deliver long term benefits. In addition, processing players also have a role in driving awareness and hence end-consumer demand. Convincing consumers to pay premiums for better quality products will be crucial to improving consumer demand, a lack of which is the fundamental challenge underlying current commercial unviability of infrastructure investment. A concerted push on driving demand through awareness, while simultaneously investing in infrastructure to make products available is best done through large processing players with end-to-end visibility.

5 Low value-added in processing: There is major fragmentation of food processing capacity, with a large unorganized segment and widespread use of primitive processing. This results in lower value-added at the processing stage, especially from a nutritional point of view. Powerful ideas like fortification of flour with micronutrients that have been adopted globally10, would be difficult to implement and monitor in India, given this large unorganized presence and difficulty in ensuring adoption of improved technology. For example, the 58 percent of iron currently lost in India, during the processing of 15 to 18 million tons of wheat to flour could ensure a daily availability of around 40 to 50 milligrams of iron per capita – almost double the recommended dietary allowance of 30 milligrams (see figure 32 on page 40). The high consumer sensitivity to price means that greater value-addition, which would increase the cost of foods, is difficult. Lack of scale limits the ability to increase value-addition through cost-effective adoption of new technologies. The processing industry also has limited incentives to drive this. For example, under current regulation, a premix of ingredients for fortification would incur VAT, whereas tax breaks have helped improve cost-effectiveness in global examples.

10 Around 75 countries have regulations mandating fortification of flour through addition of iron and / or folic acid. including North and South America, UK, Australia
Over-regulation of larger processing players is also a challenge to increased processing value-addition. For example the harmonization of Indian regulations with global standards such as Codex, would enable greater flexibility for food processors – such as enabling cost reduction – thereby ensuring consumers don’t discount higher quality, safer options purely due to prohibitive costs. In addition, this limits the market making role of the processing industry by preventing the ease of translating globally successful new food products in the Indian market. Harmonized regulations could vastly increase the choices and quality of foods available to domestic consumers while potentially improving affordability by allowing processors to leverage global scale, reducing long testing lead times and additional re-testing costs.

6 Limited ability to control quality and safety: While India does have strong food safety laws and an organization tasked with ensuring food safety and quality, there are major gaps in the actual implementation. The sheer number of players, especially in the large unorganized segment, involved in the food value-chain, makes implementation of quality and safety norms difficult. In the case of the meat industry, for example, the number of unregistered premises where animals are slaughtered is more than six times the number of registered
slaughterhouses (see above figure 33). Unregistered slaughter houses aren’t regulated, have poor hygiene levels and lack in basic facilities such as drainage and waste disposal. In addition, poor pre- and post-inspection practices due to the absence of veterinary staff also impact quality. As a result, microbial contamination and contamination from dung and soil pose significant health risks to domestic consumers. An abattoir modernization program currently ongoing as part of the 11th and 12th five year plans is targeting to address some of these challenges.

The food safety challenge spans the value-chain. For example, the highly unorganized supply chain for perishables limits the ability to effectively control safety. This has led to practices such as milk adulteration and use of carbide for fruit ripening becoming more widespread. The need to offload all fresh produce to minimize losses means that poor quality food is also sold off. At the farm-level as well excessive use of pesticides and fertilizers and inadequate cleaning during the post-harvest stage result in harmful chemical residues entering the food value-chain.

7 Limited availability of skilled resources: A severe shortage of skilled manpower across the food value-chain is a major challenge. For example, a major driver of higher milk production is the targeted productivity improvement through artificial insemination breeding. The delivery system is resource intensive, requiring around 259,000 para-veterinarians and other support staff in order to drive work at labs and directly to farmers. Against this requirement, only 52,000 were available as per the 12th Planning Commission working group, a shortage of 80 percent. At the food processing stage, resource skills and knowledge are also a major challenge, with lack of awareness of food regulations resulting in high downstream rejection rates, especially with unorganized suppliers. Without substantial investment in skill development across the value-chain and including R&D and technology, this could become a critical bottleneck.

8 Low consumer awareness: Consumer awareness is a critical aspect of an improved nutritional situation in the country. Consumers currently lack awareness of several nutritional and food safety and quality aspects, most notably insistence on primarily fresh produce resulting in exposure to health risks and low quality foods. Low consumer demand also limits improvements across the value-chain for perishable goods. There is limited knowledge of fundamental micronutrient deficiencies in the Indian diet and of how consumption of certain foods can address this gap, for example fruits and vegetables, meat and poultry and fortified processed foods. Consumers’ aversion to processed foods as fundamentally unhealthy is also a challenge, limiting the industry from improving food variety or adding new healthy food segments.

