



INDUSTRY REPORT ON MAIZE BASED SPECIALITY PRODUCTS AND INGREDIENT SOLUTIONS

A Frost & Sullivan Report

December 30 2023

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Disclaimer

The market research process for this study has been undertaken through secondary / desktop research as well as primary research, which involves discussing the status of the market with leading participants and experts. The research methodology used is the Expert Opinion Methodology. Quantitative market information was sourced from interviews by way of primary research as well as from trusted portals, and therefore, the information is subject to fluctuations due to possible changes in the business and market climate. Frost & Sullivan's estimates and assumptions are based on varying levels of quantitative and qualitative analyses, including industry journals, company reports and information in the public domain.

Forecasts, estimates, predictions, and other forward-looking statements contained in this report are inherently uncertain because of changes in the factors underlying their assumptions, or events or combinations of events that cannot be reasonably foreseen. Actual results and future events could differ materially from such forecasts, estimates, predictions, or such statements.

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Frost & Sullivan has prepared this study in an independent and objective manner, and it has taken adequate care to ensure its accuracy and completeness. We believe that this study presents a true and fair view of the Global and Indian Maize based Speciality Products and Ingredient Solutions Industry within the limitations of, among others, secondary statistics, and primary research, and it does not purport to be exhaustive. Our research has been conducted with an "overall industry" perspective, and it will not necessarily reflect the performance of individual companies in the industry. Frost & Sullivan shall not be liable for any loss suffered because of reliance on the information contained in this study. This study should also not be considered as a recommendation to buy or not to buy the shares of any company or companies as mentioned in it or otherwise."

Abbreviations

APAC: Asia Pacific

Bn: Billion

CAGR: Compound Annual Growth Rate

EMEA: Europe Middle East & Africa

EU: European Union

Gol: Government of India

HDPE : High-density polyethylene

INR: Indian Rupees

MEA: Middle East and Africa

Mn: Million

NA: North America

PP: Polypropylene

USD: United States Dollar

MT: Metric Ton

MTD: Metric Ton per Day

KT: Kilo Ton

FICCI: Federation of Indian Chambers of Commerce & Industry

IS: Indian Standard

TPA: Tons per annum

TPD: Tons per day

1. Macroeconomic Overview

1.1. Real GDP Growth and Forecasts: Global and Key Regions

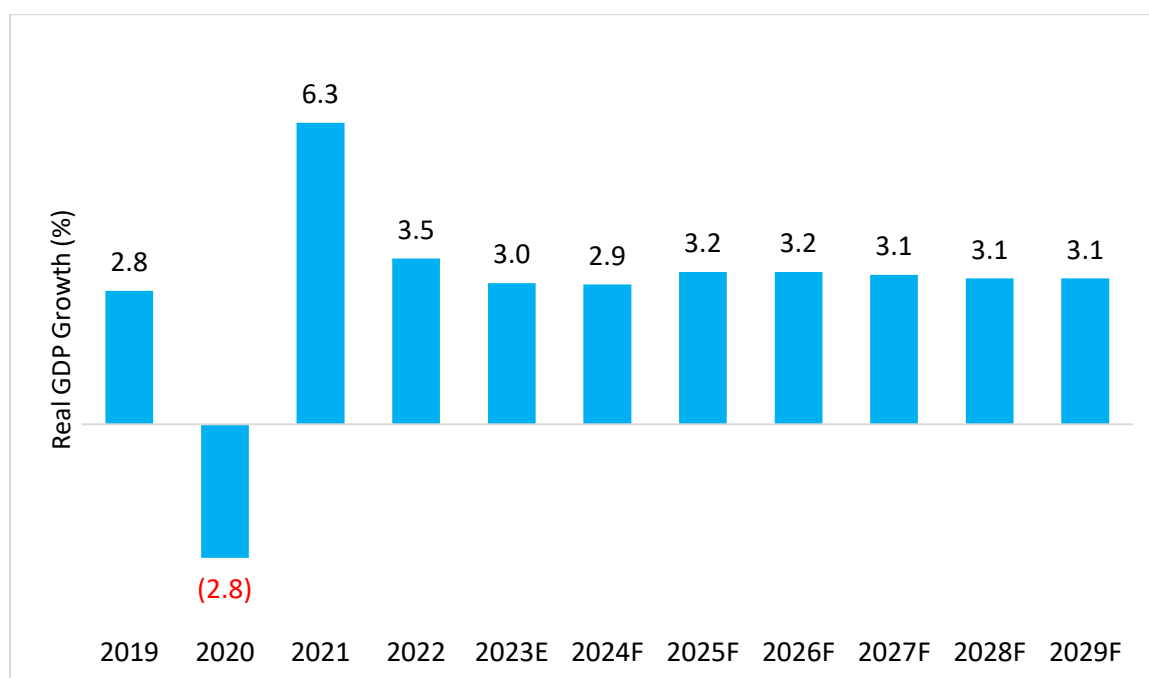
Following a significant uptick in global economic growth momentum in 2021, the world economy slowed to 3.5% in 2022, as the Russo-Ukrainian war severely hampered critical food and energy supply chains, pushing up prices to unprecedented levels across countries. These elevated and volatile commodity and energy prices led to a cost-of-living crisis around the globe, exacerbating food insecurity and further aggravating domestic inflation levels.

In 2023, the global economy is expected to grow by a modest 3.0%, as high interest and inflation rates continue to weigh on economic activity. Moreover, growth remains uneven with Europe facing a marked slowdown due to dampened consumer demand and falling real wages. Germany, Europe's largest economy, is likely to record a substantial decline in 2023, as a subdued export market, a weakening domestic industrial sector, and labour market upheaval weigh on growth. The US, on the other hand, has defied expectations of a recession, as a resilient labour market, and high household spending spurred an improvement in consumer sentiment.

China's economy is likely to continue to gain traction in 2023, as the country aims to revive its economy through the issuance of a fiscal stimulus package that will foster retail and industrial growth, lower unemployment, increase private sector confidence, and strengthen the yuan. However, a deepening property crisis and tensions with the US might cause some pullback.

In 2024, advanced nations are likely to see a soft landing as tight monetary policies and elevated prices continue to weigh on business and consumer spending and investment inflows. However, emerging markets such as India, China, Saudi Arabia, Vietnam, Thailand will remain resilient amidst strong domestic demand, wage growth, and a competitive private sector. For the period between 2024 and 2029, the global economy is expected to grow at an average rate of 3.1%.

Exhibit 1: Real GDP Growth, Global, 2019-2029F (%)



Note: E-Estimates and F-Forecasts. Negative numbers are in parentheses.

Source: International Monetary Fund (IMF); Frost & Sullivan

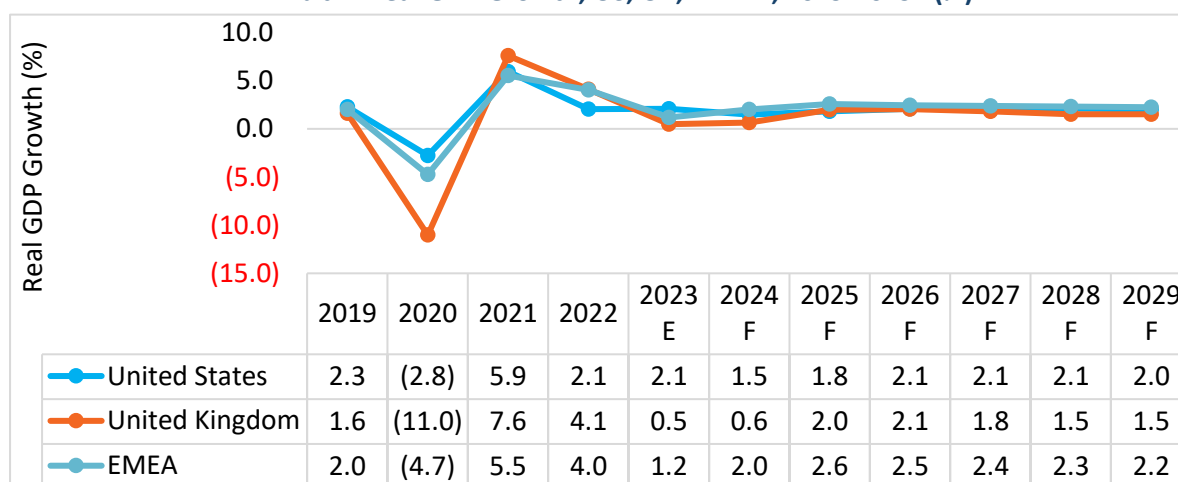
In 2023, the US is expected to grow by 2.1%, primarily supported by accelerating consumer spending. The country’s labour market has also continued to outperform, with wage growth and job creation remaining strong. However, rising mortgage rates, high property prices, and tight supply are contributing towards a housing market crisis within the US. This could weigh on economic growth over the long-term.

Lower-than-expected growth within regional heavyweights such as the UK, and Germany will weigh on the Eurozone’s 2023 economic growth potential. Constrained manufacturing activity, subdued business confidence, interest rate hikes, and geopolitical concerns are impacting growth.

Saudi Arabia and the United Arab Emirates in the Middle East will see steady long-term growth momentum as oil revenues get actively re-invested into local non-oil economies. As these nations prioritise economic diversification away from fossil fuels, growth of their manufacturing and tertiary sectors will position them as key drivers of global growth over the coming decade.

While African economies have remained resilient despite multiple external shocks such as a global monetary policy tightening and supply disruptions, the region’s short-term growth outlook is subject to downside risks. Extreme and frequent climate events, growing debt servicing costs, and regional geopolitical instability will weigh on growth. However, over the long-term, export diversification to include the region’s abundant natural resources, availability of a huge young population, adoption of climate mitigation policies, and developing a sustainable fiscal policy will encourage economic growth.

Exhibit 2: Real GDP Growth, US, UK, EMEA¹, 2019-2029F (%)



Note: E-Estimates and F-Forecasts. Negative numbers are in parentheses.

Source: IMF; Frost & Sullivan

¹EMEA (European Union, Middle East and Central Asia, and Sub-Saharan Africa): The following countries were considered for the regional calculation:

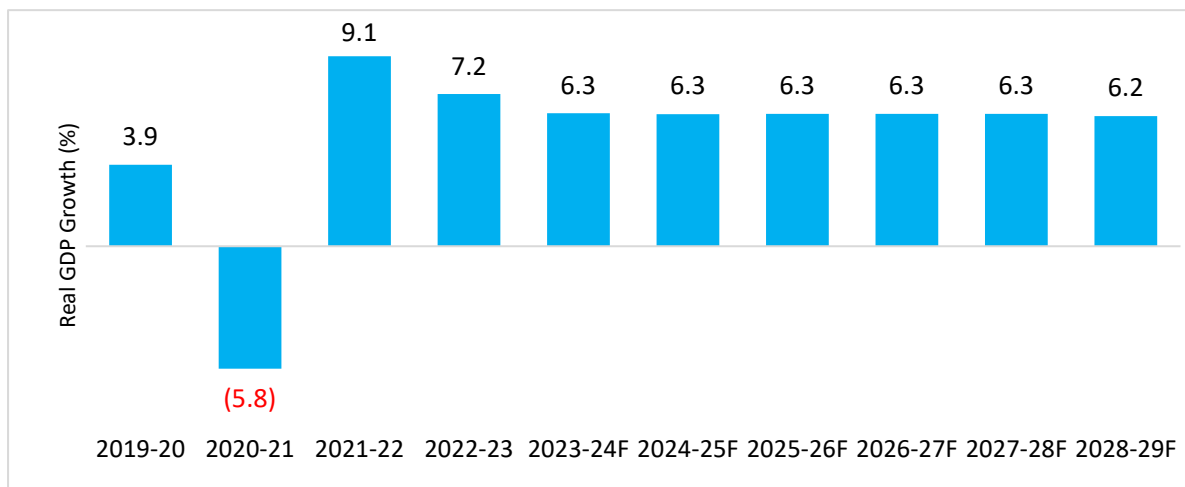
European Union: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, The Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden

Middle East and Central Asia: Afghanistan, Algeria, Armenia, Azerbaijan, Bahrain, Djibouti, Egypt, Georgia, Iran, Iraq, Jordan, Kazakhstan, Kuwait, Kyrgyz Republic, Lebanon, Libya, Mauritania, Morocco, Oman, Pakistan, Qatar, Saudi Arabia, Somalia, Sudan, Syria, Tajikistan, Tunisia, Turkmenistan, United Arab Emirates, Uzbekistan, West Bank and Gaza, Yemen

Sub-Saharan Africa: Angola, Benin, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad, Comoros, Democratic Republic of the Congo, Republic of Congo, Côte d’Ivoire, Equatorial Guinea, Eritrea, Eswatini, Ethiopia, Gabon, The Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, São Tomé and Príncipe, Senegal, Seychelles, Sierra Leone, South Africa, South Sudan, Tanzania, Togo, Uganda, Zambia, Zimbabwe

1.2. Real GDP Growth and Forecasts: India

Exhibit 3: Real GDP Growth, India, FY2019-20 – FY2028-29F (%)



Note: E-Estimates and F-Forecasts. Negative numbers are in parentheses.

Source: IMF; Frost & Sullivan

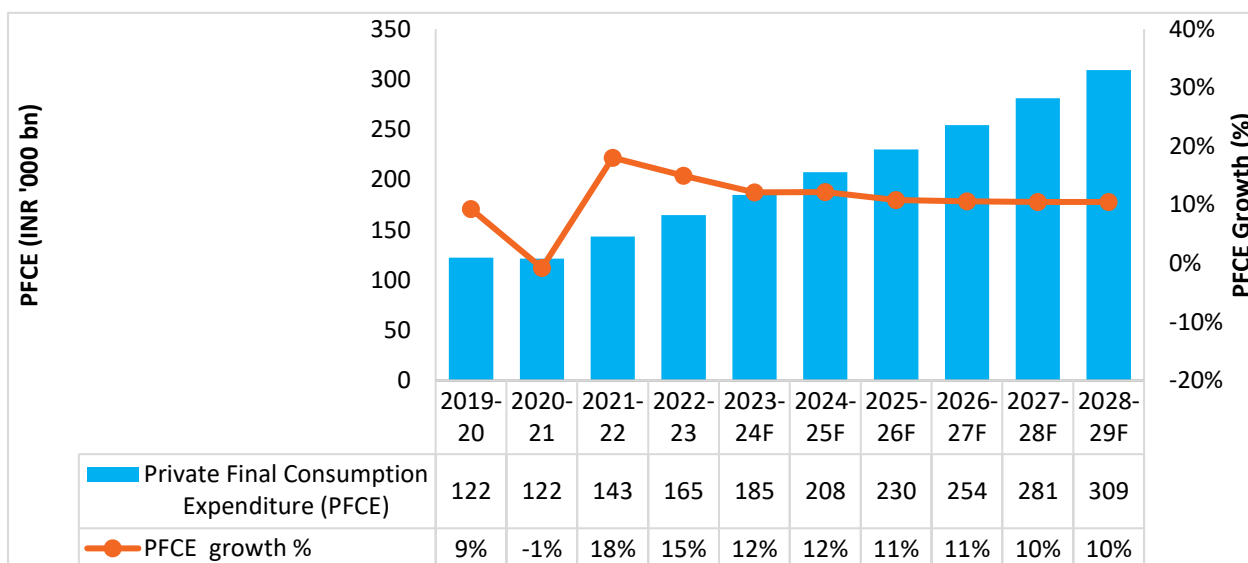
On the contrary, despite a challenging global environment, India will be a bright spot with GDP growth estimated to touch 6.3% in 2023. Expanding government spending across key growth industries such as infrastructure, logistics, manufacturing, energy, transportation, and construction is leading to employment generation, increasing the influx of vital foreign investments, and improving the competitiveness of the country's private sector. Growing focus on micro-level healthcare, education, digitalization, and finance access is leading to socio-economic development of the Indian populace.

During the 2023-2029 period, the Indian economy is expected to grow at an average rate of 6.3%, supported by a demographic dividend, increasing urban household income levels, technological advancements, and climate change mitigation policies. With the country's strong growth outlook, India is poised to overtake Germany and Japan to become the 3rd largest economy globally before 2030.

1.2.1. Private Final Consumption Expenditure (PFCE) Growth in India

PFCE has remained an important factor in insulating the Indian economy traditionally, contributing to over 60.0% of the country's GDP. PFCE picked up steam after a brief plunge in 2020 due to the pandemic. In Q1 2022-23, PFCE witnessed growth of 31.8% compared to the same quarter previous year. This points to relatively strong demand recovery following the onset of the pandemic and the Delta-variant wave. After the first quarter of 2022, PFCE growth has gradually stabilized, with growth rates continuing to moderate. However, the overall positivity was impacted by the Russo-Ukrainian war, causing inflation spiral and monetary policy tightening, particularly in Q4 2022-23. In Q1 2023-24, PFCE rose by a strong 9.1% indicative of domestic demand rebound. A pattern has been emerging in India's demand recovery thus far, by which demand growth for mid-premium products has been stronger, while that for budget and entry-level products has been weaker.

Exhibit 4: Private Final Consumption (INR 000’Bn) and Growth (%), India, FY2019-20 to FY2028-29F



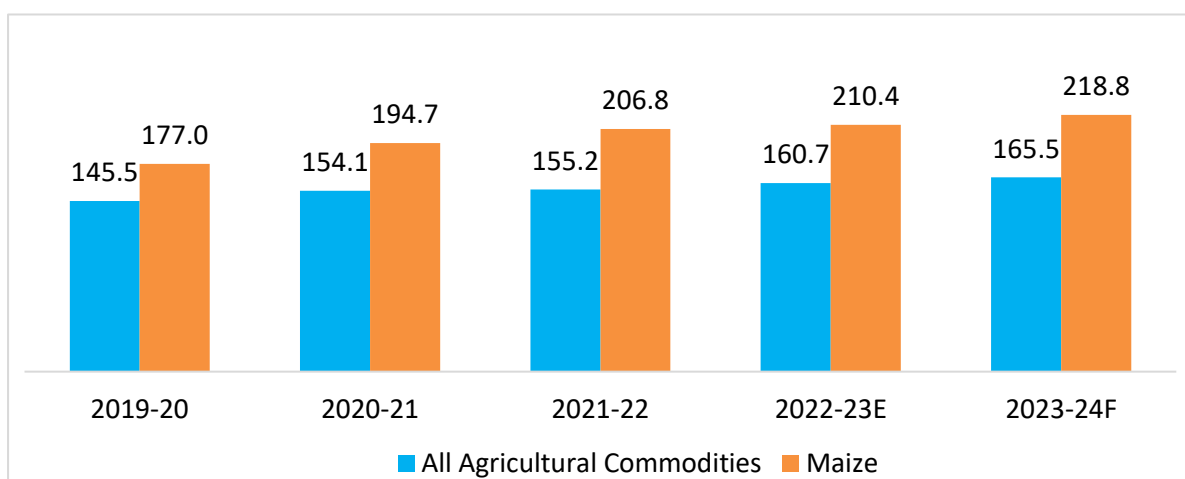
Source: MOSPI, Frost & Sullivan

1.3. Overview of Agriculture Statistics and Performance

FY2022 total agricultural production increased by a marginal 0.7% compared to the previous year. The extreme weather events in 2022, such as higher than normal temperatures in March impacting wheat production and rainfall shortages in Uttar Pradesh, Bihar, Jharkhand, and West Bengal affecting paddy production, have led to lower-than-expected agricultural production.

Meanwhile, maize production increased by 6.2% during FY2022, amid better seed availability, expansion of storage and marketing networks, increasing public-private partnerships, and growing agricultural subsidies.

Exhibit 5: Index Numbers of Agricultural Production, India, FY2020 - FY2024F



Note: Figures for 2022-23 are estimates, while figures for 2023-24 are forecasts; Base: Triennium ending 2007-08= 100. The index number of production for a specific year for an individual crop is the percentage of current year production of the crop with respect to the base year production of the crop.