Educating consumers of the need to increase consumption of better quality, safer foods and to increase targeted micronutrient intake can drive quantum improvements in the country’s nutrition situation while providing impetus for back-end improvements in the respective industries.
Imperatives for Food Security of India

The country today faces several issues across the food value chains that impact food availability, affordability, quality and safety, and consumer awareness (see figure 34). There are many government and private initiatives in place to help overcome these challenges. However, the success so far has been mixed due to scale of the industry, limited resources, and gaps in implementation. India requires a fresh look at the existing initiatives to enhance effectiveness and remove impediments in implementation.

The success of these initiatives will require private enterprises as well as government to focus on priority areas like regulatory standardization, consolidated food and food processing policy, stronger implementation of policies in select areas such as food safety and consumer awareness, and innovative models in areas of farm extension services and commercial viability of food chains.

Figure 34
Areas of focus required to address challenges

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Challenge sub-themes</th>
<th>Key initiatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slowdown in farm production growth</td>
<td>• Farming viability&lt;br&gt;• Effectiveness of farm-level programs</td>
<td>1️⃣ Enhance private participation in production&lt;br&gt;</td>
</tr>
<tr>
<td>Limited alignment of production incentives to food security goals</td>
<td>• MSP production signals&lt;br&gt;• Tax/duty impacts</td>
<td>1️⃣ Enhance private participation in production&lt;br&gt;</td>
</tr>
<tr>
<td>Limited coverage of organized procurement</td>
<td>• Regulatory limitations&lt;br&gt;• Transparency in supply chain</td>
<td>4️⃣ Enhance transparency of price, volume &amp; inventory in wholesale markets&lt;br&gt;</td>
</tr>
<tr>
<td>Poor procurement and supply chain infrastructure</td>
<td>• Regulatory limitations&lt;br&gt;• Commercial viability for players</td>
<td>5️⃣ Simplify regulatory environment&lt;br&gt;</td>
</tr>
<tr>
<td>Low value-added in processing</td>
<td>• Scale, technology, commercial viability&lt;br&gt;• Regulatory limitations&lt;br&gt;• Consumer choice</td>
<td>7️⃣ Enhance focus on high nutrition products&lt;br&gt;</td>
</tr>
<tr>
<td>Limited ability to control quality and safety</td>
<td>• Regulation implementation</td>
<td>8️⃣ Revamp food safety laws focusing on enforcement&lt;br&gt;</td>
</tr>
<tr>
<td>Limited availability of skilled resources</td>
<td>• Resource quality and availability</td>
<td>9️⃣ Focus on effective implementation of skill development programs&lt;br&gt;</td>
</tr>
<tr>
<td>Low consumer awareness</td>
<td>• Effectiveness of awareness program&lt;br&gt;• Consumer choices</td>
<td>10️⃣ Create market demand through higher awareness of quality and nutrition&lt;br&gt;</td>
</tr>
</tbody>
</table>

Source: A.T. Kearney
1. **Enhance private participation in production:**

Many food chains in India suffer due to lack of adequate scale in production which in turn creates limited ability of farmer to invest in new technology as well as ability to enhance productivity. Alternate models like contract farming, corporate farming and co-operative farming can help address these issues with availability of new technologies, production practices and greater access to finance. Models like contract farming also provide greater control on quality and price of supply for private players. These models are specifically relevant for food chains that face issues of limited farm extension services, credit support or when there is a need to introduce new crops (see figure 35). Success of contract farming requires greater enforceability of contracts which is a crucial bottleneck in this area.

Government and private players will need to work together to identify and implement contract farming at a large scale. Government will need to ensure an effective mechanism for contract enforcement and grievance redressal for all stakeholders. Protection of rights for small farmers is another area where Government needs to play an active role. Private players will need to develop relevant contract farming models for various crops and geographies. These contract farming models may include entities like banks and input providers to address specific challenges faced by the region.

**Figure 35**

**Enhancing commercial viability of production through contract farming**

<table>
<thead>
<tr>
<th>Private enterprise</th>
<th>Overview of model</th>
<th>Benefits to private players and Farmers</th>
<th>Geographical Scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mahindra Krishi Vihar</td>
<td>Supply of quality inputs, technical guidance for rice production, Purchase of produce at predetermined prices</td>
<td>Assured availability of produce at fixed prices, Assured quality</td>
<td>Chhattisgarh</td>
</tr>
<tr>
<td>Himalayan International limited</td>
<td>Supply of farm practices and inputs for herb production, Quality monitoring</td>
<td>Assured availability of produce at fixed prices, Assured quality</td>
<td>Himachal Pradesh</td>
</tr>
<tr>
<td>Tata Chemicals along with SBI</td>
<td>Supply of farm inputs and practices for grape production</td>
<td>Assured quality, Easy availability of crop loans, Farmers can also sell to local markets</td>
<td>Maharashtra</td>
</tr>
<tr>
<td>Frito-ley India</td>
<td>Supply of farm practices and inputs for potato cultivation</td>
<td>Assured availability of produce at fixed prices, Assured quality, Higher farm productivity</td>
<td>West Bengal</td>
</tr>
</tbody>
</table>

Source: Corporate Catalyst India
2. Leverage Private-Public partnerships to Enhance Effectiveness of Farm Extension Services:

Government today plays a key role in several food chains like perishables through its farm extension services to farmers. While this has resulted in benefits in many areas, there are key gaps in quality and availability of farm services. The public provision of services has been in adequate in many areas. The widely dispersed farmers can be hard to reach and their information requirement varies significantly. In addition, there are issues in performance and accountability in existing mechanisms. Recent studies\textsuperscript{11} in Uttar Pradesh show that only 18 percent of farmers had access to extension services from any source. In this context, public private partnerships can play a key role in enhancing effectiveness of these services. Several countries have explored different models for farm extension service reforms (see figure 36). A private partnership model, where these services are financed by government but delivered through private enterprises or NGOs, has been implemented in several countries (for example, see sidebar: Venezuela model of extension services).

Figure 36

\textit{Farm extension reform models across countries}

<table>
<thead>
<tr>
<th>Delivery</th>
<th>Public</th>
<th>Private</th>
</tr>
</thead>
</table>
|          | • Revision of public sector extension via downsizing  
|          | • Country Examples: Canada, Israel, USA | • Cost recovery – fee based system  
|          | • Country Examples: OECD countries, Mexico |
|          | • Partnerships- through private enterprises/ NGOs  
|          | • Country Examples: Chile, Estonia, Hungary, Venezuela, South Korea, Taiwan | • Privatization / commercialization  
|          | | • Country Examples: Netherlands, New Zealand, England and Wales |

Source: FAO

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\textbf{Venezuela model of extension services\textsuperscript{12}}

The farm extension services in Venezuela were inadequate to support agriculture modernization in mid 1990s. While several agencies provided extension services, but extension agents were not providing adequate service levels to small-scale farmers. A decentralized program was developed that was primarily funded by Government. The program focused at the municipal (district) level and relied on extension agents contracted through private firms and NGOs. Customer participation was encouraged through establishment of Civil Associations for Extension (ACES) at the municipal level. The ACEs, consisting of representatives of the municipal government and beneficiaries of extension services, coordinate the implementation of extension activities.

\textsuperscript{11} Achievements and Challenges in Farm extension services in India, Global Journal of emerging market economies

\textsuperscript{12} Worldbank
To enable these models, Government will need to assess effectiveness of current extension services and identify key regions and crops that face major issues in service delivery. In addition, it will need to develop administrative and monitoring mechanism to track performance of private players and NGOs that provide extension services. Success of this model will require private players to identify effective low cost extension models for delivery based on public financing.

3. Invest in R&D and technology to improve yields and reduce wastage / nutrient drop

The need for increased R&D and adoption of modern technologies is most critical at the production and processing stages.

• At the production stage, this is critical to counter the challenges of plateauing yield growth, increasingly scarce resources such as land and water, rapidly deteriorating quality of soil among others. Investments in R&D and technology will be essential to drive the much needed second green revolution in India. For example, extraordinary success stories such as the use of SRI (system of rice intensification) techniques in states like Bihar and Tamil Nadu should be built upon, through pilots in other states and best practice sharing. There is a need for sustained investment of all value-chain players in continually improving the factor productivity of agriculture, be it through high-yield seed varieties, better cultivation techniques or wastage reduction at harvest.

• At the processing stage, small scale and unorganized sectors, which account for a substantial portion of the food processing industry, need targeted programs to improve productivity, access to technology, credit and downstream markets. This will enable reduced wastage and nutrition losses in processing. Potential programs could include financial assistance for procurement of machinery and credit, technical advice on productivity improvement and machinery selection and trainings on adopting standardized processes. The linking of these incentives to actual wastage reduction and nutrient quality improvement, while ideal, would likely be difficult to implement without involvement of private sector organized players in value chain.