Source: Economic Survey 2022-23; Ministry of Finance - India; Frost & Sullivan

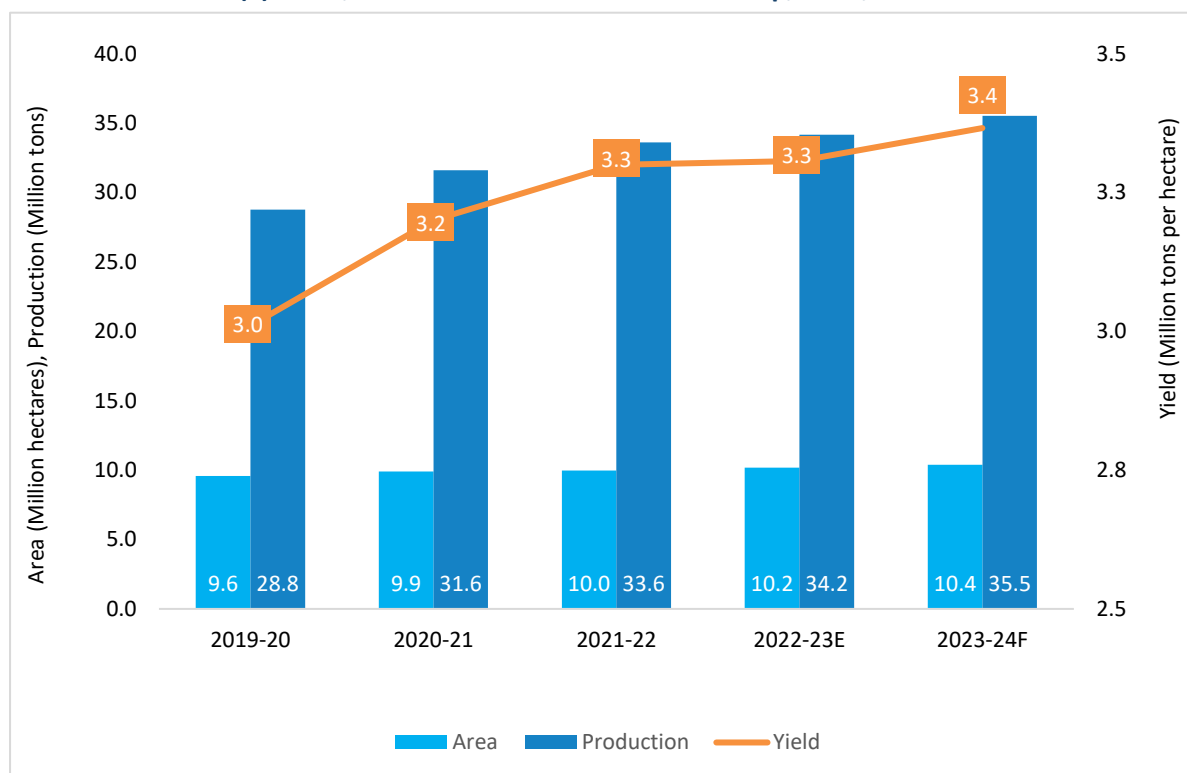
The index number for maize production crossed 200 in FY2022 recording a consistent rise since FY2020.

Maize is an important crop in India responsible for the employment of over 650 million farmers. As of Local Marketing Year 2022/23, India is the fifth¹ largest maize producer globally. The increased maize production in India during the year can mainly be attributed to the delayed arrival of monsoon and its slow progress, which led to a larger section of farmers preferring to plant Maize over other crops such as pulses and cotton. Meanwhile, India needs to increase its maize production by 10 million tonnes over the next five years to meet domestic demand. To achieve this, India needs to encourage greater investments within the maize supply chain in a systematic manner.

Climatic conditions such as El Nino are likely to impact India’s kharif season agricultural production. A delayed as well as uneven monsoon has considerably impacted the country’s rice production, despite higher than usual acreage. Production of moong, urad, soybean, and sugarcane is also expected to be impacted due to the erratic monsoon season.

This drop in kharif production could cause some setback to the Indian government’s effort to minimize food inflation and could also increase the country’s agricultural import share.

Exhibit 6 (a): Area, Production and Yield of Maize Crop, India, FY2020 – FY2024F

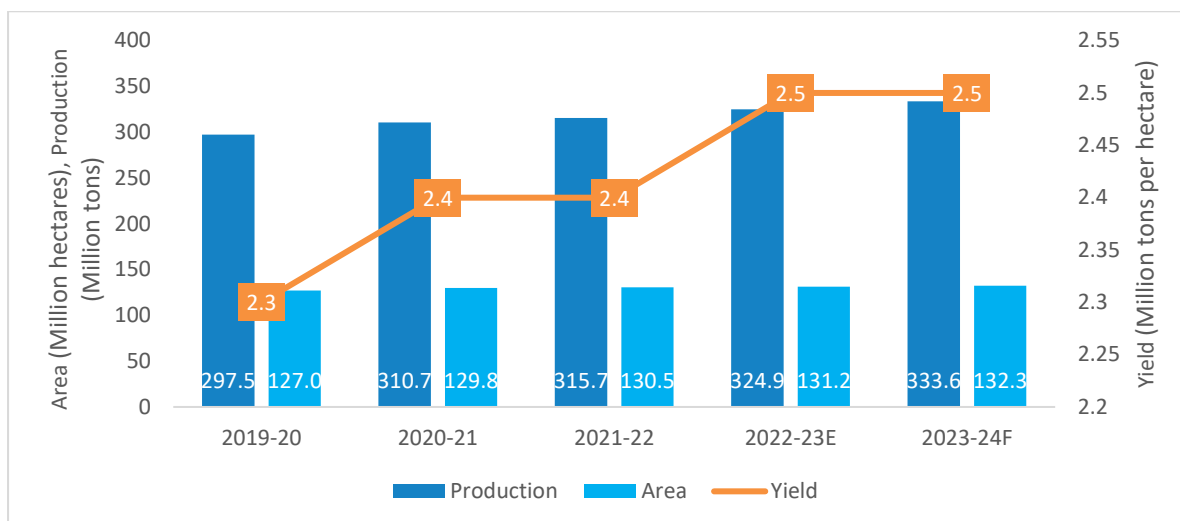


Note: Figures for 2022-23 are estimates, while figures for 2023-24 are forecasts.

Source: Ministry of Agriculture and Farmers Welfare - India; Economic Survey 2022-23; Frost & Sullivan

¹ According to Grain: World Markets and Trade October 2023, United States Department of Agriculture

Exhibit 6 (b): Area, Production and Yield of All Agricultural Commodities, India, FY2020 – FY2024F

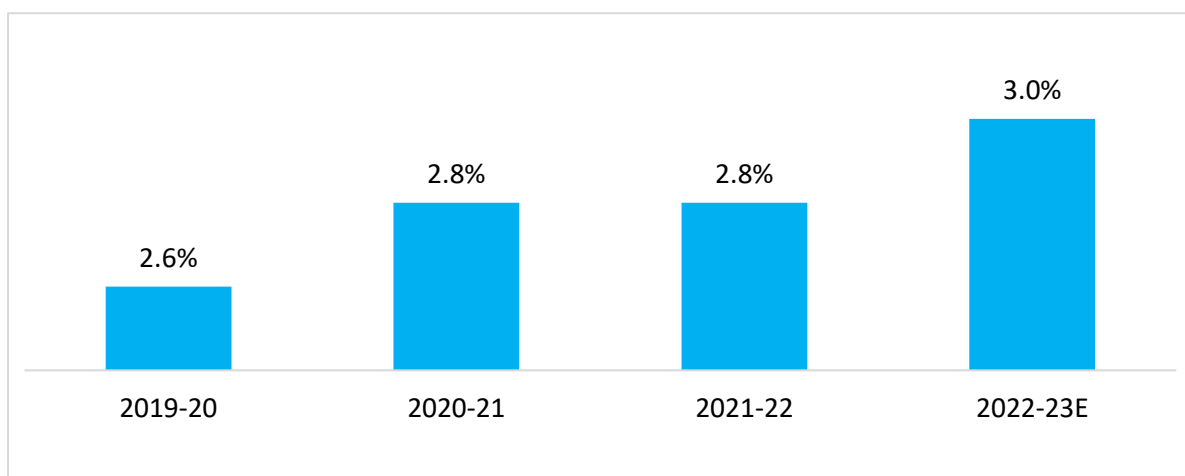


Note: Figures for 2022-23 are estimates, while figures for 2023-24 are forecasts.

Source: Ministry of Agriculture and Farmers Welfare - India; Economic Survey 2022-23; Frost & Sullivan

India's contribution to global maize production registered a moderate increase from 2.6% in FY2020 to 3.0% in FY2023 and is forecast to marginally decline to 2.9% in FY2024 (Exhibit 6). India has the potential to increase its maize production from the current levels of ~34 million tonnes to 50 million tonnes by raising yield to 5 tonnes/ha over the next five years. Appropriate policy measures and steps to strengthen post-harvest infrastructure, improve storage facilities, implement price stabilization mechanisms, and development of an integrated value chain plan will bolster overall productivity and farmers' income.

Exhibit 7: Production Contribution in Global Maize Production, India, FY2020 – FY2023E (%)



Note: Figures for 2022-23 are estimates and 2023-24 are forecasts

Source: Economic Survey 2022-23; United States Department of Agriculture; Frost & Sullivan

2. Raw Material Overview for Maize Starch in India

2.1. Overview of Maize Production in India

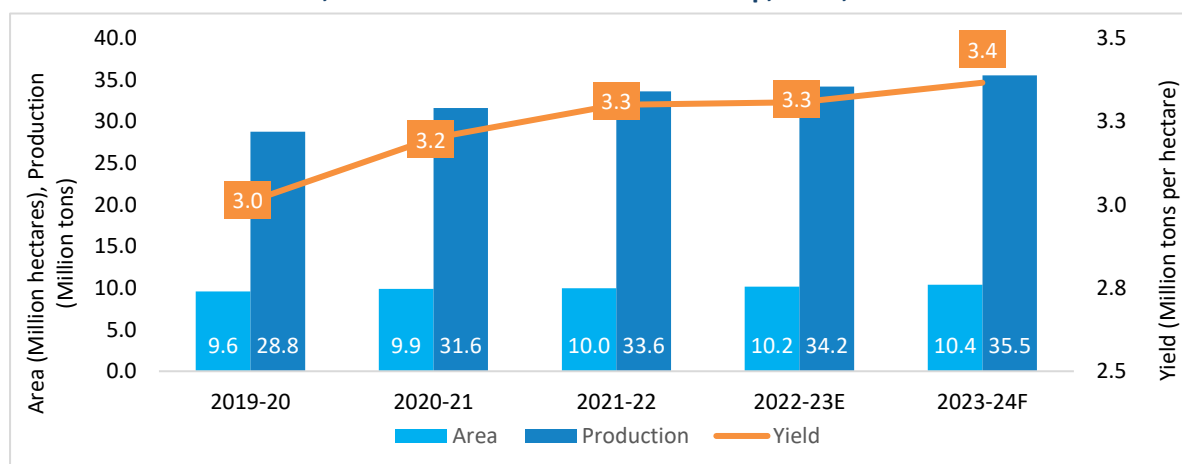
Maize is one of the major cereal crops grown in India. Maize is a crop with versatile applications in end use industries and with a high nutrition content. Maize crop has an important place in the food grain basket of our country and is the third most important versatile food grain crop due to its importance in food, feed, specialty maize, starch etc.

There is an increased demand for maize in India which is also evident from an upward trend over the last two decades on area and productivity gains from new improved hybrid seeds. Domestic demand from livestock feed manufacturers and the maize starch industry is driving the demand along with the prevalent competitive prices.

Production has increased at CAGR 6.2% from 2018 to 2022. India ranks 4th in terms of global maize acreage and 6th in production. Rising domestic demand for industrial usage and poultry feed may outstrip the domestic maize production in the near future.

In addition to its prominence among food grains, maize is crucial to India's agribusiness value chain's overall development. It is crucial to comprehend the current economics of supply and demand for maize in India. The sowing and harvesting seasons have a significant impact on the supply and demand of maize. Maize is supplied from March to May and September to December. Demand spikes normally from January to March.

Exhibit 8: Area, Production and Yield of Maize Crop, India, FY2020 – FY2024F



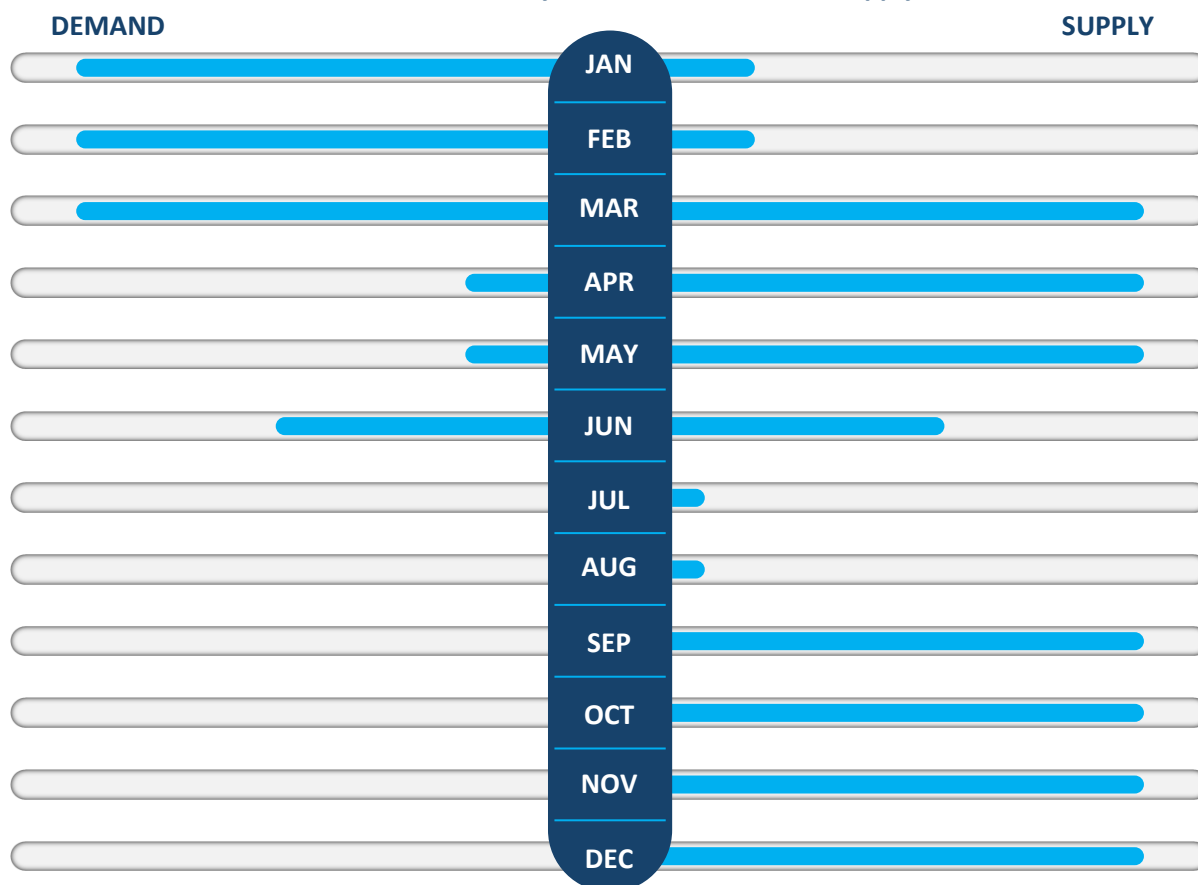
Note: Figures for 2022-23 are estimates, while figures for 2023-24 are forecasts.

Source: Ministry of Agriculture and Farmers Welfare - India; Economic Survey 2022-23; Frost & Sullivan

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Exhibit 9: Seasonality of Mazie Demand and Supply



Source: Analysis based on GAIN Report “India Grain and Feed Annual “

Feed mills and Poultry farms often hold stock for 30 to 60 days, depending on their mill capacities, financial stability, and receivables cycle. Maize starch millers stock Maize for 3- 5 months. Purchase of maize usually happens during peak arrival season at low prices for stocking purpose. The inventory is maintained to tide over the peak price months, and buying for regular requirement continues in parallel. Trading companies normally enter into forward trade agreements with consumers (mills, poultry farms) and purchase the grain during peak arrival season. These holding patterns, along with the seasonality of planting and harvesting, have a significant impact on the supply-demand relationship for maize.

Although maize prices are also volatile in nature which leaves the manufacturer for Maize Starch with limited pricing power in commodity product like starch powder. Large players with higher capacities such as Gujarat Ambuja, Sukhjit Starch, Roquette and Sanstar have better control over prices. Due to rising consumer demand and limited domestic supply, India is likely to continue importing minor amounts of food grade maize for the food processing industry.

Exhibit 10: Maize Import, India, 2018 – 2022

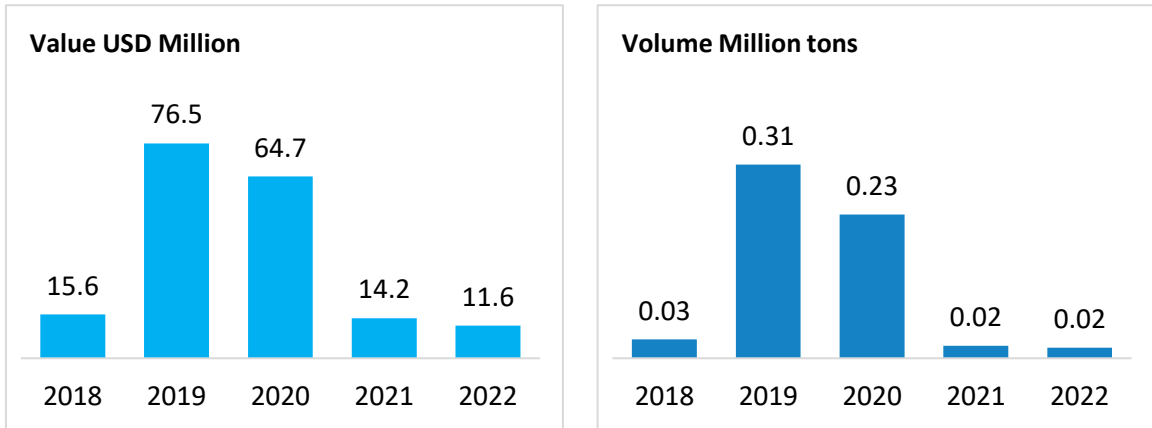


Exhibit 11: Maize Export, India, 2018 – 2022

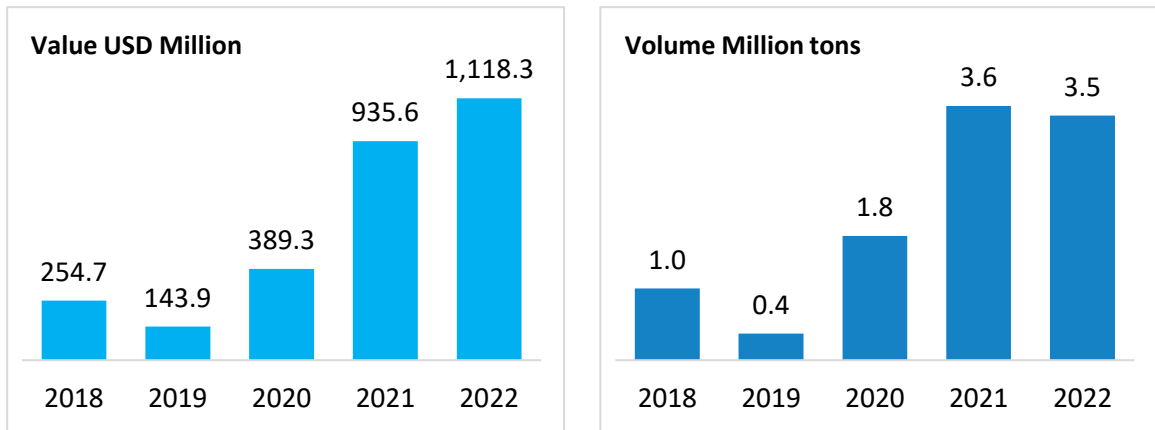
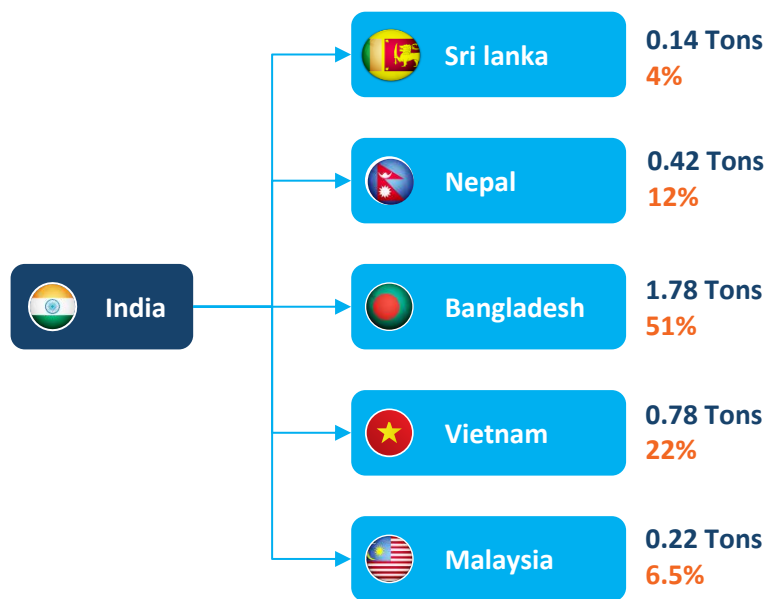


Exhibit 12: India's Export Partners for Maize, 2022



Note: HS code: 1005

Source: Trademap; Frost & Sullivan

2.2. Nutritional Value and Quality of Maize

Maize quality standards and specifications are important because they safeguard safety, nutritional value, and the worth of maize in the market. The general appearance of maize serves as a gauge of its quality. If some of the grains are harmed by insects or rodents, are stained, mouldy, fractured, or contaminated by non-grain material of either organic or inorganic origin, the quality of the crop declines.

Exhibit 13: Nutritional Importance of Maize

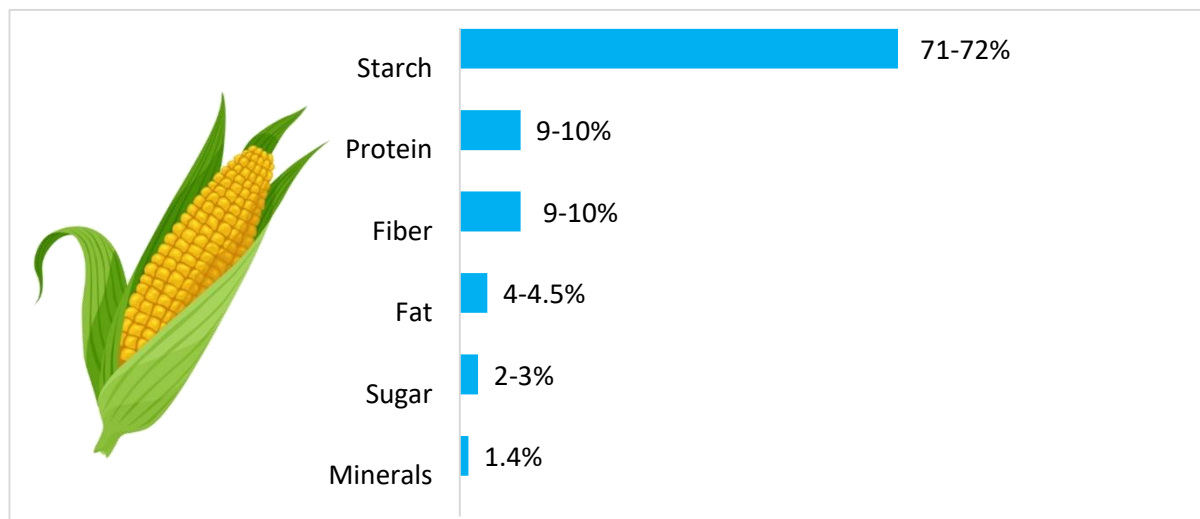
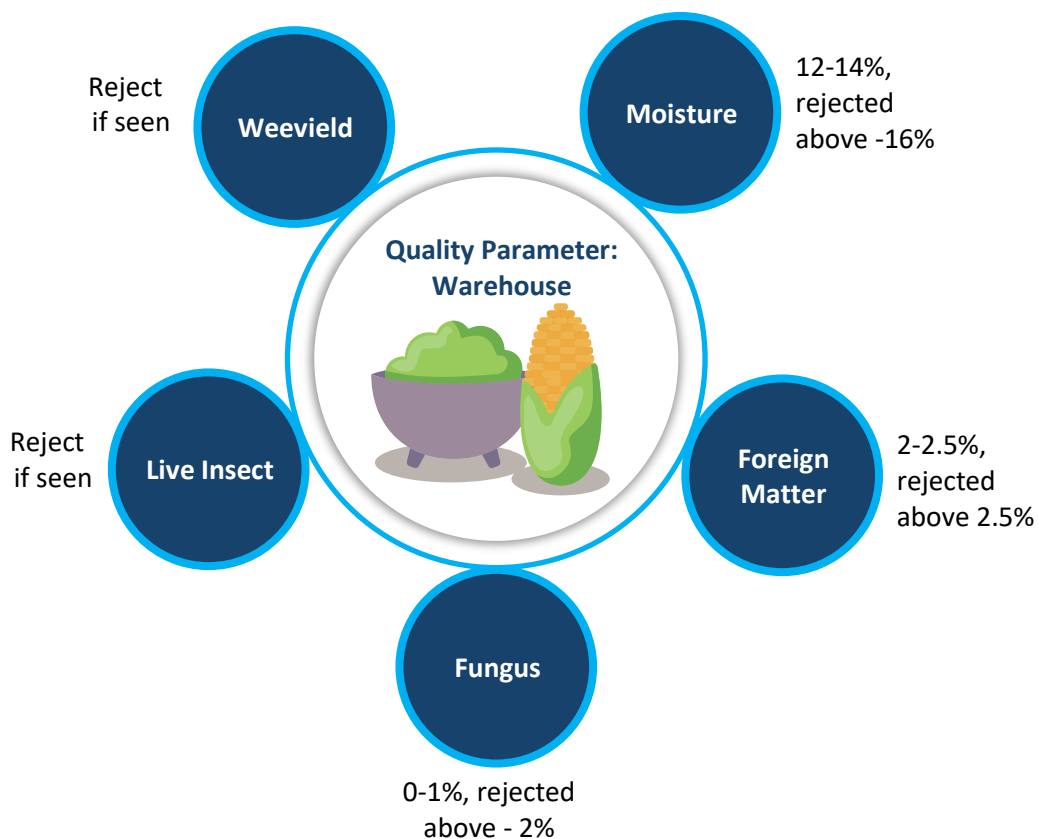


Exhibit 14: Quality Parameters for maize



The starch in most maize hybrids is composed of about 70–80% amylopectin and 20–30% amylose. Understanding the hardness and texture of maize is crucial for commercial milling processes as starch is the most prevalent component in maize. Maize kernel contains roughly 75% starch. In addition to providing energy, starch acts as a source of sugar for the developing germ during germination. Maize can be prepared in a variety of ways for use as an energy source for animals (including humans), including cracking or milling it before cooking it into a variety of food dishes.

Understanding the hardness and texture of maize is important for commercial milling processes. Maize, like all cereals, has high starch content. Maize kernel consists approximately 65-75% starch (dry basis). Starch provides energy, and during germination it would provide as source of sugar for the developing germ.

Starch in Maize has amylopectin up to 75% as its major component. It varies between 70% and 80% in normal maize, but a genetic variation in the starch synthesis can have starch composed of 100% amylopectin, sometimes called waxy Maize. Another 25% of starch is made of amylose.

Currently Indian Maize millers are facing challenge of procuring good quality maize at competitive price. One aspect of this is the export of good quality maize and another is trader's urgency to procure maize from farmers which may lead to negligence in post-harvest activities, particularly drying.

Also, the boost given by government for Ethanol production may lead to further challenges in procuring Maize for Starch manufacturing.

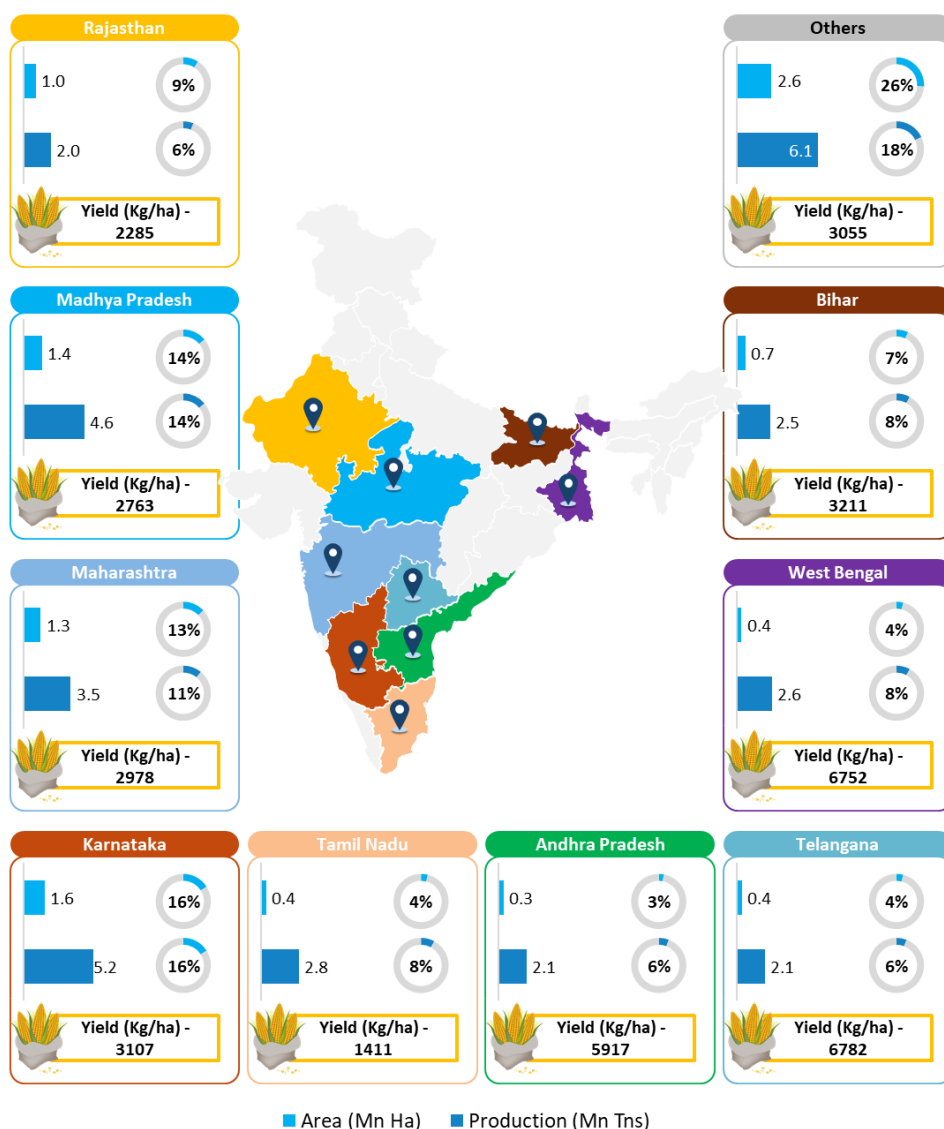
2.3. Assessment of State-wise Raw Material Availability of Maize Crop and Crop Acreage

The predominant Maize growing states that contribute more than 80% of the total maize production are Karnataka (16%), Madhya Pradesh (14%), Maharashtra (11%), Tamil Nadu (8%), West Bengal (8%), Bihar (8%), Andhra Pradesh (6%), Telangana (6%) and Rajasthan (6%). Apart from these states maize is also grown in Uttar Pradesh, Jammu & Kashmir and North-Eastern states (Around 26% contribution).

Maize has emerged as important crop in the non-traditional regions i.e., peninsular India. State like Karnataka which ranks 1st in area (1.68 mn ha) and production (5.22 mn tons) has much lower productivity (3.1 tons/ha) compared to states of Telangana (6.82 tons/ha), West Bengal (6.75 tons/ha) and Andhra Pradesh (5.92 tons/ha)

As of 2022-23, Karnataka was the largest producer of Maize in India. Karnataka contributed 16% of the total Maize production in India. The other top 3 maize producing states of India are Madhya Pradesh, Maharashtra, and Tamil Nadu.

Exhibit 15: Statewise Maize Production in India, tons, 2022-23



Source:

Directorate of Economics & Statistics, Frost & Sullivan

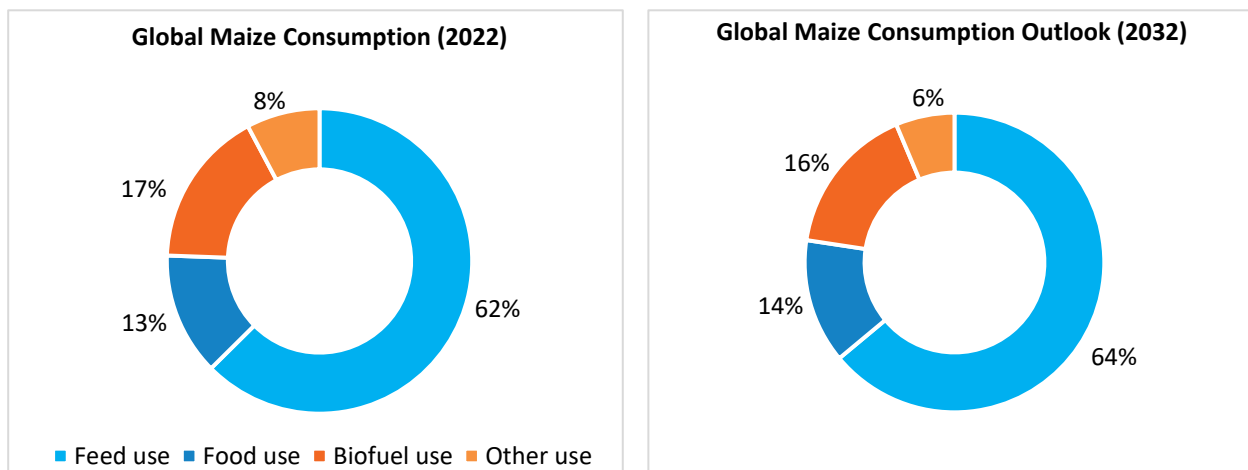
2.4. Overview of Maize Consumption Trend in India

Global maize consumption is projected to increase by 1.2% per annum as per OECD-FAO Agriculture outlook compared to 2.3% per annum in the previous decade. This increase is principally driven by higher incomes that translate into higher feed demand, which accounts for the largest share of total utilisation, rising from 57% in the base period to around 59% by 2032. 52% of the increase in feed consumption will be in Asian countries (more than half of this in China) due to fast expanding livestock and poultry sectors. Feed demand globally is expected to rise by 110 Mt to 794 Mt, mainly in China, the United States, Brazil, Indonesia, Argentina, India, Vietnam, and Egypt. Consumption in Southeast Asia will increase due to its fast-expanding poultry industry. The use of maize as food is expected to increase primarily in Sub-Saharan Africa where population growth is strong. White maize¹ will remain an important staple, accounting for about a quarter of total caloric intake. Growth in maize consumption as food in African countries is expected at about 2.7% p.a. on average.

Globally, maize use for biofuel production is expected to increase at a much slower rate than in the past two decades as national ethanol markets of key producers are constrained by biofuel policies. Brazil and USA together account for more than 80% of the increase.

The global consumption of maize is anticipated to rise to 1.36 Bn MT by 2032, primarily driven by higher per-capita income leading to increased meat consumption and, in turn, higher demand for animal nutrition. The proportion of maize used in animal nutrition is expected to further increase to about 64%, mainly due to rapid expansion of the livestock sector, particularly poultry, in Southeast Asian countries.

Exhibit 15: Global Maize Consumption Pattern and Future Outlook

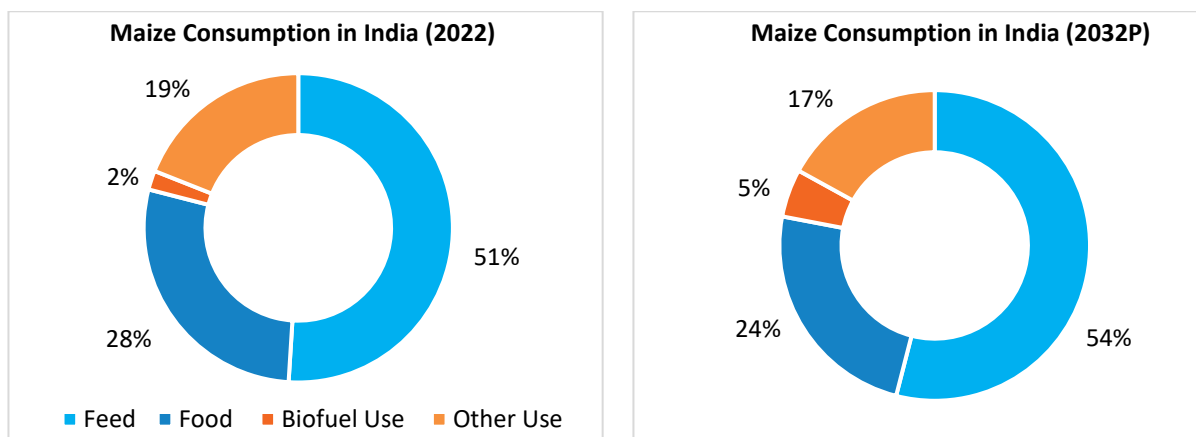


Source: OECD-FAO Agriculture Outlook 2023-2032, Frost & Sullivan Analysis

Maize Consumption Trend in India

Maize consumption in India reached around 30.6 million MT in 2022 and expected to reach around 31.3 million MT by 2023. Feed industry consumed about 51% of the total maize, while food consumption accounted for 29% (refer exhibit 8). Biofuel production using maize is still in its initial stages, with just about 1% of maize currently being utilized for this purpose. Domestic demand from feed manufacturers and the starch industry supports competitive prices. This encouraged farmers to cultivate maize, with plantings rising above 10.1 million hectares in MY 2022/2023. By 2032, the share of maize used in animal nutrition is expected to increase to about 54% by 2032. If the Indian Government continues to implement positive policy changes with respect to ethanol blending, the usage of maize for biofuel production is also expected to increase further. The starch industry's maize demand is also growing on strong domestic and export demand for textile products.

Exhibit 16: Maize Consumption Pattern and Future Outlook in India



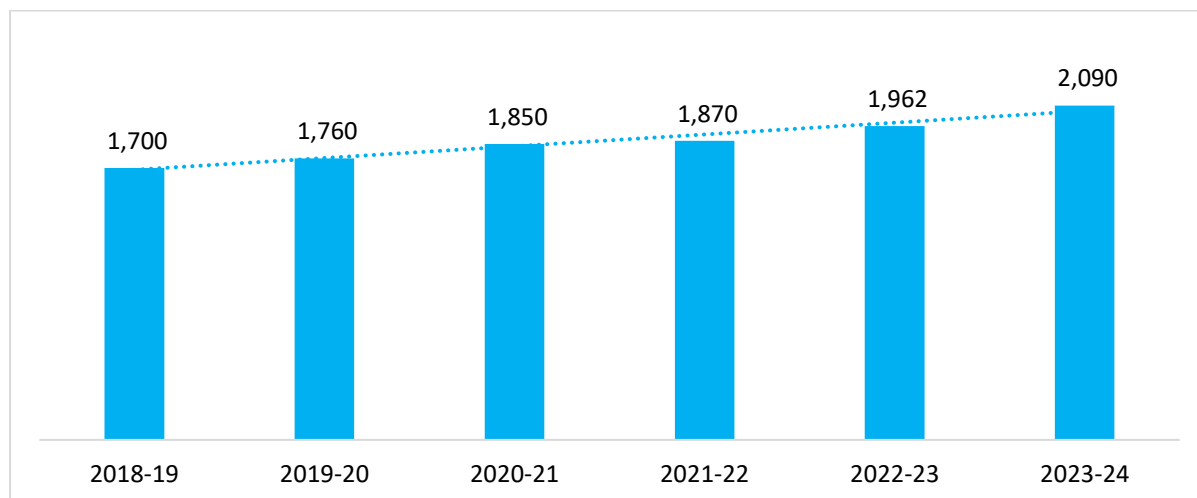
Source: FICCI, YES Bank Report on Transforming India’s Maize Sector – The Critical Role of Technology and Innovations, Frost & Sullivan

2.5. Overview of Prices for Maize in India

Maize is the largest crop in the Feed grain segment in India and overall, the third most important staple crop in India. Maize prices have declined below Rs. 2,000 per quintal in commercial markets hovering around or below the minimum support price (MSP) of Rs. 1,962 in key producing states such as Karnataka, Maharashtra, and Madhya Pradesh in view of high moisture in the crop. Production also declined in the key maize growing states of Madhya Pradesh, Karnataka, Uttar Pradesh, Maharashtra, and Telangana due to heavy rainfall in October resulted in damage of the standing crops. As per Industry sources in 2022, arrivals of kharif maize were delayed due to prolonged rainy season and cloudy weather which impacted the harvesting and drying process of maize across the country.

Despite the record MY 2022/2023 harvest, strong domestic and export demand has resulted in steady maize prices. The Union Cabinet has approved increase in MSP for Maize (Kharif) and other Kharif Crops for marketing season 2023-2024 by 6-7%.

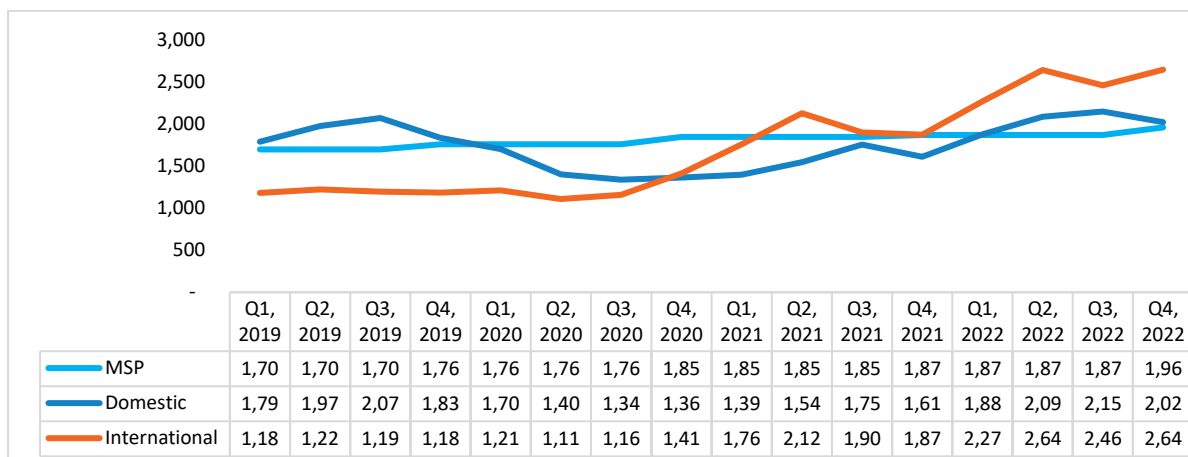
Exhibit 17: Maize Minimum Support Prices (MSP), India, FY2018 – FY2023 (Rs per quintal)



Source: Farmers portal, Govt. of India; Frost & Sullivan

The exhibit below shows a comparative trend in domestic market prices, MSP and international prices of maize during the period 2018 to 2022. The domestic prices of maize were higher than the international prices till 2020(Q3) except being marginally lower in 2018(except Q1) and 2020 (Q4). This made Indian maize less competitive in the international market. However, since late 2020, both domestic and international maize prices have improved, and international prices have surpassed domestic prices. The domestic prices of maize remained below MSP during the period 2018 to 2021 except in 2019 and have hovered above the MSP since the beginning of 2022 in the backdrop of global spike in maize prices.