Academia, government and private players all have a major role to play in identifying, prioritizing and enabling implementation of the most cost-effective and high-impact innovations. In addition, private players and governments can also enable adoption of readily available technologies and greater mechanization through financial or procurement assistance.

4. Enhance transparency of price, volume and inventory in wholesale markets

This is most relevant for foods sold through the government regulated Mandi route – primarily fruits and vegetables. The key improvement needed is in transparency of transactions, enabling effective and efficient demand-supply matching. There are multiple aspects that need to be addressed, primarily coverage of transactions and reliability of data. Technology can be a useful aid in this scenario. For example, in Thailand’s Phitsanulok Agricultural Central Market, weighbridges are linked to computers. This enables immediate invoicing for tolls, automatic generation of sales records and ensures reliability of volume data. It is challenging in India’s context, to expect availability of real-time price data for all transactions, due to the large share of secret bidding transactions. However better knowledge of volume and inventory data can allow more accurate price estimations and reduce opportunities for collusion.
The role of government is critical. A policy framework for ensuring transparency and an effective monitoring mechanism need to be developed. Private players need to support government efforts through active flagging of transparency issues and investments in improving markets where they have long-term interests.

5. Simplify regulatory environment

The regulatory complexity of the food value chain in India needs to be addressed on priority. There should be focus on two key areas including standardizing legislation across states and ensuring alignment with globally accepted standards.

- Standardization of regulations such as APMC Acts across states should be accelerated. Lack of standardization leads to higher costs and longer timelines for companies that operate across states. Standardization of food regulations across states is thus critical to improve efficiency of the food value chain.

The Ministry of Agriculture has recommended states to amend the APMC Act on the line of a Model Act that will facilitate development of agricultural marketing infrastructure through private sector investments. This will enable alternate marketing channels for farmers for sales of their produce where prices are more remunerative for them. However, there is no stipulated time frame for implementation – only a few states have amended regulations as per the Model Act and even fewer have implemented it. Some states like Himachal Pradesh, Andhra Pradesh have already implemented contract farming and direct marketing in their Acts leading to better prospects for farmers in these states while others have done only partial implementation or not initiated the action in this regard. The implementation timelines need to be stipulated and implementation support rendered by the Ministry of Agriculture.

- Variation of India’s food safety regulations from global standards such as Codex is a major challenge both to multi-national processing companies in India and food exporters. The difference in standards leads to higher costs and longer timelines for players looking to import ingredients into India, and high rejection rates for export-focused businesses. The FSSAI is currently reviewing existing FSS standards with respect to Codex standards and standards of other countries to identify areas requiring harmonization. As per the planned timelines, the draft of standards of codes and practice is expected to complete by 2013 and adoption of such standards and notifications is expected to happen by December, 2014. It will be critical for FSSAI to adhere to these timelines to ensure that rapid implementation of harmonized standards.

The role of government is of primary importance in driving adoption and standardization of regulations in a timely manner. Private players need to support policy efforts through continued advocacy. For example, detailed understanding of economic benefits to the domestic food market can drive greater urgency in adoption of regulations.

6. Enhance Commercial Viability of Organized Supply Chains

Supply chain infrastructure is currently inadequate for many categories like Fruits and Vegetables that can lead to loss of nutrient value of food produce. Even though, there are government incentives to support new investments, there is limited business case for third party logistics players in areas like cold chain.

13 Source: Ministry of Agriculture, Academia.edu
14 Source: FSSAI
Food processing industry can play a key role in building supply chain capabilities as their presence across the value chain will help in better benefit realization of improvements in supply chain efficiency. As illustrated in the case of Thailand (see figure 37), collaboration among retail players, logistics operators and support from the government can effectively drive organization levels and efficiency of supply chains. Government will also need to play its part by developing specialized models to support investments. For example, changes to viability gap funding models, land acquisition and holding requirements and PPP operating models might be necessary to ensure greater commercial viability.

Private players also have an important role in driving consumer demand for certain types of foods to make back-end infrastructure investments viable. For example, increasing consumer awareness of the quality and safety issues of fresh fruits and vegetables or live cut meat can spur demand for frozen / chilled produce and increase the viability of cold storage infrastructure.