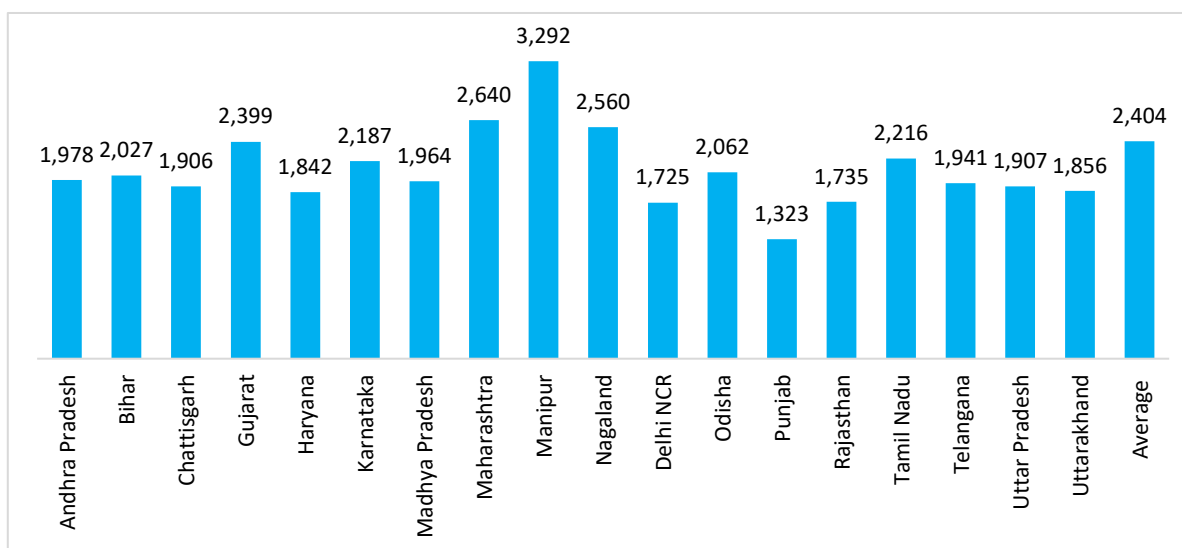
Exhibit 18: Maize Minimum Support Prices (MSP), India, FY2018 – FY2023 (Rs per quintal)



Source: Commission for Agriculture Cost & Prices (CACP), MoA, Govt. of India; Frost & Sullivan Analysis

In terms of Average wholesale price of Maize in India in 2023 (till October) hovered at around INR 2,404/quintal as against INR 2,153/quintal in September 2022. Prices are expected to remain sideways during the next coming weeks amid subdued demand although supply is limited. Drought/water stressed condition was observed during August month in several States including Karnataka, Madhya Pradesh (MP) and eastern parts of Uttar Pradesh as rainfall deficit continue throughout the month due to which crop in those States are prone to stunted growth like condition.

Exhibit 19: Wholesale Prices Monthly Analysis for Maize during September 2023



Source: AGMARKNETI, Govt. of India; Frost & Sullivan Analysis

2.6. Overview of Usage of Maize in India – End Use Industries

Maize is the third most important cereal crop in India after rice and wheat. It is a staple for human consumption and a quality feed for animals too. In addition, maize also serves as a basic raw material for manufacture of various industrial products like food sweeteners, starch, pharmaceuticals, cosmetics, textiles etc.

Steady demand from the poultry and aqua feed sector supported maize consumption in 2022 and 2023 for the animal nutrition segment. With recovery from the COVID-19 pandemic, India's poultry and aquaculture feed industry has grown on account of improving consumer demand for poultry products and exports demand for aqua products, namely shrimp. The starch industry's demand for maize is also growing on strong domestic and export demand for textile products (modified starch) and demand for native starch driven by the food industry. There is a small but rapidly growing use of low-quality maize, other coarse grains, and spoiled/broken rice and wheat, all estimated at around 2-3 MMT, for potable liquor use for distilling blended whiskies and other spirits. Food use of maize and other coarse grains is lower than the earlier years due to higher supplies of subsidized rice and wheat from the government's public distribution system and lower harvests of millet, sorghum, and barley.

A) Animal Nutrition

Steady demand from the poultry and aqua feed sector supported maize consumption in 2022-2023. With recovery from the COVID-19 pandemic, India's poultry and aquaculture feed industry has witnessed growth on account of improved consumer demand for poultry products and export demand for aqua products, particularly shrimp. As per Industry sources, commercial feed accounts for 55-60 percent of the total animal nutrition market.

The commercial feed industry which is the end use industry for maize caters to the poultry (74-75 percent), aquaculture (14-15 percent), and dairy cattle (10-12 percent) feed sectors. The major growth drivers for usage of maize for Animal nutrition in India can be attributed to

- **High Nutritional Value:** Maize holds significant importance in animal nutrition due to its exceptional nutritional value. It serves as an excellent source of energy, due to its high starch content thus readily digested by animals. Maize feed consists of crucial amino acids playing a vital role in the growth and development of animals. Furthermore, it offers essential nutrients such as phosphorus, potassium, vitamins etc. thereby enhancing the overall nutrition profile of maize.
- **Usage for different varieties of feed and fodder:** Maize provide different options for animal nutrition manufacturers to create customised feed mixes that can be aligned to the livestock specific nutritional requirements. While the maize kernel can undergo different processing methods including grinding into powder or flakes, pellets or fermented products. Maize straw is used as animal fodder since the ancient times. However, the fodder quality of green maize is far excellent. Amongst the non-legume fodder crops, maize is the only fodder which produces better nutritional quality along with good quantity of biomass.

- **Cost Effective Feed:** Maize provides cost-effectiveness for animal nutrition manufacturers. As a producer of maize, India plays a crucial role in its global supply. The abundant availability of maize coupled with its relatively stable prices contributes to reducing overall production costs.
- B) Food Use:** Maize for human consumption (6-7 MMT) represents a small share of the production compared to that for feed use. The other coarse grains – sorghum, millet, and barley – see a larger share of production go to food use. These grains were the staple diet for rural and lower income semi-urban households.
- C) Industrial Use:** Some 3.5 to 4 MMT of maize is used by the starch industry to cater to the textile industry’s needs. India’s domestic ethanol program uses molasses (a sugar industry by-product) as feedstock for ethanol production for fuel use. However, small quantities of ethanol are produced from rice milling industry waste (broken rice), and low-quality rice, wheat, maize, and coarse grains for potable liquor and other industrial uses. Small quantities of Distillers Dried Grains with Solubles (DDGS) (300,000 MMT to 500,000 MMT) from these ethanol plants are used by the animal nutrition industry. The government has announced schemes to the private sector for setting up grain-based ethanol plants by offering subsidized ‘excess’ rice from government stock, and price incentives over molasses-based ethanol by the government parastatal fuel marketing companies. Some of these plants have come into operation in 2023, but industry sources are not sure about the supplies of subsidized rice to these units.

2.7. Key Trends and Growth Drivers for End use Industries for Maize Consumption

There are multiple drivers of maize demand in India presently. Some of the key drivers include:

- **Growing Demand from Poultry and Aquafeed sector, contributing to more than half of the domestic production:** Steady demand from the poultry and aqua feed sector supported maize consumption in 2022-2023. With recovery from the COVID-19 pandemic, India’s poultry and aquaculture feed industry has witnessed growth on account of improved consumer demand for poultry products and export demand for aqua products, particularly shrimp.
- **Growing urbanization, leading to increased demand for Processed Food Products like Maize flakes, Bakery products:** The demand for maize/maize-based flour in the processed food segment has witnessed an upward trend on account of increasing demand for convenient and easy-to-prepare food products. Maize flour is used in a wide range of food products, including baked goods, snacks, breakfast cereals etc. In addition, the growth is further influenced by factors such as population growth, changing dietary preferences, and economic conditions. However, factors such as fluctuations in raw material prices and the availability of substitutes may hinder market growth.
- **Growing Organised Dairy sector, requiring more of Fine Cereals or Maize-based concentrates:** The dairy sector in India, largely backyard & small-scale operations (2-3 animals), consumes limited amounts of compound feed and depends on home-made feed mixes - oil cakes, household food waste, spoiled/broken wheat and rice, and other cheap grain mixes – to feed to lactating cows/buffaloes while in milk. There is a growing trend among dairy farmers to replace low-yielding local dairy cattle breeds with higher-yielding crossbred cows and buffaloes, which require higher-energy feeds including maize based feed

concentrates, driving a 10- 12 percent per annum growth in demand for commercial dairy feed in recent years.

- **Rising International Price due to Diversion of Maize Grain towards Biofuel Production:**

While globally maize is the primary feed-stock for ethanol production, it is used in India mostly for animal nutrition and industrial use. As per Govt. estimates, India's maize output needs to be increased to 44-45 million tonnes in the next five years amid growing demand for the grain for ethanol production and poultry industry. The Government is aiming to increase maize production to achieve and sustain the target of 20% ethanol blending in auto fuels by FY25, given the limited scope for expanding sugar and grain areas. This is expected to be achieved through developing high yielding varieties which has higher recovery for ethanol in collaboration with IIMR and other research institutions. Distilleries would be working with the farmers for assured procurement of maize in the line with the sugar sector.

3. Maize Starch & Maize Based Specialty Products And Ingredient Solutions Market Overview

3.1. Introduction to Maize starch and its application

Maize Starch is plant-based ingredient derived from wet milling process of maize. Plants store the most abundant and edible carbohydrate, starch, as α -D glucan polymer. It is one of the most significant polymers and is widely employed in both food and non-food products. Natural sources of starch are cereal grain seeds, tubers, roots, and legume fruits, leaves, and seeds. The main sources of commercially derived starch are tapioca, wheat, potatoes, rice, and maize. Maize has been widely used for manufacturing starch globally and would account to ~70% of raw material used.

The process of starch manufacturing involves grinding a maize crop which is high in starch and then using wet separation techniques. Because starch can be modified chemically or physically, it is regarded as a versatile ingredient. Unmodified or native starch, modified starch (dextrin, pre-gelatinized starch, oxidized starches), and derivatives (high fructose Maize syrup, glucose) are the three primary categories of starch-based goods.

The Global Maize Starch market is anticipated to rise at a considerable rate during the forecast period with a CAGR of ~4.26% between 2023 and 2029. In 2023, the market was valued at USD 45,156 Mn in value terms and was around 85 Mn MT in volume terms. Maize starch is a carbohydrate extracted from the endosperm of Maize. Maize starch is the most commercially used starch in various industries. Food and Beverage, Pharmaceutical, Adhesive, Paper, Textile are some of the major industries using maize based specialty products and ingredients solutions

The growing demand for convenience food in recent years has necessitated the increased use of maize based specialty products and ingredients solutions. Starches are increasingly utilized as a food additive in various applications such as thickening of sauces, viscosity-control agent to the binding of baking ingredients, moldings of gums, etc. Additionally, the functional superiority of modified starches has rapidly expanded its application spectrum across the diverse range of applications. Maize is the major raw material in the production of maize based specialty products and ingredients solutions and Maize starch accounts for a significant share in the starch market compared to the starch derived from other raw materials such as rice, potato, cassava, and others. Such functional properties of starches are contributing to the growth of the market.

Exhibit 20 : Global Maize Starch Market, USD Mn, 2019-2029F

Source: Frost & Sullivan, Primary Research & Analysis

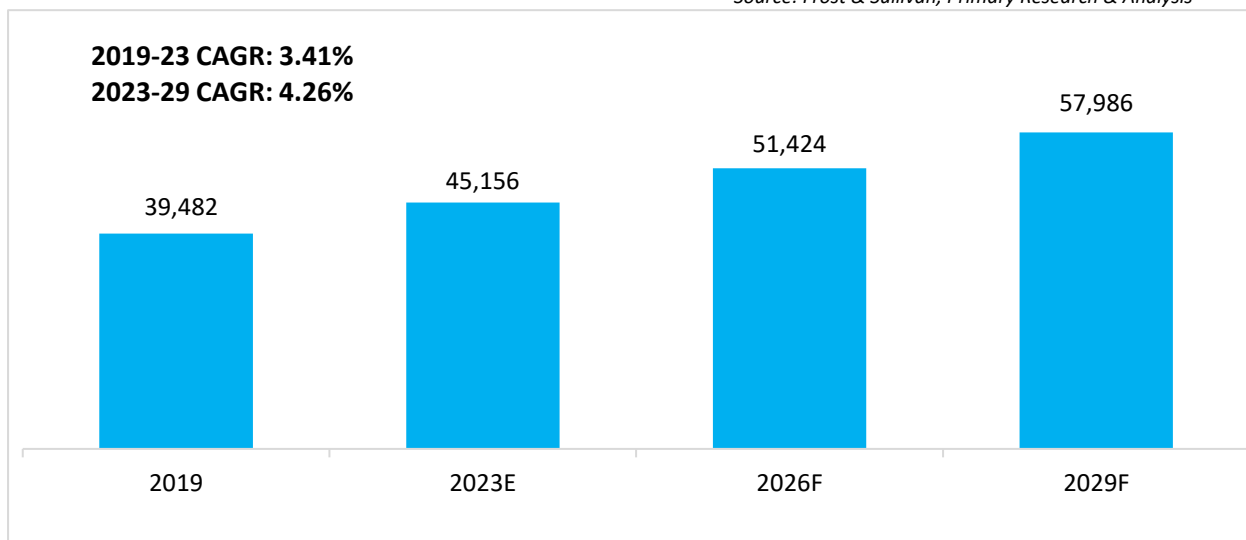
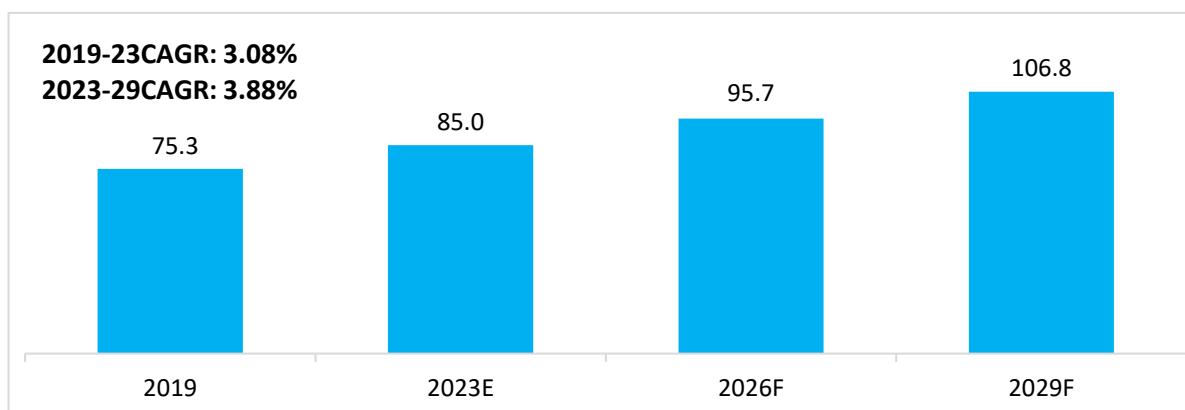


Exhibit 21: Global Maize Starch Market, Mn Tons, 2019-2029F



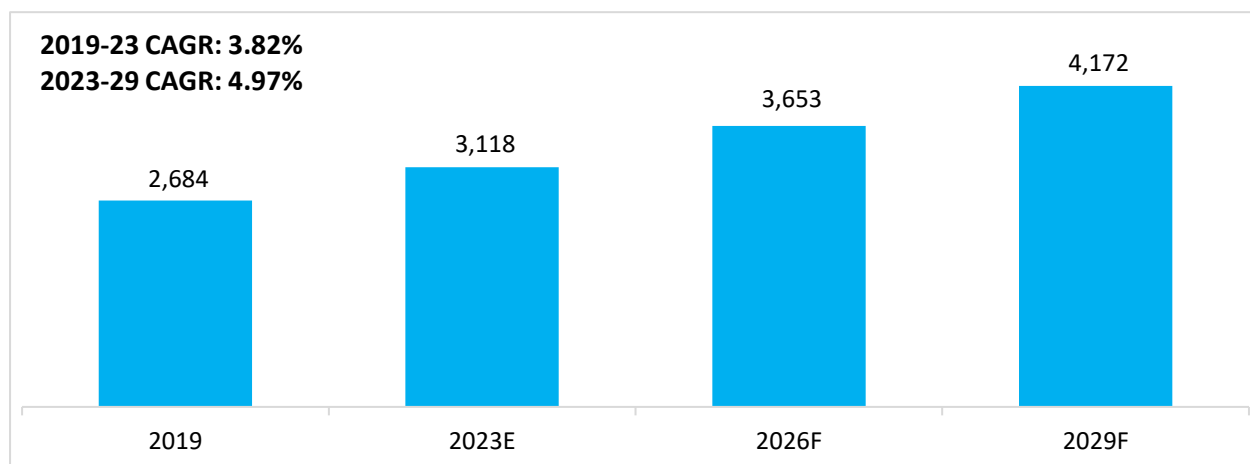
Source: Frost & Sullivan Primary Research & Analysis

In India, Maize is third important cereal/crop after wheat and rice and has a great potential of processing due to its high nutritive value and commercial uses. Maize is common name for a cereal grass widely grown for food and livestock fodder. Maize starch, it is a carbohydrate extracted from the endosperm of Maize. Off the total Maize produced in India, nearly one-third of production is for human consumption with ~10-15% used for starch production. Nearly 50-55% is consumed for feed (animal & poultry) production.

This white powdery substance is used for many culinary, household, and industrial purposes. India is among the top 10 maize producing countries in the world. Karnataka, Andhra Pradesh and Maharashtra together account for nearly half of India's production of Maize. We see that India exports as well as imports Maize Starch. Import figures are very small compared to exports, thus depicting India's ability to meet the domestic demand.

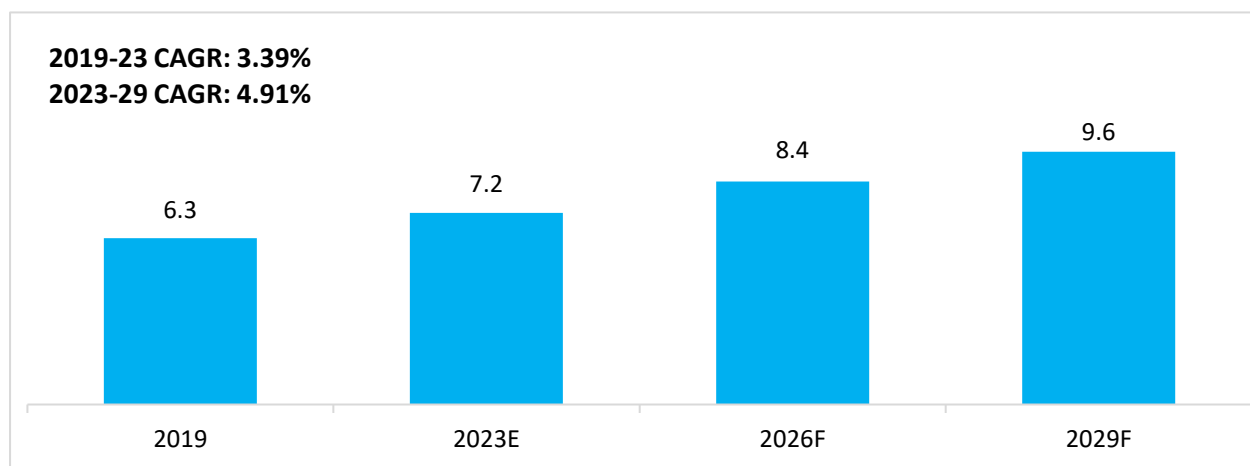
The Indian Maize Starch market is anticipated to rise at a considerable rate during the forecast period with a CAGR of ~4.97% between 2023 and 2029. In 2023, the market was valued at USD 3,118 Mn in value terms and was around 6.9 Mn MT in volume terms.

Exhibit 22: India Maize Starch Market, USD Mn, 2019-2029F



Source: Frost & Sullivan Primary Research & Analysis

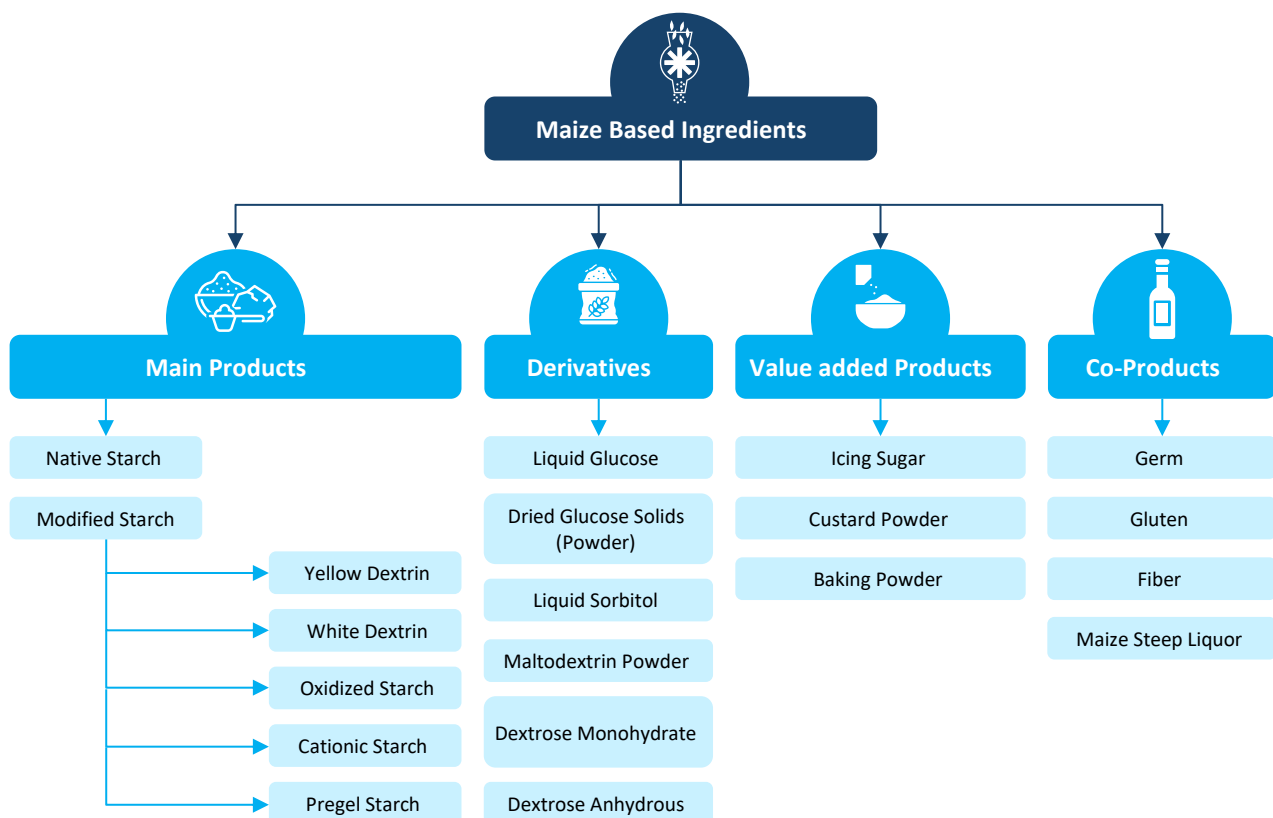
Exhibit 23: India Maize Starch Market, Mn Tons, 2019-2029F



Source: Frost & Sullivan Primary Research & Analysis

Based on product type, the India Maize starch market is segmented into native, and modified. Amongst both, Native Maize Starch accounts for a higher share accounting for more than 60% of the total market in value terms.

Exhibit 24: Maize based speciality products and ingredient solutions



Definitions and Application of products: -

1. Native Starch

Native starch is powder obtained from starchy part of maize which as application in many industries.

Application - Custard, desserts, sauces, instant foods, tablets, baked foods, confectioneries, pastas, soups and mayonnaise.

2. Modified Starch

Modified starch, are prepared by physically, enzymatically, or chemically by treating native starch to change its properties

Application- Thickening agent, stabilizer, or emulsifier; in pharmaceuticals as a disintegrant; or as binder in coated paper

3. Yellow Dextrin

Yellow Dextrin is water-soluble produced using less acid & high temperatures for a long time-period. The Yellow Dextrin is used to produce high solids pastes (40-60%). These dry rapidly when applied to thin films.

Application- Binder in adhesive applications, extenders in dyes and as a binder in abrasive industry, adhesive for envelopes, corrugation, gummed labels, and tapes along with others.

4. White Dextrin

White Dextrin is water-soluble optically active solutions of low viscosity which is white in colour

Application- Textile finishing, coating- thickening-binding agent in pharmaceuticals & paper coatings, stabilizing agent for certain explosive metal azides.

5. Oxidized Starch

Oxidized starch has a range of viscosity and fluidity to suit the requirement of different applications. It is used mainly in paper processing for surface sizing.

Application- Coating applications, fabric and textile industry for yarn smoothing and flattering.

6. Cationic Starch

Cationic starch is a modified starch mainly used as wet-end starch. Cationic starches are two types; quaternary ammonium type cationic starch and tertiary amino type cationic starch.

Application- Wet end additives in paper making.

7. Pregel Starch

Pregelatinized starch is soluble in cold water as it easily takes up the water and swells at room temperature. It forms paste when mixed with cold water.

Application- Used in cream fillings, canned, sauces, soup mixes, gravies, tomato ketchup, pasty creams, dairy desserts and other food product industries.

8. Liquid Glucose

Liquid glucose is a clear, viscous, colourless solution. The functional properties of liquid glucose include viscosity, humectancy, high fermentability, colligative properties, along with imparting sweetness.

Application- Used in confectionary, candies, syrups, pharmaceutical excipients, bakery, ready to eat sweets

9. Dried Glucose Solids

Dried Glucose Solids is in uniform powdered format with high bulk density, equivalent to sucrose, yet with lower sugar content.

Application- Used as sweetener and bodying agent in confectionary products, jams, jellies, preserves, syrup and toppings.

10. Liquid Sorbitol

Sorbitol is a polyol or sugar alcohol. It is a bulk sweetener with excellent humectant and texturizing agent. Sorbitol is about 60% as sweet as sucrose offering one-third fewer calories.

Application- Processed foods, Toothpaste, Pharmaceuticals, Cosmetics, Bakery, Confectionery, and Seafood (cryoprotectant qualities).

11. Maltodextrin

Maltodextrin is a polysaccharide with major application as a thickener and a food additive. Partial hydrolysis is used to produce it from starch. Maltodextrin occurs as a white hygroscopic spray-dried powder.

Application- Food additive, anti-caking agent, bulking agent, and food flavour carrier. Used in artificial sweeteners.

12. Liquid Dextrose

The crystallized or liquid forms of D-glucose made by full hydrolysis of starch used as sources of carbohydrates or as soluble carrier for Bio-Industry & Fermentation and Plant Care.

Application -Bio-Industry & Fermentation- Processing Aids, Plant Care - Fertilizers, Nutrients

13. Dextrose Monohydrate

Dextrose Monohydrate is the Monohydrate form of D-glucose which is a natural Monosaccharide and Carbohydrate. Dextrose Monohydrate has a sweet taste and is used as a sweetener and texturizing agent. It is also used as a fermentation substrate.

Application- Nutritional supplement, confectioneries, jams, jellies; bakery such as cakes, biscuits, cookies; beverages, supplement in the pharmaceutical industry. Also used in Animal Nutrition/Poultry feed.

14. Dextrose Anhydrous

Dextrose Anhydrous is also known as “Maize Sugar Anhydrous” or “Anhydrous Dextrose” or “Anhydrous Sugar”. It is purified and crystallized D-glucose with the total solids content not less than 98.0% m/m. It is a colourless, odourless white powder with less sweetness than cane sugar.

Application- Nutritional supplement and sweetener in baked goods, candy, and gum, jarred and canned foods, creams and frozen dairy products (like some ice-creams and frozen yogurts), and cured meats.

15. Icing Sugar

Icing sugar is also known as powdered sugar or confectioner’s sugar. It is made by grinding granulated sugar into a very fine powder and produced industrially using a small amount of anticaking agent, such as maize- starch or tricalcium phosphate (E341). These are added to absorb moisture and support the free flowing of the powder by preventing sticking together in clumps.

Application-Icing sugar is used in the preparation of bakery and confectionery products such as cakes, chocolates, fudge among other desserts. It is also used in frostings and coatings as it does not produce a grainy texture.

16. Custard Powder

Custard is composed of a mixture of maize starch, milk and eggs which is thickened by heat. Maize-starch is the commonly used thickener which makes up the bulk of custard powder. Maize-starch is effective at thickening liquids; it dissolves quickly and hence is majorly used in custard powder. Vanilla is the flavoring which is generally used in custard powder in a very subtle amount.

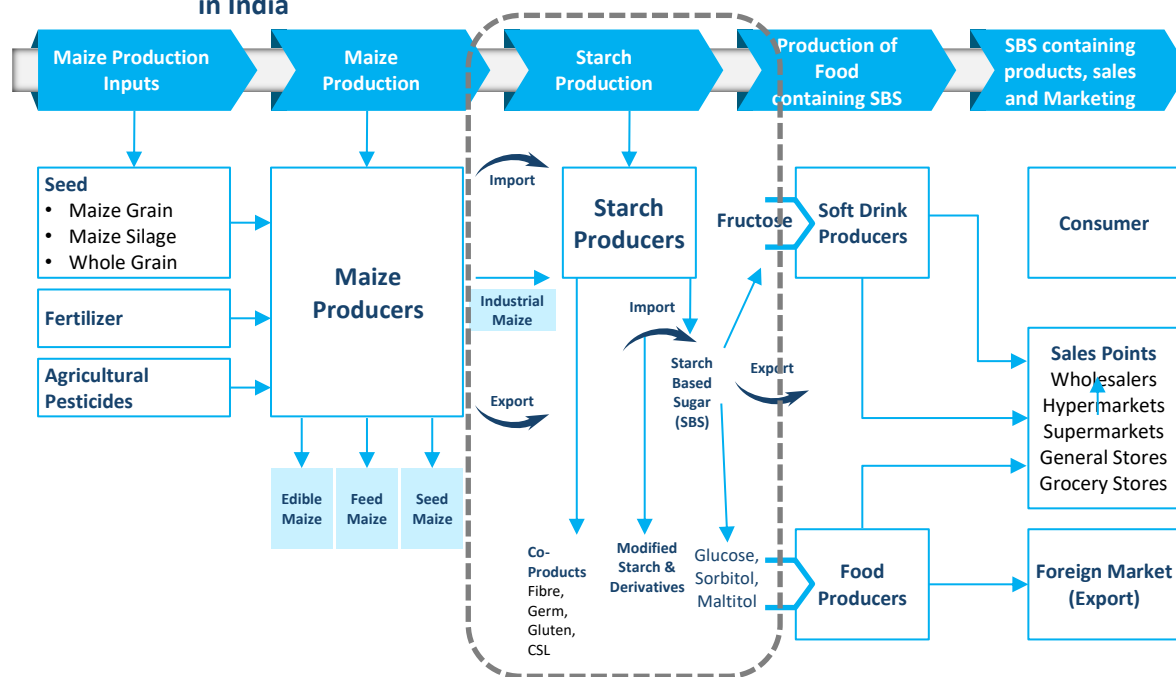
Application- Cakes, puddings, ice-creams, sweet pies among other desserts. It finds major application in making cookies and instant puddings.

17. Baking Powder

Baking powder is a white solid composed typically of three components, including an acid, a base, and a filler. These materials have a significant impact on the taste and texture of the finished product.

Application-Baking Powder is used in various industrial applications including baking and cooking, metal polishing, water treatment, meat curing, personal care products and pharmaceuticals.

3.2. Value Chain of Maize Based Specialty Products And Ingredients Solutions Industry in India



Stage of Value Addition

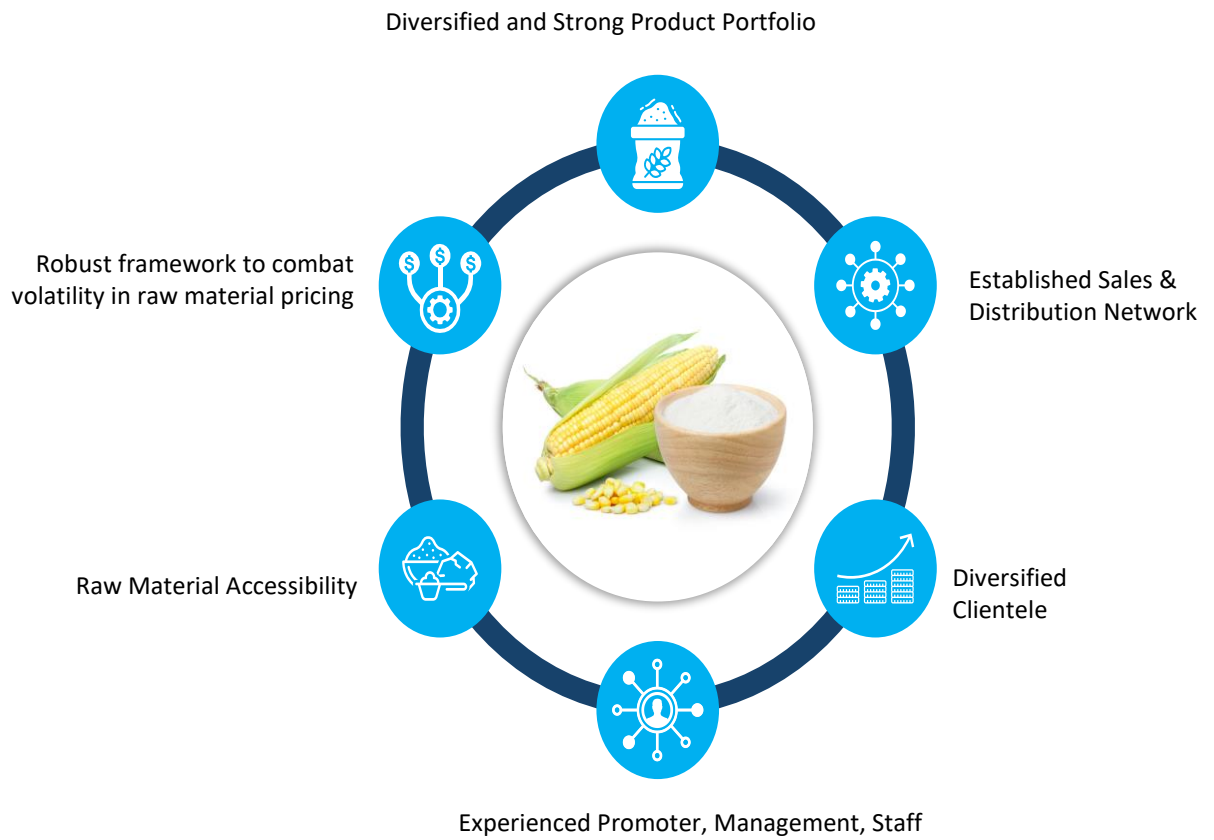
Source: NISAD, Frost & Sullivan

3.3. Key material used for fuel and other consumables used in Maize processing industry-

Maize based speciality products and ingredient solution manufacturers use coal as primary source of fuel. Odisha, Jharkhand, Chhattisgarh, West Bengal are some of the prominent sources of coal in India. India also imports coal from countries like Indonesia and Vietnam which are high grade coals. Maize industry mostly uses domestic coal which is priced between Rs 4 – 7/ kg. This coal is normally low in calorific value. High Calorific value coals are priced from Rs 8/ kg and above.

Use of husk as fuel in maize milling plants has increased in last decade owing to government’s efforts for controlling air pollution by trying to stop burning of husk. Maize based speciality products and ingredient solutions manufacturers purchase rice husk with a moisture content of 13–15% from millers or traders. After being reduced in size, husk can be used to make briquettes and pellets. Industries are turning to renewable energy sources, and since husk is both economical and environmentally beneficial, its use as fuel has been increasing.

3.4. Overview of competencies required for the maize based specialty products and ingredients solutions.



3.5. Assessment of geographical location plants for Maize starch in India

Maize based speciality products and ingredient solutions manufacturing plants are located across pan India, with large numbers of plants located in Gujarat, Maharashtra, Karnataka owing to huge maize production by these states. In recent years, number of plants have been commissioned in West Bengal, Bihar, UP for ease of export access to neighbouring countries.

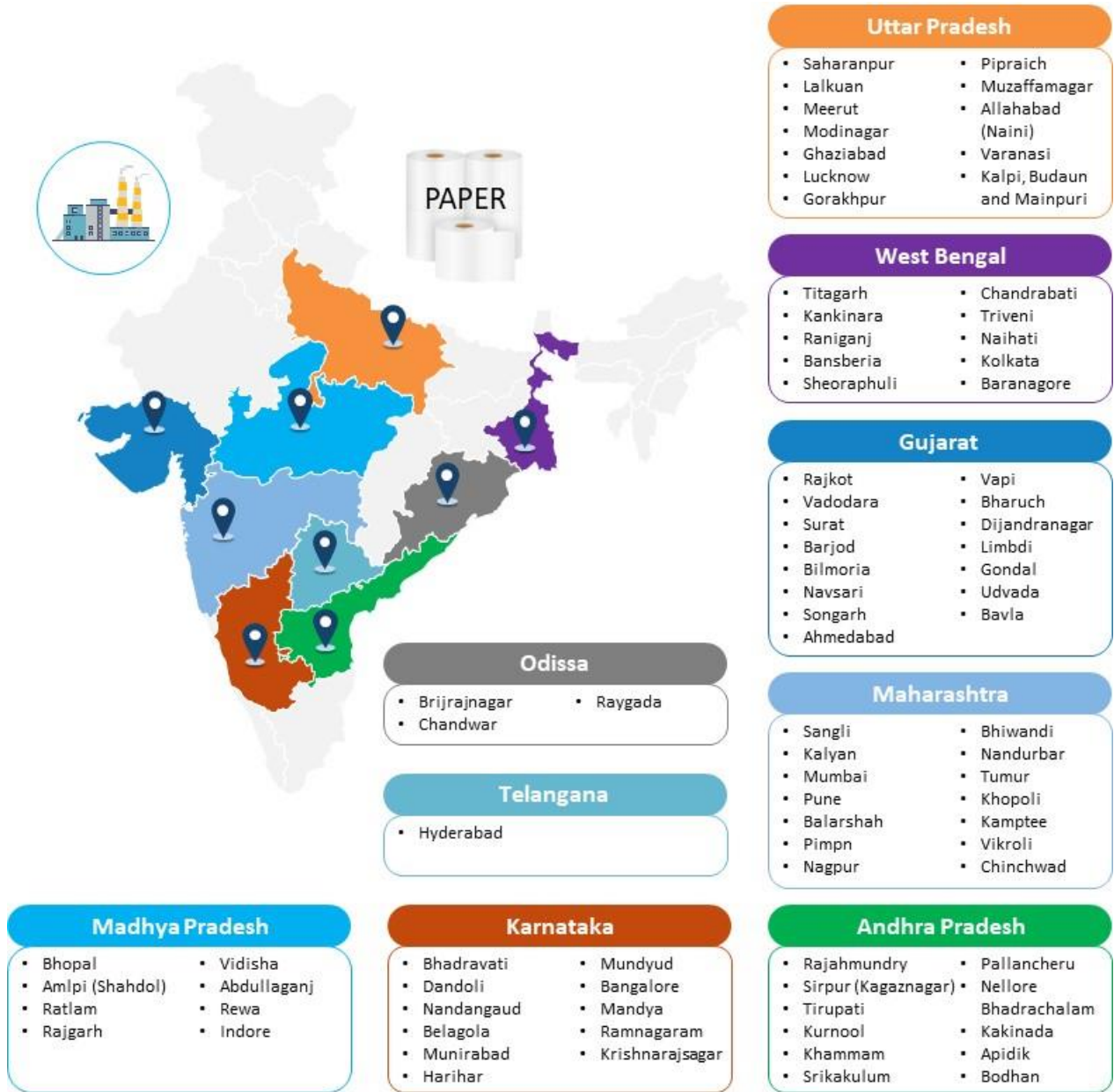
Exhibit 25: Locations of Maize based Ingredients Plants in India