**Figure 37**

Enhancing commercial viability of organized supply chains – the case of Thailand

<table>
<thead>
<tr>
<th>Thailand situation</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Fragmented, unorganized fruits &amp; vegetables market – around 90% 'wet'</td>
</tr>
<tr>
<td>• Limited share of modern retail in fresh produce market - ~11% of fruits &amp; vegetables buyers and ~7% of fresh produce trading</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Program approach</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Industry</strong></td>
</tr>
<tr>
<td>• JV of Dutch retailer Ahold and Thailand's Central Retail Corp. set up 'World Fresh' DC</td>
</tr>
<tr>
<td>— Streamlining of upstream and downstream linkages driven by competitive pressure and recessionary pressures</td>
</tr>
<tr>
<td>— Adoption of farming certification standards to develop preferred suppliers</td>
</tr>
<tr>
<td>• 'Thai Fresh Project' initiated by consortium of Golden Exotics and KLM Cargo</td>
</tr>
<tr>
<td>— Distribution &amp; packing center established with scientific sorting, cold storage facilities</td>
</tr>
<tr>
<td>— Post-harvest centers established at provincial level for producer monitoring</td>
</tr>
</tbody>
</table>

| **Government** |
| • US Dept. of Agriculture and logistics player EMO Trans sharing best practices for cold chain infrastructure and professionals |
| • Agro industries included within group of industries offered special tax incentives |
| — Incentives such as tax holidays, import duty exemption on machinery etc. |

**Impact**

• Export growth exploded from stagnation over 8 years from 1990 to 1998 to ~25% CAGR nearly quadrupling in size by 2006
• Streamlining of flow of fresh produce from DCs to retail outlets
• Development of integrated cold supply chain
• Adoption of modern farming practices due to downstream quality and safety requirements

Source: Cold Chain Summit 2007
7. Enhance focus on high nutrition products

The need for food products with higher nutrition levels is being increasingly recognized as an important solution to micronutrient deficiency in the country. The grains and pulses segment is likely to be key for lower income groups, as it forms an important constituent in Indian diet along with significant government role in its distribution through public distribution system. However, challenges around unorganized nature of milling activity that may not have adequate resources for grain fortification as well as commercial unviability due to higher costs.

Success of fortification initiatives would hence require Government as well private sectors to develop innovative models that can be implemented at a large scale at low costs (see figure 38). Government will also have an important role as the policy maker as well as the monitoring agency for successful implementation. In addition, government can leverage its deep involvement in the food grain value chain to drive better nutritional outcomes. For example, distribution of fortified flour or brown rice through PDS could drive demand and provide scale to processing facilities, while not significantly impacting government subsidy burden. For higher income groups, the major role is that of the private sector, in driving consumer awareness for higher nutrition products in order to drive demand and improve viability.

India’s success in driving universal salt iodization can also be used as a model in this area. For example, the key success factors of the program were

- Legislation mandating universal iodization of salt equalizing cost impacts for refiners
- Effective central monitoring coalition with regional hubs
- Presence of dedicated government commissioner and department (Salt Department) to champion production, production monitoring, delivery, distribution and quality control
- Consumer awareness programs targeted at grassroots awareness improvement through schools and local health clinics (Anganwadi centers)

Figure 38

Wheat flour fortification programs – the case of Nepal

<table>
<thead>
<tr>
<th>Background of Nepal situation</th>
<th>Program structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>• High incidence of anemia</td>
<td></td>
</tr>
<tr>
<td>— 48% of children under the age of five are anaemic</td>
<td></td>
</tr>
<tr>
<td>— 36% of women in Nepal are anaemic</td>
<td></td>
</tr>
<tr>
<td>• Large share of wheat milled in mid to small scale industries</td>
<td></td>
</tr>
<tr>
<td>• Micronutrient Initiative partnered with Government to launch Flour Fortification program</td>
<td></td>
</tr>
<tr>
<td>• Flour fortification made mandatory across all flour mills</td>
<td></td>
</tr>
<tr>
<td>• Premix for fortification containing iron, folic acid and vitamin A provided by Micronutrient Initiative</td>
<td></td>
</tr>
<tr>
<td>• Low cost device being tested (with cost of &lt; USD 500) that can be added on to existing flour mills</td>
<td></td>
</tr>
<tr>
<td>• Low cost of implementation likely to help in nation-wide implementation of initiative</td>
<td></td>
</tr>
</tbody>
</table>

Given India’s similar situation of widespread use of small scale flour mills, India too will require a cost effective solution for wider implementation

Sources: Micronutrient Initiative and Project Healthy Children
• More recently, the launch of a state-of-the-art web-based MIS for real-time data on quality and quantity of iodized salt

8. Revamp food safety laws focusing on enforcement

The food safety challenge in India is driven by the large share of unorganized processing in areas like meat and poultry, milk; the large share of food processing undertaken outside industry (in kitchens, by local street vendors and restaurants); and government role through its programs like mid-day meal schemes at schools.