Source: Company websites, Frost & Sullivan

3.6. Overview of clusters for end-use industries across various states in India

Exhibit 26: Paper Industry in India



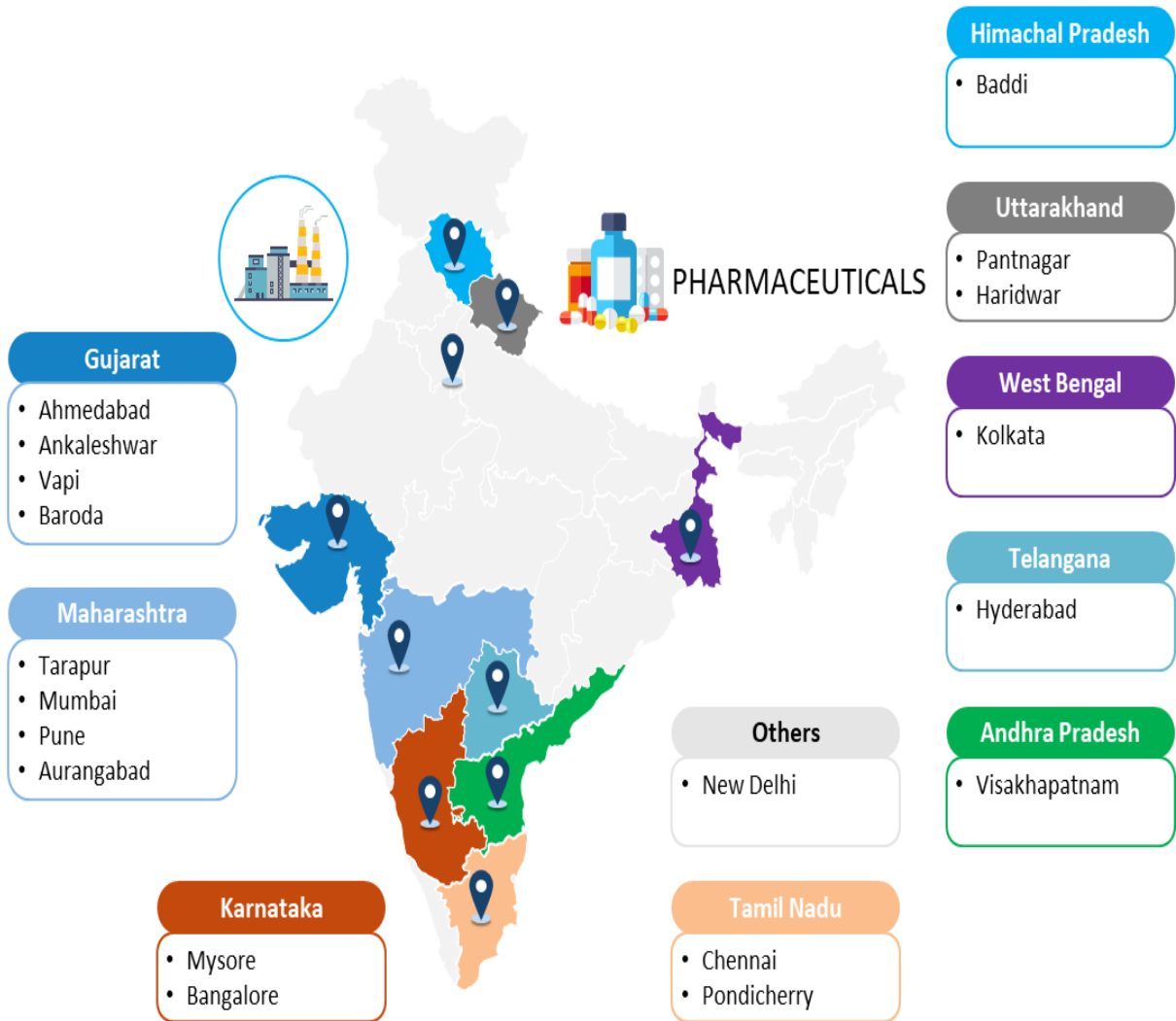
Source: Company websites, Frost & Sullivan Analysis

Exhibit 27 : Textile Industry in India



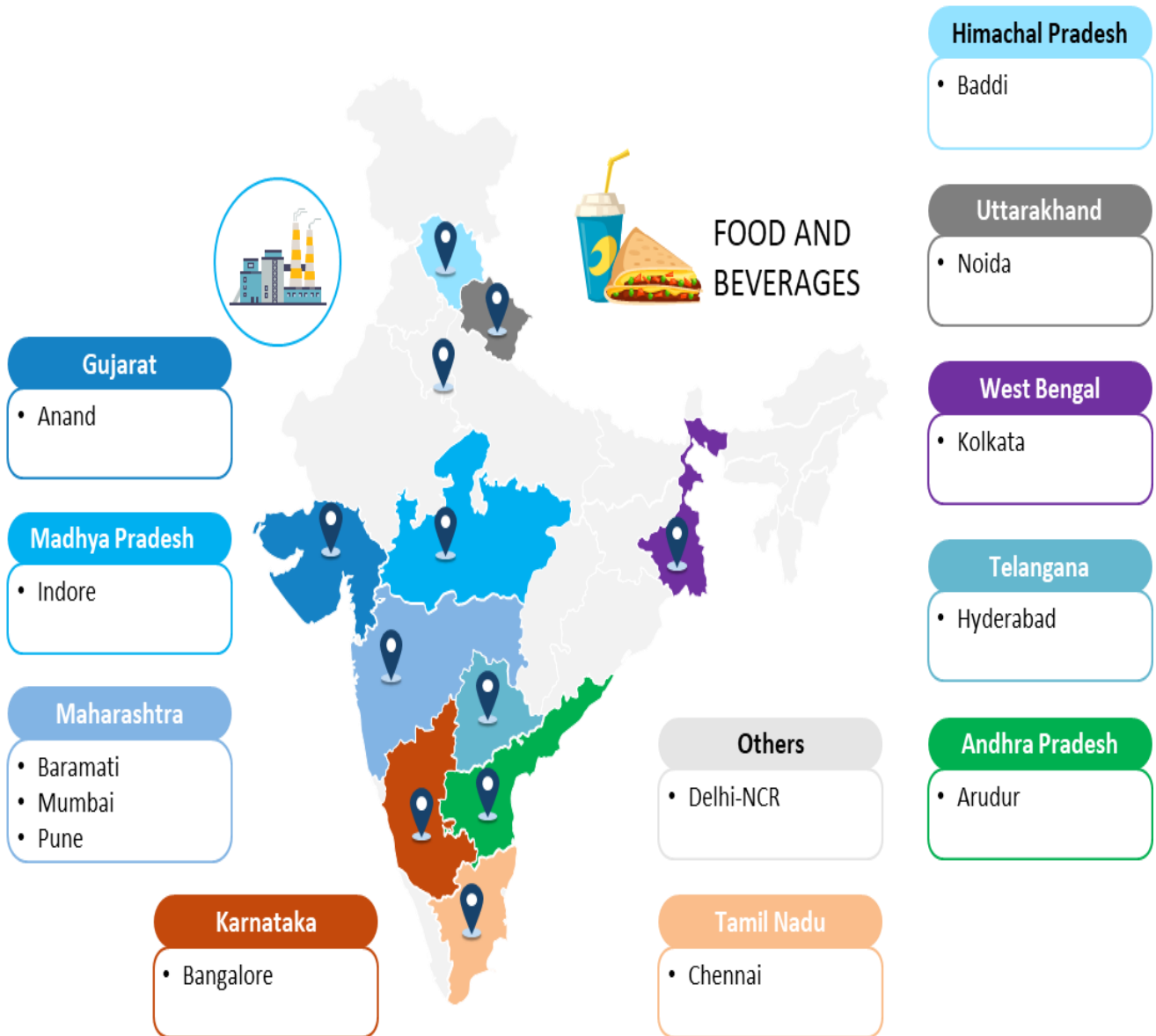
Source: Company websites, Frost & Sullivan

Exhibit 28: Pharmaceutical Industry in India



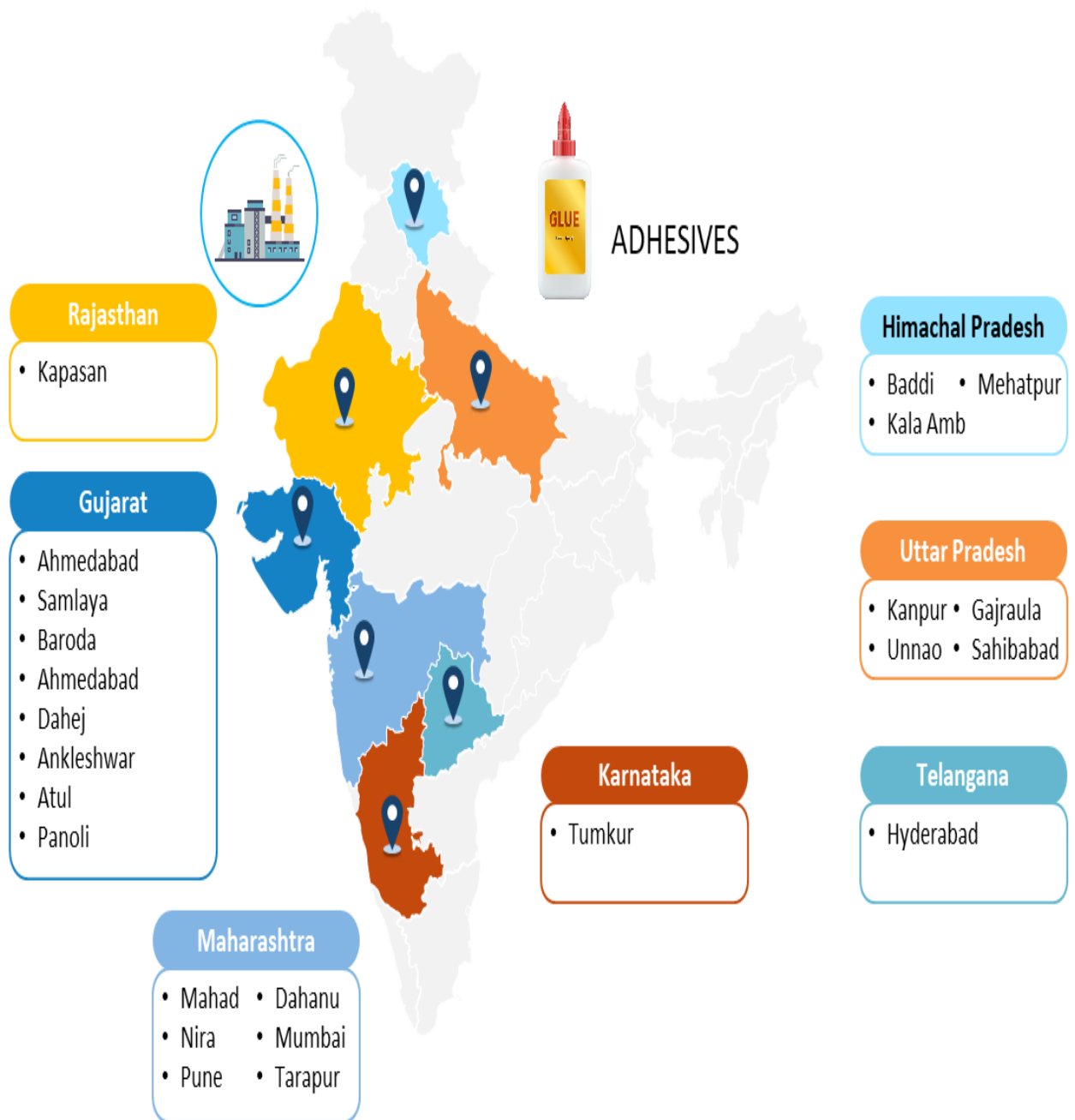
Source: Company websites, Frost & Sullivan Analysis

Exhibit 29: Food & Beverage Industry in India



Source: Company websites, Frost & Sullivan Analysis

Exhibit 30: Adhesive Industry in India



Source: Company websites, Frost & Sullivan

3.7. End Use Industries Growth Rate

Sr No	End Use industry	Global, 2023-2027 Growth rate, %	India, 2023-2027 Growth rate, %
1	Animal Nutrition	7.32%	8.21%
2	Snacks	6.34%	9.01%
3	Confectionary	5.88%	8.86%
4	Convenience Foods (RTE, Soups)	6.76%	9.89%
5	Sauces & Spices	6.48%	8.51%
6	Spreads	6.57%	6.87%
7	Pharma	5.87%	6.89%
8	Paper	3.2%	4.1%
9	Apparel (Textile)	2.76%	3.58%

*RTR- Ready to Eat

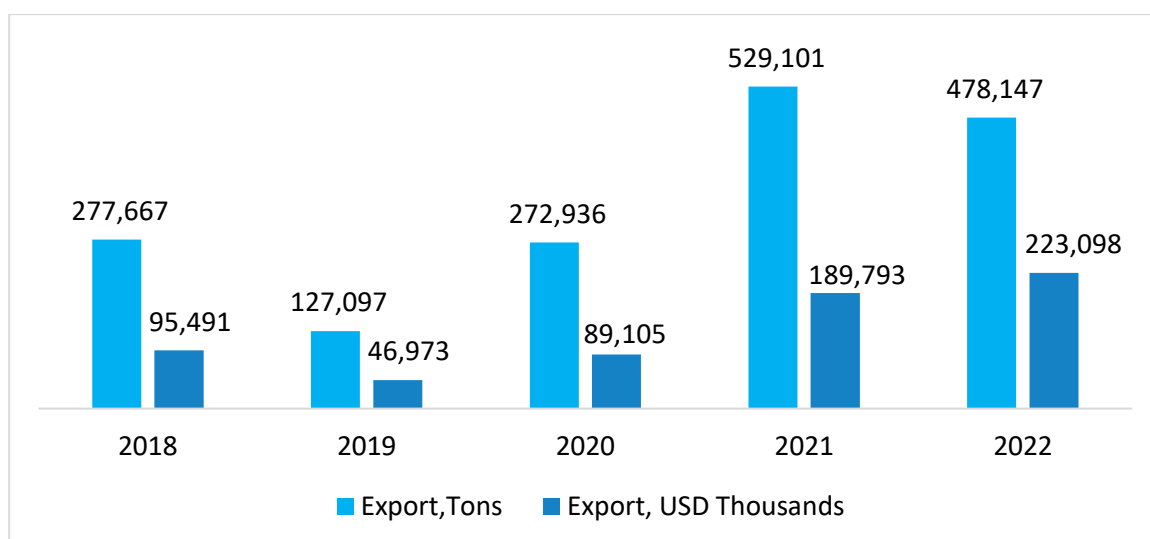
Source: Statista, Frost & Sullivan Analysis

The increasing demand of maize based ingredient in food and beverage, pharma and animal nutrition, adhesive, paper, textile, etc from developing economies like India is likely to increase the consumption of these ingredient.

3.8. Overview of Maize starch exports and imports in Indian market (HS code: 11081200)

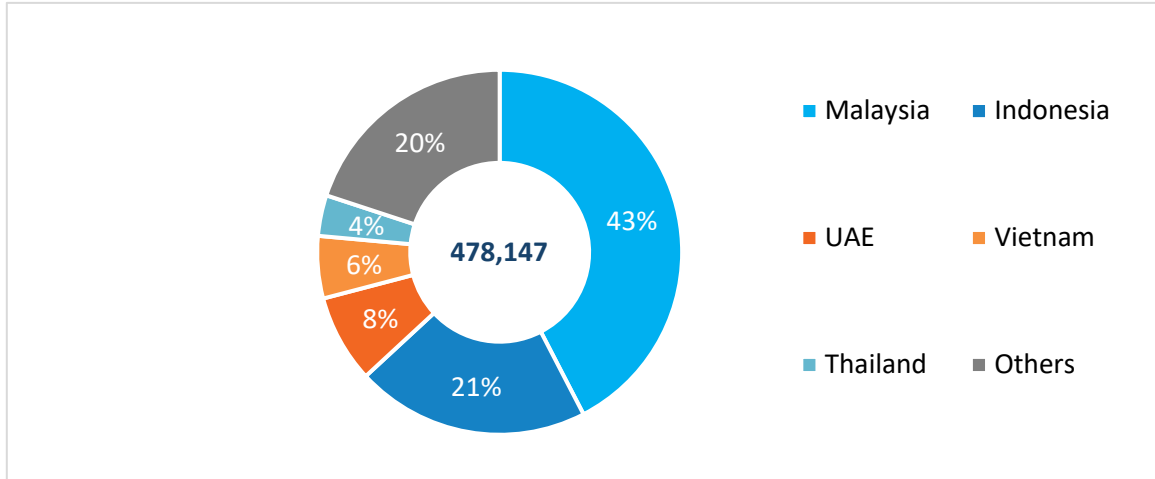
India has always been a net exporter of Maize starch. Globally, India is the largest exporter of maize starch with ~20% of share in 2022. South-East Asian countries are the major importers of maize starch from India.

Exhibit 26: Maize Starch Export by India, 2018-2022



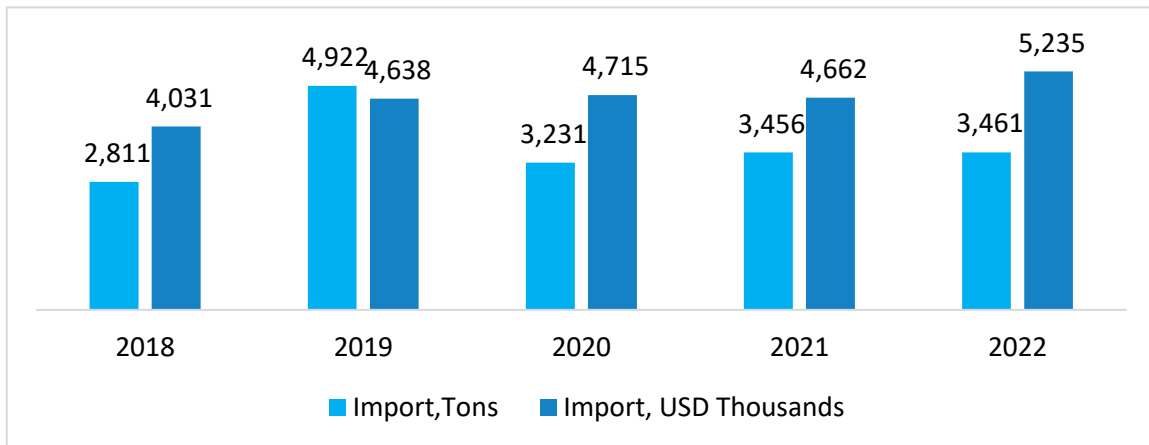
Source: Trademap, Frost & Sullivan

Exhibit 27: Maize Starch Export by India, Tons, 2022



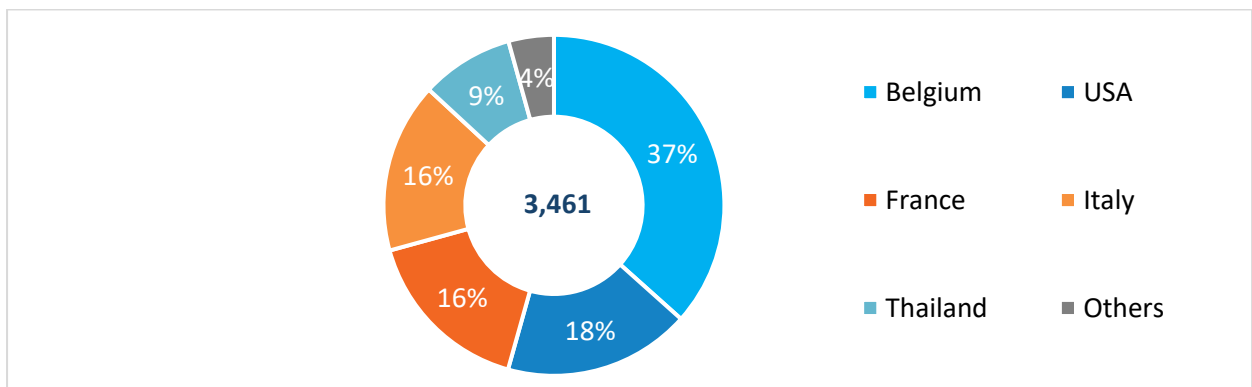
Source: Trademap, Frost & Sullivan

Exhibit 28: Maize Starch Import by India, 2018-2022



Source: Trademap, Frost & Sullivan

Exhibit 29: Maize Starch Import by India, Tons, 2022



Source: Trademap, Frost & Sullivan

3.9. Growth drivers for maize based specialty products and ingredients solutions industry in India

- **Abundant availability of Raw Material** – India is major producer of maize globally. It ranked 6th in the world's maize production and 4th in terms of maize acreage. Across 205.87 Mn Ha, 1.21 billion MT of maize was produced worldwide. Maize is 3rd most grown cereal

after paddy and wheat in India. Rising demand of maize for Ethanol production will also push Indian farmer to increase the productivity in coming years. Thus, abundance in maize availability is allowing many wet millers to increase the plant capacities.

- **Wide range of applications** – Starch has multiple uses across industries. Food industry is largest consumer of maize based specialty products and ingredients solutions. Starch is used in making of western snacks, pudding, salad dressings, noodles, pasta, gravies, and sauces. Sweetener such as liquid glucose is major ingredient in confectionary, candies, gums, cakes, pastries, and other sweet items. Paper industry is one of the key industries where industrial starches is used in large quantities. Cardboard paper uses significant quantities of modified starches, actively and in processing. Starch is also used for manufacturing adhesives. Native and modified starch is used in pharma industry as a tablet and capsule diluent, an excipient, a tablet and capsule disintegrant, as binder or as a glidant. Thus, demand for maize based specialty products and ingredients solutions have diversified applications boosting its demand.
- **Increasing demand for ready to eat category** – With the changed lifestyles, ready to eat/cook foods are gaining popularity. Baby food, chips, baked goods, drinks, candies, sauces, soups, noodles, pasta and ready to eat snacks are some sectors where consumption of starch is increasing. Crispiness, bulkiness/carriers, texturization, humectant, dusting, extrusion, and thickening agent are among some of the functional uses of Maize starch which are essential in ready to eat/cook category. The demand for starch is anticipated to increase in the future, except for textiles, as it is seen as a cost-efficient element with no effective replacements anticipated.
- **Global opportunities** – India is the largest exporter of Maize starch globally. It exported ~478 KT of Maize starch in 2022 which accounted for 20% of global trade. Export volumes have increased by 15% since 2018- 2022. India is also amongst the Top 10 global exporter of sweetener like liquid glucose. With local raw material availability, abled processing sector and good quality at lower cost with further increase the demand of Indian maize based specialty products and ingredients solutions globally.

3.10. Challenges for maize based specialty products and ingredients solutions product in India

- **Rising Prices** - Extreme weather and droughts associated with climate change in EU, Americas have adversely impacted maize crops. Because of the limited supplies prices of maize and thereby maize starch have increased drastically in couple of years. Further limiting the availability of maize, for industrial uses is the growing amount of maize that is allocated to the manufacturing of ethanol due to environmental and regulatory concerns.
- **Substitutes** - Maize starch though seldomly replicable, researchers and innovators are trying to replace it with starches from other crops such as rice, tapioca, and arrowroot.
- **Intense Competition** - A decade ago, there were few global players having hold over maize based specialty products and ingredients solutions markets. But in recent decade, many

small players have started manufacturing maize based specialty products and ingredients solutions This has led to pricing pressures in global markets with some unorganised players compromising on quality.

3.11. Entry and Exit Barriers for Maize Starch Industry in India

Entry Barriers-

- **Capital Costs-** Capital cost for maize based speciality products and ingredient solutions manufacturers are high as it requires elevators, destoners, blowers, tanks, dryers, and many more machineries which requires huge investment by new entrants. Land acquisition could also be a hurdle.
- **Competition-** With presence of giants such as GAEL, Sukhjit Starch, Sanstar Ltd, etc who have well established domestic and exports markets, new entrant will have to face severe competition.
- **B2B nature of business-** Consumers of maize based specialty products and ingredients solutions are the well-established companies in F&B, Pharma, Textile, Paper industry where relations are build over time and it would take new entrant to break through existing client-supplier relations in market.
- **Economies of Scale-** Viable capacities for maize starch milling industry is 500-600 MTD and anything below that would be loss making operation. New entrants must strive for lower production per unit costs to achieve economies of scale.
- **Availability of Raw material-** Maize though widely grown in country, is less available for milling as it has its traditional uses for animal nutrition industry with emerging demand from ethanol producers. New entrant may find it difficult to secure stocks of good quality maize for right price.

Exit Barriers-

- **Investment in specialist equipment** – Investment in specialised equipment makes it difficult to use it in other industries is typically a barrier to exiting the industry.
- **High fixed costs-** High levels of dedicated fixed costs tend to be an impediment to leaving an industry.

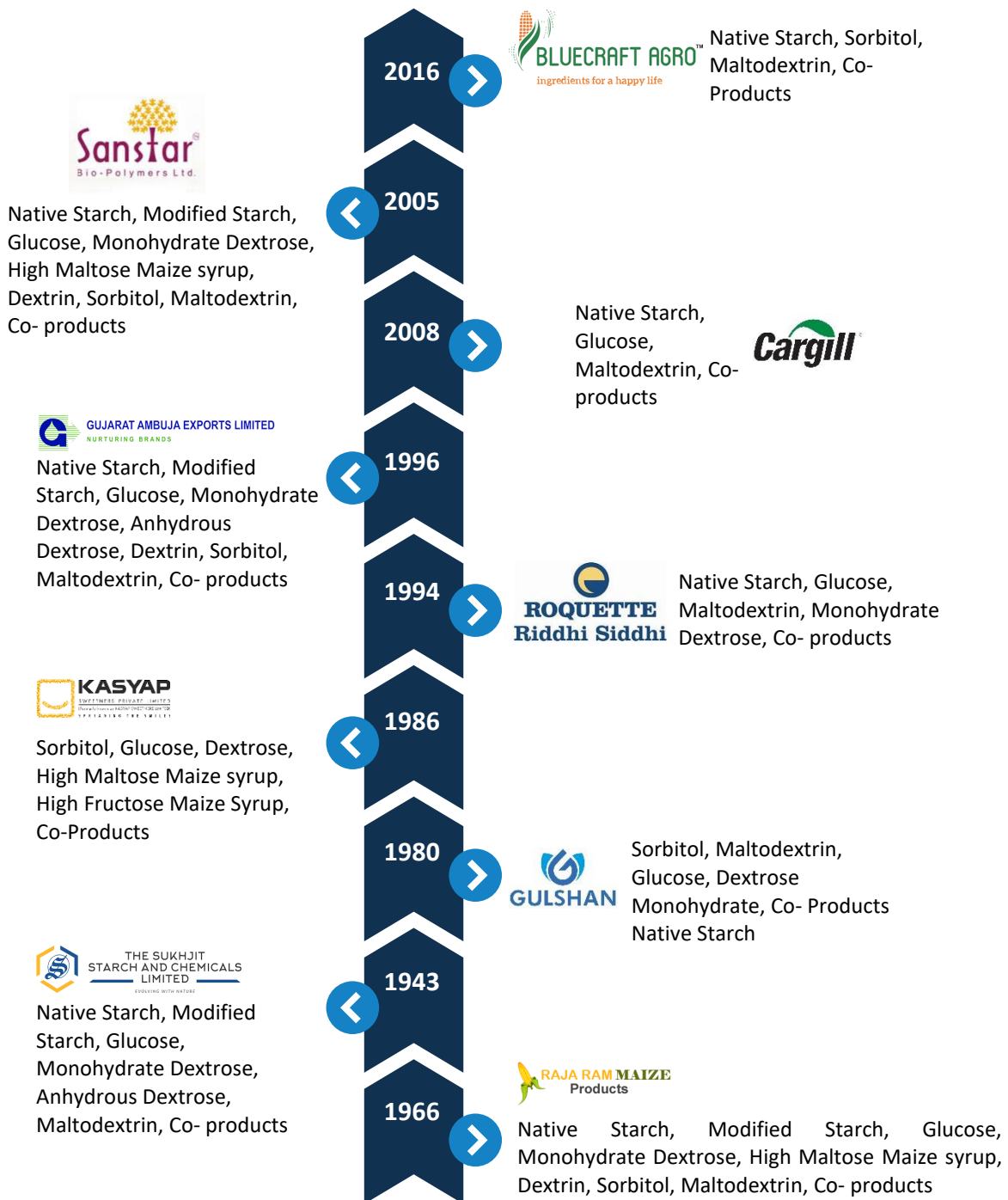
Exit Barriers for Clients

Business to Business (B2B) nature of the maize based speciality products and ingredient solutions business creates significant exit barriers for their customers as well. Maize based speciality products and ingredient solutions find application across diverse end industries globally, including food, pharmaceuticals, animal nutrition, etc. which are subject to stringent rules and regulations across geographies. This leads to customers performing rigorous quality checks and tests on our products right from the sample sharing stage to the commercial production stage, which involve time and resources on the part of customers. Given this, the customers generally do not prefer to change the suppliers frequently and results into the propensity amongst the customers to continue with the same set of suppliers.

3.12. Players present in the maize based specialty products and ingredients solutions market in India and their product offerings.

Maize based speciality products and ingredient solutions is well established industry in India with long history and is based on ongoing innovation to satisfy changing consumer and industrial demands. There are a lot of participants in both the organised and unorganised sectors in this

fiercely competitive maize starch market. In the categories with additional value, such as derivatives and starch, there are medium sized to large firms. Specialized companies offer some niche type of starches used in oil drilling, adhesives and so on. It's a profitable industry with moderate to high capital and technology investment. Some of the major companies in Indian maize based specialty products and ingredients solutions sector are Gujarat Ambuja Products Ltd, Cargill, Roquette, Sanstar, Sukhjit Starch Products and so on.

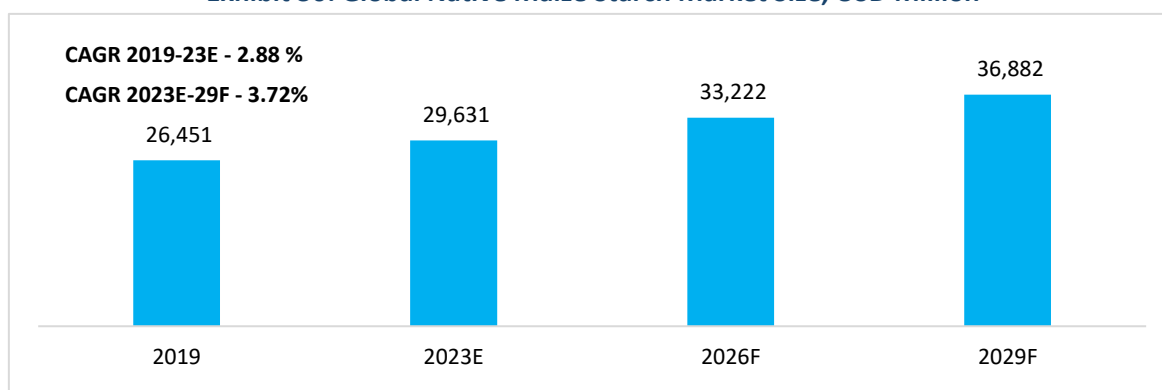


4. Global and Indian Maize Native Starch and Co-Products Industry

4.1. Global Native Maize Starch Market

The Global Native Maize Starch industry is expected to be valued at USD 29,631 million in 2023 with estimated growth rate of CAGR 3.72 % from 2023 -2029. Historically, the native maize starch market grew at CAGR 2.88% from 2019 till 2023E. Increasing demand from Food & Beverages, Textiles, Paper industries clubbed with governments focus to increase productivity of maize is driving the growth the native maize starch market. Use of native maize starch in cosmetics, adhesives and pharmaceutical industry is further fuelling the growth of market.

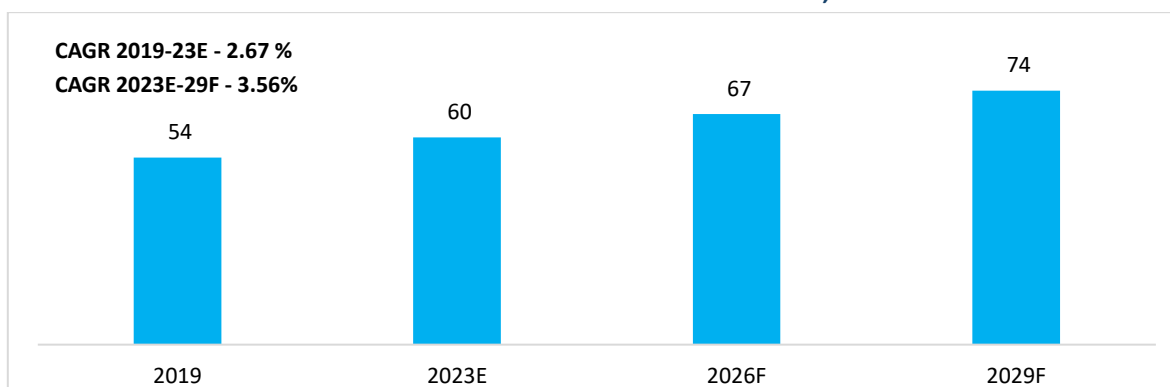
Exhibit 30: Global Native Maize Starch Market Size, USD Million



Source: Industry sources, Frost & Sullivan

In terms of volume, the native maize starch market is expected to be valued at 60 million tons in 2023 having grown at CAGR 2.67% from 2019. The market is expected to reach 74 million tons by 2029 with CAGR of 3.56%.

Exhibit 31: Global Native Maize Starch Market Size, Million Tons



Source: Industry sources, Frost & Sullivan

Native Maize Starch is available in forms like flakes, pearls, coarse or fine powders and larger particles but the powder form is majorly used across globe. Native Maize starches have certain inherent features for use in the development of foods, pharmaceuticals, and industrial products. Specially food industry prefers starch in powder form to be used for pasta, noodles, sauces, salad dressings, ready to eat sausages and so on. Among other advantages, they are readily available, generally low in price, and yield a simple, consumer-friendly label when listed in an ingredient panel.

4.2. Geography-wise Breakup of the Global Native Maize Starch Industry

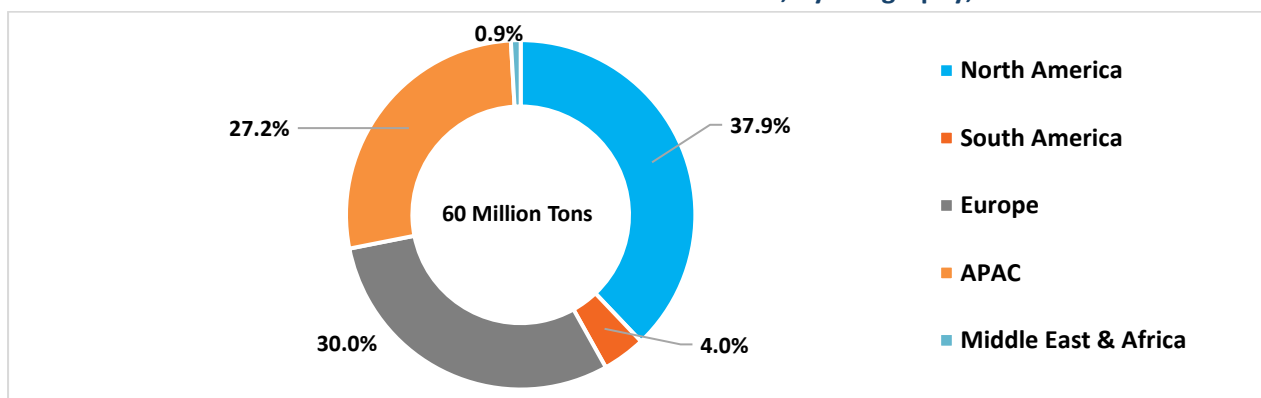
North America is currently the largest market, accounting for 22.9 million tons of the world's consumption of native maize starch in 2023. It is anticipated to reach ~27.6 million tons in volume and increase at a compound annual growth rate (CAGR) of 3.2% until 2029, maintaining its leading position in the maize starch market.

USA leads the world in 2023 production of maize based specialty products and ingredients solutions, followed by European countries.

South America and Middle east and Africa region account for ~4% & ~1% share in global native maize starch industry.

Asia Pasific (APAC) region has seen the highest growth from 2019 to reach 16.4 million tons in 2023E by CAGR 3.0%. It currently accounts for 27.2% in global native maize starch industry. Increasing demand from countries like Indonesia, Malaysia clubbed with growing production and increasing numbers of players in India and Chins is likely to boost the native maize starch market.

Exhibit 32: Global Native Maize Starch Market Size, By Geography, 2023E



Source: Industry sources, Frost & Sullivan

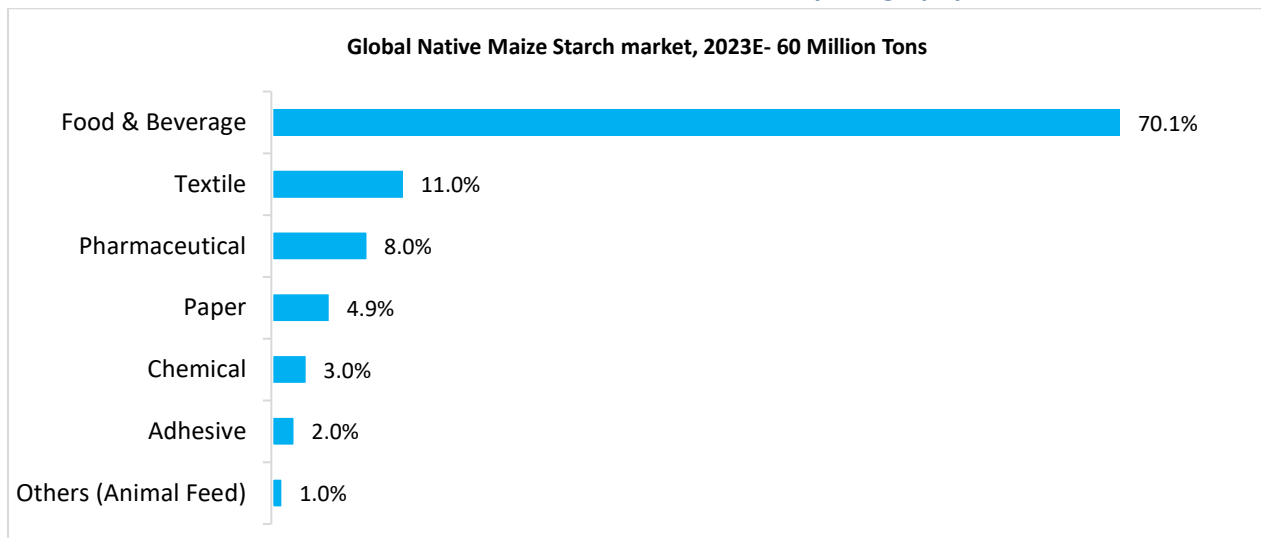
4.3. Application wise breakup of the Global Native Maize Starch

Native maize starch has largest application in food & beverage industry which accounted for ~70.1% in 2023 with volumes ~42.3 million tons. Native maize starch is used as a texture enhancer, thickener, binder, and emulsifier. It thickens soups, gravies, and sauces. It improves the texture of food and beverage products. It usually creates a translucent combination when combined with a cold liquid to generate a slurry, which is then thickened with a hot liquid.

It is also free of gluten, has no fats, proteins, or fibre. It is therefore frequently used in the production of gluten-free baked goods like pasta, bread, and confectionaries. Native maize starch is commonly used in desserts, baby powder, salad dressings, soups, canned and frozen goods, food coating, baking powder, chewing gum, etc.

Native maize starch is used in the paper and textile industries to help in wet end sizing, dry strength, and surface enhancement. This powder strengthens the yarn's resistance to weaving-related stress and aids in maintaining its straightness in the textile manufacturing process.

Exhibit 33: Global Native Maize Starch Market Size, By Geography, 2023E



Source: Industry sources, Frost & Sullivan

The growing demand for clean labelled products due to the surging health consciousness is boosting the market due to growing awareness of the qualities of native Maize starch over modified ones. Moreover, the rising inclination of people towards convenient food solutions, owing to the growing working population and their hectic schedules is anticipated to lead to the growth of the market. Rising cases of obesity in the region has shifted the consumer preference for artificial thickeners which in turns led to the market growth. Furthermore, the expanding varieties of dishes that can be prepared using native Maize starch is also contributing to the growth of the market.

Rising technological advancement and modernisation has resulted in advanced product innovations and diversification in various applications which directly impacts the market growth. In industrial applications, growing demand from pharmaceutical as well as adhesive paper industry has resulted in market expansion.

4.4. Global Manufacturers of Maize Starch

The global native Maize starch market is highly competitive, with several key players dominating the industry. Some of the major players in the market include ADM, Cargill, Roquette, Ingredion, Tate & Lyle, Zhucheng Xingmao, Changchun Dacheng, Xiwang Group, Luzhou Group, and Xi'an Guowei Starch.

- ADM (Archer Daniels Midland) is an American multinational food processing and commodities trading corporation. It is one of the largest providers of Maize starch globally. The company has a strong history in the food industry and has shown continued growth over the years.
- Cargill is another key player in the market. It is an American privately held global corporation and one of the largest agricultural companies in the world. Cargill has a significant presence in the Maize starch market and offers a wide range of starch products.
- Ingredion is a leading global ingredient solutions provider, specializing in sweeteners, starches, and nutrition ingredients. It has a strong presence in the native Maize starch market and offers a diverse portfolio of starch products.
- Tate & Lyle, a British multinational food ingredients company, is also a major player in the native Maize starch market. The company produces a range of starch-based ingredients for various applications.

These companies have a strong history, demonstrated market growth, and significant sales revenues. The market itself is expected to experience substantial growth in the coming years. Manufacturers are focusing on sustainable sourcing and production methods to meet the rising demand for eco-friendly and socially responsible products, further boosting the market's growth prospects. Growing research and development activities for product innovation is creating ample of opportunities to the market along with growing market players in the region will provide a stronghold to the native starch market growth.