Any food safety initiative thus needs to encompass all these areas for effective implementation so that enforcement of the FSSAI act is across the food value chain. FSSAI has currently planned several initiatives like establishing one food testing laboratory in every 20 districts in India in the next 5 years, issuing licences to about 5.5 crore food business operators across India by February 2014. The focus has to be on effective implementation as well as developing innovative solutions given scale of complexity in Indian food chain (for example, see figure 39). The processing industry will need to continue focusing on improving quality and safety compliance across their suppliers, logistics providers and retailers. In addition, they will need to support effective development of safety and quality standards through inputs on quality levels and acceptable safety norms.

9. Focus on Effective Implementation of Skill Development Programs

Several government programs exist for training and skill development, across food segments. For example, the Ministry of Food Processing Industries provides assistance in creation of training infrastructure at recognized universities, setting up of food processing training centers

Figure 39
Enhancing quality and safety in the wet poultry market – the case of Vietnam

<table>
<thead>
<tr>
<th>Vietnam situation</th>
<th>Program approach</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumption pattern similar to India- 80 percent of chicken purchased in Wet market</td>
<td>Certification program introduced, offering select farmers a chance to market their birds with an assurance of quality and reduced disease risk</td>
<td>Customers were willing to pay average of USD 0.63 higher for safer birds that ensured profits for the farmer</td>
</tr>
<tr>
<td>Limited preference for processed chicken as ‘wet market birds’ considered safer and better</td>
<td>Quality standards monitored by veterinary officials</td>
<td></td>
</tr>
<tr>
<td>Significant risk of Avian Influenza led to a pilot project to enhance safety of wet market</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Department of International Development, UK

FSSAI
and in incentivizing entrepreneurship through local training. Around INR 43 crore has been committed in five years from FY08 to FY12. The key focus however needs to be on effective implementation and monitoring of these programs. This would include ensuring quality of training imparted, reach of programs and relevance to the local economy. Output metrics such as gaps in requirement areas (such as artificial insemination for diary) should also be tracked to ensure visibility of future focus areas. In addition to academic institutions, partnerships with private players in the food value chain could also be useful in improving demand estimation, implementation tracking and quality of training.

10. Create market demand through higher awareness of quality and safety

The consumer awareness is of fundamental importance, both due to current food quality and safety challenges, as well as the need to shift to more nutritious and better quality foods.

While there have been multiple government initiatives aimed at improving consumer awareness in these areas, the results have been limited so far. A private-public partnership model can be more effective to improve awareness where government ties-up with relevant stakeholders in each food chain to disseminate information on food safety and nutrition (see figure 40). Private enterprises have deep involvement in most food chains except grains and cereal and thus have higher ability to influence consumption behavior. Government can also look to expand its awareness campaigns, for example, through greater presence in mass media.

Private players also have a major role for higher-end food products. There is a need to offer wider variety of better quality food options to customers while also improving their awareness of benefits. While private players do operate under regulatory constraints in developing new, high quality products, the critical aspect is to generate demand that may require joint efforts by food processing industry and other stakeholders that can influence consumer behavior.

Figure 40
Private public partnership models for consumer awareness

<table>
<thead>
<tr>
<th>India situation</th>
<th>Impact of private-public partnership</th>
</tr>
</thead>
<tbody>
<tr>
<td>• In 1980s, Nutrition Foundation of India (1983) identified iodine deficiency as major problem with only 15 percent or less of the known endemic areas were covered by salt iodization</td>
<td>• In 1995, HLL initiated large scale advertising campaign for its iodized salt</td>
</tr>
<tr>
<td>• The government made interventions and launched iodized salt program in 1985-86 but had limited success initially</td>
<td>• HLL aired a puppet show about IDD on Doordharshan, an Indian government-run television network, sharing costs equally with the network that had high success</td>
</tr>
<tr>
<td></td>
<td>• The penetration of iodized salt increased from 15% to around 70% in 2000</td>
</tr>
</tbody>
</table>

Sources: UNICEF, Nutrition foundation of India, Dept. of corporate Strategy and International Business, Michigan Business School
Significant efforts will be required to build a value proposition based on functional or emotional requirement. For example, protein supplements, which was a new category for Indian population is increasingly being adopted in urban youth through intensive marketing efforts that includes manufacturers as well as fitness centers.

11. Need for Consolidated Policy for Food and Food Processing Sector

The entire food value chain in India is controlled by multiple ministries, departments and laws. A comprehensive policy will ensure that various initiatives across the departments are aligned to the overall goal of ensuring availability, awareness, affordability, access, quality and safety of food. It will provide action agendas for all stakeholders in food value chain from government, producers, supply chain, food processing companies and distribution to focus on prioritized areas. The integrated national plan adopted by Bangladesh (see figure 41) is a good example of this. In India’s case there are multiple possible benefits, including for example:

- The net impact of various government subsidies – from fertilizers and seeds at input stage to low cost food supply at distribution stage –, direct public spending on research and development, and tax revenue on foods can be better balanced through an integrated view. For example, observing lower marginal growth from input productivity growth can drive re-orientation of subsidies (for example fertilizer subsidy) to improve factor productivity through investments in R&D or high-yield cultivation techniques. Alternatively government can also re-direct subsidy to improving nutrition per gram of food rather than total available quantity of foods through investments in the processing sector. Such a cross-value-chain view would only be feasible under the aegis of a consolidated food and food processing policy.

- Government has a key role to play in the non-perishable segment to ensure sustainability of farmers as well as affordability of food, issues with incentive structures create demand-supply mismatch in some food categories, resulting risk of excess for certain food outputs and inadequate production in other areas. A comprehensive national level plan will help in improving these demand-supply imbalances.

Figure 41

Highlights of Bangladesh national food policy

<table>
<thead>
<tr>
<th>Country requirements</th>
<th>Plan of action</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Strategic guidance to address challenges to food security of the country</td>
<td>• 26 strategic areas of intervention along with priority actions to be undertaken in the short term, medium term and long term in areas like:</td>
</tr>
<tr>
<td>• Food security includes food supply and availability, physical, social and economic access to food, as well as nutrition/utilization of food</td>
<td>— Agricultural research and extension</td>
</tr>
<tr>
<td></td>
<td>— Infrastructure</td>
</tr>
<tr>
<td></td>
<td>— Marketing and trade</td>
</tr>
<tr>
<td></td>
<td>— Agro processing</td>
</tr>
<tr>
<td></td>
<td>— Skill development</td>
</tr>
</tbody>
</table>

Source: Ministry of Food and Disaster Management, Bangladesh
Way forward

The target of ensuring food security for more than a billion people requires a concerted effort by all stakeholders including government and the food processing industry. While there are several initiatives required in the sector, there are four broad themes that can form the basis of action agenda (see Figure 42 on page 53 for details):

- Leverage greater private-public partnerships in areas of production, extension services, supply chain and high nutrition foods
- Simplify regulatory and policies and ensure stronger implementation in areas of integrated planning, implementation and standardization
- Ensure greater transparency in price, volumes and inventory of food produce
- Drive innovation and skill development to drive growth over next decade

In addition to private players and government, industry bodies and academia will also have a crucial role in success of these initiatives. Industry bodies will need to participate in driving consultations for policy making and ensuring greater interaction of government and private players to develop private-public partnerships. Universities and other research institutions need to be an integral part of initiatives focused on innovation and capability building.
## Figure 42

### Expected impact of initiatives on the market for foods

<table>
<thead>
<tr>
<th>Initiatives</th>
<th>Role of Private Players</th>
<th>Role of Government</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Enhance private participation in production</strong></td>
<td>• Develop suitable commercial models for different crops, e.g. build partnerships with banks, inputs providers to agriculture for areas where these are major gaps</td>
<td>• Develop and support mechanisms to protect interest of all parties (e.g. ensuring effective contract enforcement and grievance redressal mechanism)</td>
</tr>
<tr>
<td><strong>Leverage private-public partnerships to enhance effectiveness of farm extension services</strong></td>
<td>• Identify effective extension models for delivery (focus on low cost options) • Provide extension services based on public funding</td>
<td>• Evaluate effectiveness of current extension services and identify key regions / crops that face major challenges • Develop administrative and monitoring mechanisms • Provide funding to private sector players / NGOs for service delivery leveraging rationalized government extension program</td>
</tr>
<tr>
<td><strong>Enhance commercial viability of organized supply chains</strong></td>
<td>• Invest in infrastructure with a long-term benefits horizon (esp. downstream players incl. food processors and retailers) • Create consumer demand for food products through quality &amp; safety awareness</td>
<td>• Develop alternate / specialized models to enable investment – for example through changes to viability gap funding model, land holding requirements, upfront tariff fixation etc. • Provide higher fiscal incentives to food processing industry for supply chain investments</td>
</tr>
<tr>
<td><strong>Enhance focus on high nutrition products</strong></td>
<td>• Create wider choices of high nutrition products for consumers • Drive demand through higher consumer awareness and invest in low cost models</td>
<td>• Develop suitable policies (for e.g. mandatory fortification) and monitoring mechanisms for implementation • Support viability improvement benefits e.g. tax holiday on fortification premix and fortification machinery etc. • Provide fortification through PDS system</td>
</tr>
<tr>
<td><strong>Develop consolidated policy for food and food processing</strong></td>
<td>• Support policy development through best practice sharing and benefits quantification</td>
<td>• Develop comprehensive policy mapping nutrition requirements of population to agricultural production implications • Align multiple ministries, departments and regulations to overall policy for effective implementation • Enhance viability of entire food chains by balancing direct farm subsidies, R&amp;D investments and subsidies for agri-infrastructure creation</td>
</tr>
<tr>
<td><strong>Simplify regulatory environment</strong></td>
<td>• Drive advocacy on timely implementation – for example quantifying potential losses due to lack of regulatory support</td>
<td>• Stipulate timelines for APMC act standardization; ensure some degree of uniformity across states • Support greater ease of certification for new products through codex harmonization • Ensure adherence to timelines on Codex harmonization</td>
</tr>
<tr>
<td><strong>Revamp food safety laws focusing on enforcement</strong></td>
<td>• Support safety / quality improvement programs (e.g. certification) by providing inputs on quality levels and acceptable safety norms • Continue to drive compliance from upstream value-chain linkages</td>
<td>• Improve implementation-focus of food safety laws – encompass all areas of food chain under safety laws</td>
</tr>
<tr>
<td><strong>Enhance transparency of price, volume and inventory in wholesale markets</strong></td>
<td>• Actively report markets with poor transparency • Support infrastructure / technology investments to improve information availability</td>
<td>• Develop effective monitoring mechanism for data availability and accuracy • Develop regulatory framework to improve transparency</td>
</tr>
<tr>
<td><strong>Invest in R&amp;D to improve yields and reduce wastage / nutrient drop</strong></td>
<td>• Invest in R&amp;D and technology to improve yields, increase nutrition and reduce wastage • Provide technical and financial assistance to upstream farmers</td>
<td>• Invest in agriculture research and agro-processing research to increase yields and lower wastage/ nutrient drop • Develop a local-level program to support unorganized, MSME processing industries; program should provide assistance and oversight on implementation and actual food quality / wastage improvement</td>
</tr>
<tr>
<td><strong>Focus on effective implementation of skill development programs</strong></td>
<td>• Provide knowledge transfer for government programs for skill development</td>
<td>• Drive implementation-focus of current programs; track output metrics of effectiveness</td>
</tr>
<tr>
<td><strong>Create market demand through higher awareness of quality and nutrition</strong></td>
<td>• Drive consumer awareness on better quality diet and issues of food safety through targeted marketing campaigns</td>
<td>• Drive consumer awareness on food quality &amp; safety, nutrition through mass communication • Leverage involvement of private players for awareness campaigns targeted at overall nutrition improvement – identify target areas and modalities of awareness campaigns</td>
</tr>
</tbody>
</table>

- **Greater Public Private Partnerships**
- **Policy and regulatory support**
- **Higher transparency**
- **Innovation and skill development**
Effective implementation of these initiatives is required to ensure that the key targets of availability, affordability, quality and safety, awareness are met in line with the overall goal of achieving adequate food and nutrition for the entire population of India (see Figure 43).

This paper aims to identify focus areas for government and food processing industry. The applicability of various models and initiatives discussed in this paper will need to be assessed across various food chains in India. Similarly, detailed business case assessment is required to evaluate the economic feasibility of setting-up cold chain infrastructure by food processing industry in India. Further study across these areas will need to be driven by government in consultation with industry stakeholders.

Figure 43

**Expected impact of initiatives on the market for foods**

<table>
<thead>
<tr>
<th>Key initiatives</th>
<th>Availability</th>
<th>Affordability</th>
<th>Quality and safety</th>
<th>Awareness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enhance private participation in production</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leverage private-public partnerships to enhance effectiveness of farm extension services</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enhance commercial viability of organized supply chains</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Enhance focus on high nutrition products</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Develop consolidated policy for food and food processing</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Simplify regulatory environment</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Revamp food safety laws focusing on enforcement</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enhance transparency of price, volume and inventory in wholesale markets</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Invest in R&amp;D to improve yields and reduce wastage/nutrient drop</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Focus on effective implementation of skill development programs</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Create market demand through higher awareness of quality and nutrition</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

[Box showing: Greater Public Private Partnerships, Policy and regulatory support, Higher transparency, Innovation and skill development]
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