On the other hand, Lack of knowledge about consumption of adequate amount of starch can hamper market growth. Fluctuation in raw materials as well as scarcity of labour can challenge market growth in the near future. Native starch has some limitations during process like low solubility in cold water, high viscosity, low gelatinization temperature, high tendency to retrogradation.

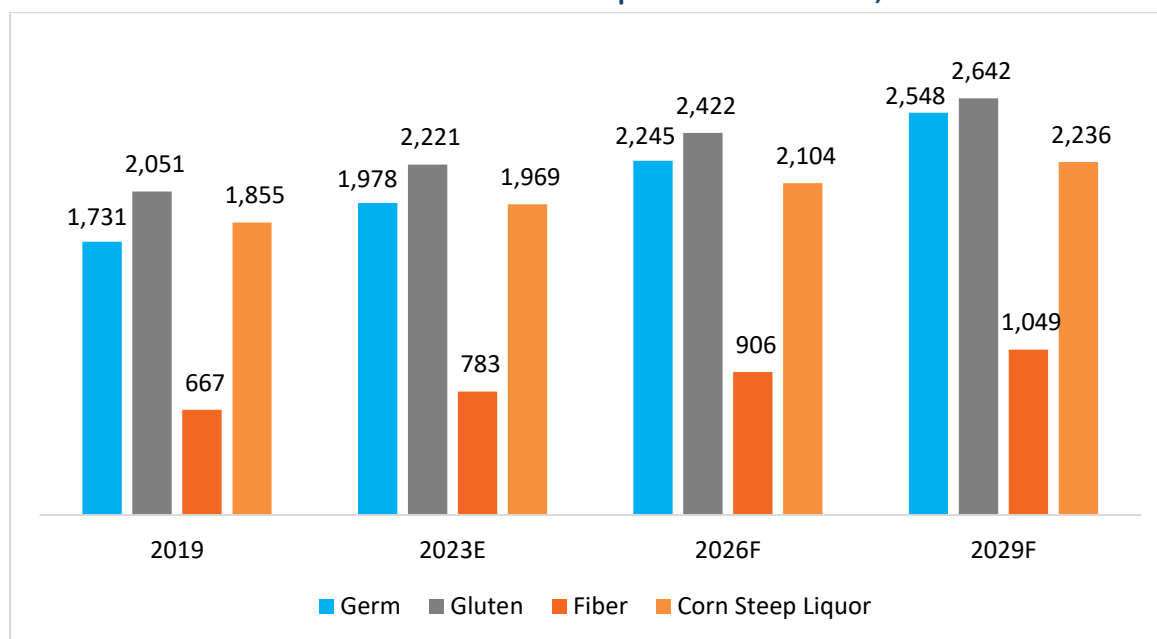
4.5. Global Co- products Market

Residual products such as Germ, Gluten, Fiber, and Maize steep liquor which remain after separating the maize starch slurry during maize wet milling process are categorized as co- products. The current market for Co- products stands at USD 6,950.1 million and is expected to reach USD 8475.3 million by 2029.

Maize Germ market is valued at USD 1,978 million in 2023. It is mostly used in production of feed supplements and the extraction of maize oil. Maize germ also provides as an excellent source of "slow release" starch is high in calories, very palatable and can be easily digested by cattle and poultry.

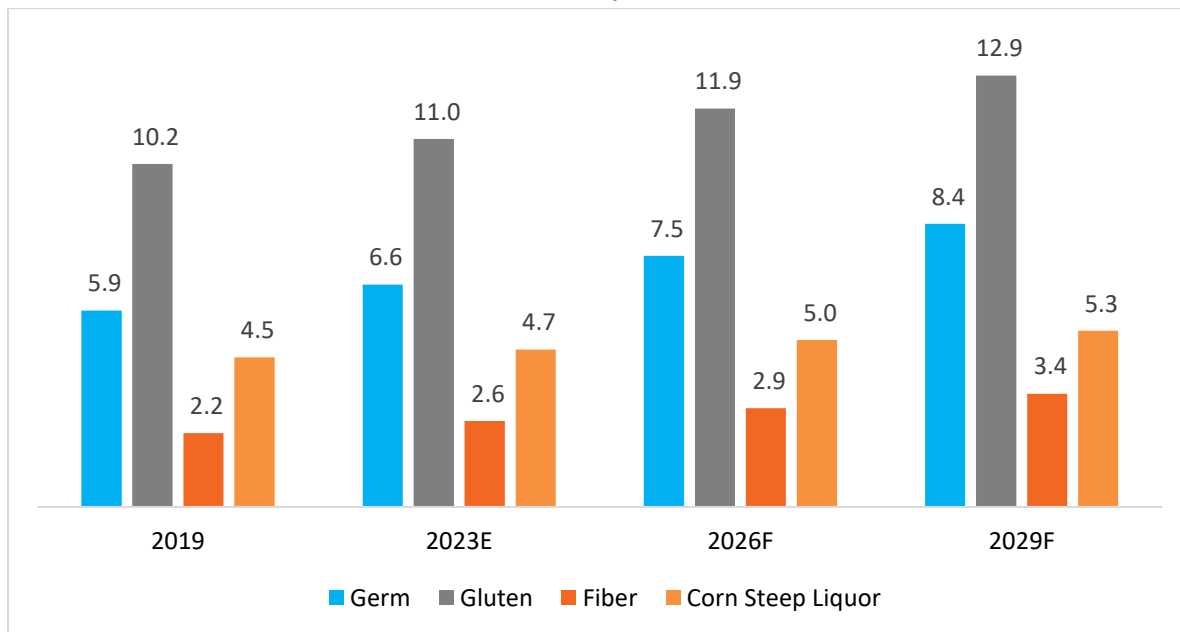
Maize gluten is high fibre component with significant amount of nutritious proteins and starch. It is added to animal nutrition as a supplement to provide them with energy and protein that is easier for them to digest and absorb. Maize gluten market was valued at USD 2,221 million in 2023 with volumes in range of ~ 11 million tons.

Exhibit 34: Global Maize Starch Co-products Market Size, USD million



Source: Industry sources, Frost & Sullivan

Exhibit 35: Global Maize Starch Co-products Market Size, Million Tons



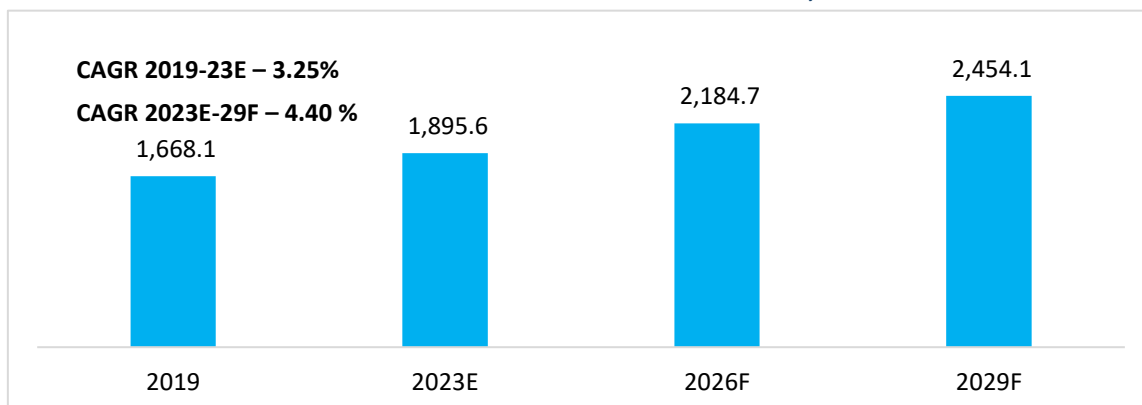
Source: Industry sources, Frost & Sullivan

Maize fibre & Maize steep liquor market was valued at USD 783 million and USD 1,969 million respectively in 2023. Microorganisms use Maize steep liquor as a nutrient in the synthesis of enzymes, antibiotics, and other fermentation products. It is frequently used in feeds for dairy and beef cattle, poultry, swine and pet food. It is occasionally mixed with other components in maize gluten feed.

4.6. Indian Native Maize Starch Market

The Indian native maize starch industry is expected to be valued at USD 1,895 million in 2023 with volume of 4.94 million tons. The market has grown at CAGR 3.25% since 2019 and is further expected to grow at CAGR 4.40% till the forecasted period. The market for maize starch has expanded significantly over the years as a result of new plants that have recently opened with milling capacities ranging from 200 TPD (Tons Per Day) to 350 TPD at the start and gradually expanding till 600-1000 MTD. Many players in Indian maize starch industry are undergoing capacity expansions to cater to increasing global as well as domestic demands. The minimum viable capacity for maize starch in Indian ranges from 600- 800 MTD.

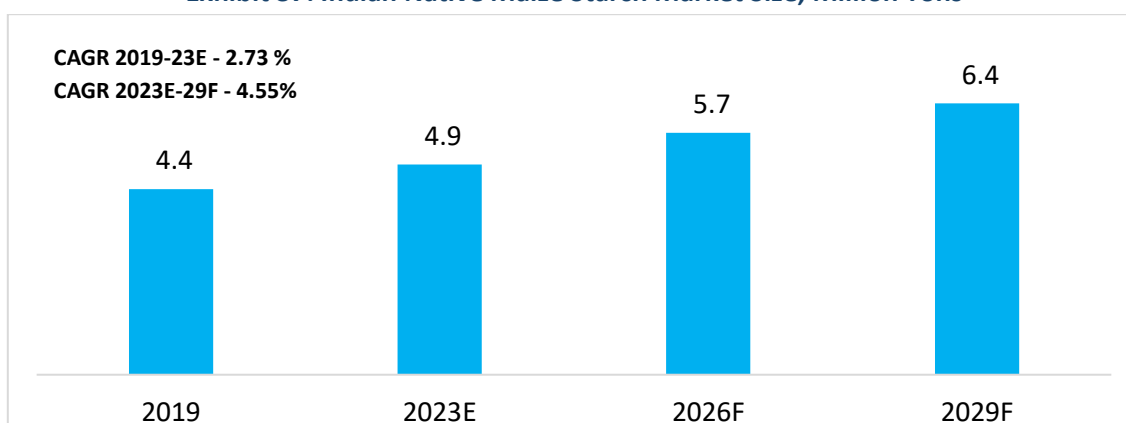
Exhibit 36: Indian Native Maize Starch Market Size, USD Million



Source: Industry sources, Frost & Sullivan

Further the growing applications of native maize starch in pharmaceutical, textile, adhesives, paper and cosmetic industry propelling the growth of native maize starch in India. Native starch is incorporated in a wide variety of consumable products, such as bakery mixes, frozen cakes, sheeted snacks, batter mixes, brewing adjuncts, dry mix soups and sauces, processed meat, pudding powders, cold process salad dressings, dips, and fruit preparations. It is also added to pet food products as native starch is an effective source of energy for dogs and cats and enhances the density and texture of the product. It is used as a stabilizing, thickening, gelling, and moisture-retaining agent. It is also employed to stiffen textiles for improving the appearance of fabrics by imparting a glossy texture. It is widely used as a flocculant, binder, and bonding agent in the paper industry.

Exhibit 37: Indian Native Maize Starch Market Size, Million Tons



Source: Industry sources, Frost & Sullivan

India's installed starch capacity presently ranges between 5.8 and 6.5 MTPA, and the industry is experiencing a surge in expansion activity, resulting in multiple projects to improve/set up new capacities. Industry experts claim that the availability of raw materials in the country and the rise in demand for starch in both the domestic and export markets have increased the capacity for maize based ingredients solution's industry to nearly triple over the past decade.

With a global share of approximately 14.3% in 2022, India stands as the world's top exporter of native maize starch. A relatively small amount of native starch is imported.

The India native Maize starch market is highly competitive, with several key players dominating the industry. Some of the major players in the market include Roquette Riddhi Siddhi Private Limited, Gujarat Ambuja Exports Limited, Sanstar Biochem, Sukhjot Starch & Chemicals Ltd., Sayaji Industries Limited, Universal Starch Chem Allied Ltd., etc.

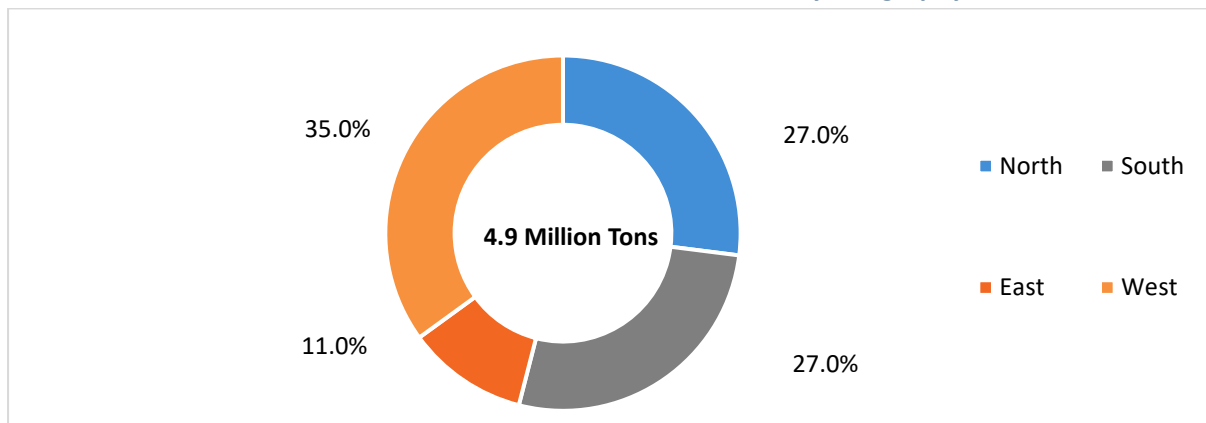
Key end users in domestic market for Native Starch are Mondelez, Parle Products, Nestle, Britannia Industries Limited, Priya Gold, ITC, Dabur, JK Paper Limited, Weikfield Foods, Arvind Ltd., JCT Ltd, Century Pulp & Paper to name a few.

4.7. Geography-wise Breakup of the Indian Native Maize Starch Industry

Diversified end use industries in India create differential demand of native maize starch. Plethora of industries in west zone states such as Gujarat & Maharashtra use native starch for application in pharma, F&B, textile, paper industry.

South and North zone rich paper and textile industry clubbed with F&B industry use native starch.

Exhibit 38: Indian Native Maize Starch Market Size, By Geography, 2023E



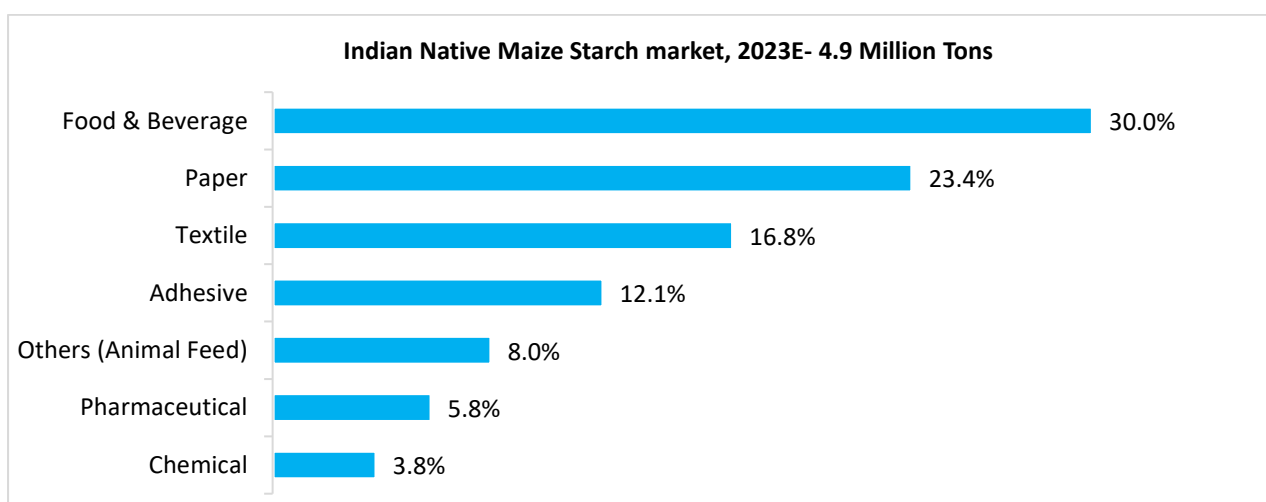
Source: Industry sources, Frost & Sullivan

4.8. Application-wise Breakup of the Indian Native Maize Starch Industry

The food and beverage, textile, paper, adhesive, and pharmaceutical industries are the main end users of maize based specialty products and ingredients solutions. In addition to being used to give cloth weight, strengthen ice cream cones, and improve the quality of writing and printing paper, starch is also employed as a binder and filler for tablets and capsules. The high-value food processing and beverage sector, where there is a significant market for native maize starches, is the most promising of all. The majority of food goods are frozen and ready-to-eat items, with the usage of starch in soup and noodle dishes growing.

About 30% of the local maize starch consumed is used in the food and beverage industry followed by 23.4% by paper industry and ~16.8% by textile industry.

Exhibit 39: Indian Native Maize Starch Market Size, By application, 2023E



4.9. Indian Co- products Market

Maize starch co-products market in Indian was approximately 1.1 million tons in 2023 which was valued up to USD 495.7 Million. Demand for oc- products, especially Maize Gluten and Maize Fiber is increasing in India owing to growing Poultry industry. Animal Nutrition industry which uses Maize Gluten and Oil Cake has experienced a significant growth in the recent past. Maize Fiber is odourless yellow fibrous matter with maximum 12% moisture content. It is considered as an essential component to ensure safe, ample, and affordable animal proteins. When mixed in animal nutrition products, it helps increasing the cattle’s’ milk yield. It is also used as feedstock for the Ethanol production. Indian market for maize fibre is valued at USD 56.7 million in 2023. Enriched fibre is also produced by adding Maize Steep Liquor to dry fibre.

Cattle, Fish and other livestock animals use maize gluten meal, a feed that is high in protein (approximately 65% crude protein, or DM), as a source of energy, and protein. For its excellent protein digestibility, it is also highly valued in pet food. Currently Indian market for maize gluten is valued at USD 161.7 million & ~ 0.23 million tons.

Maize steep liquor is a high-protein, high-energy liquid that is produced by steeping the soluble portions of maize kernels. It is frequently used as an addition in animal nutrition, particularly for ruminants.

In animal nutrition, it serves as a binding or pelleting agent. Due to its excellent nutritional value—it is high in vitamins, lactic acid, and proteins—and its utility to the pharmaceutical and enzyme industries is particularly noteworthy.

Many of India's small-scale maize milling operators trash the grain or turn it into fuel. However, discarding large amounts of Maize steep liquor could cause the allowed limit for effluent discharge to be exceeded.

Exhibit 40: Indian Maize Starch Co-products Market Size, USD million

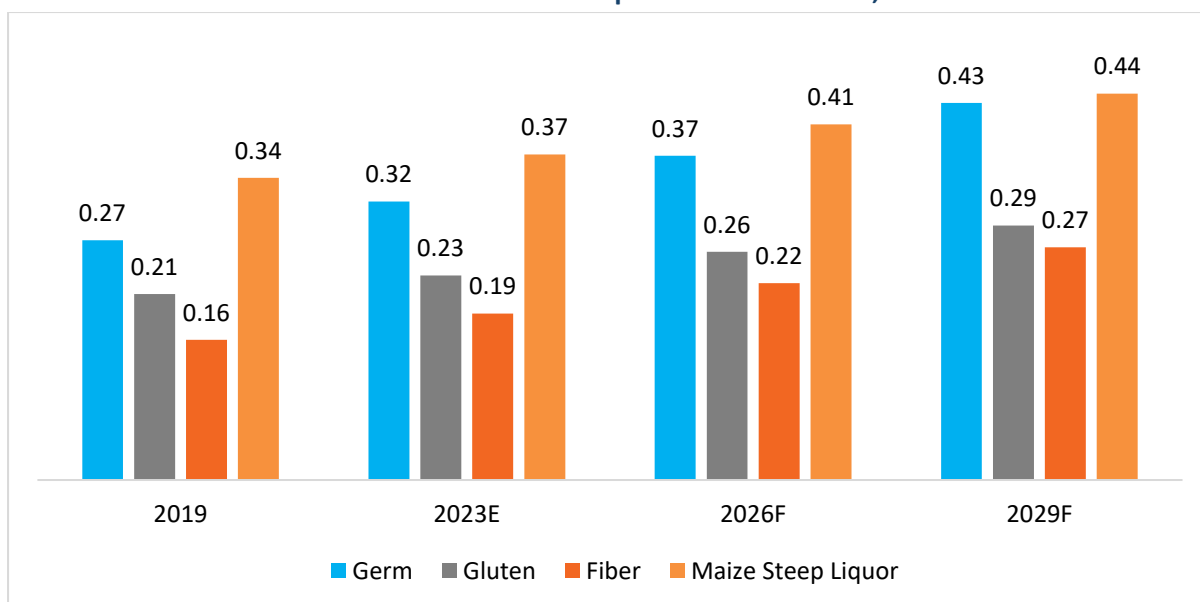
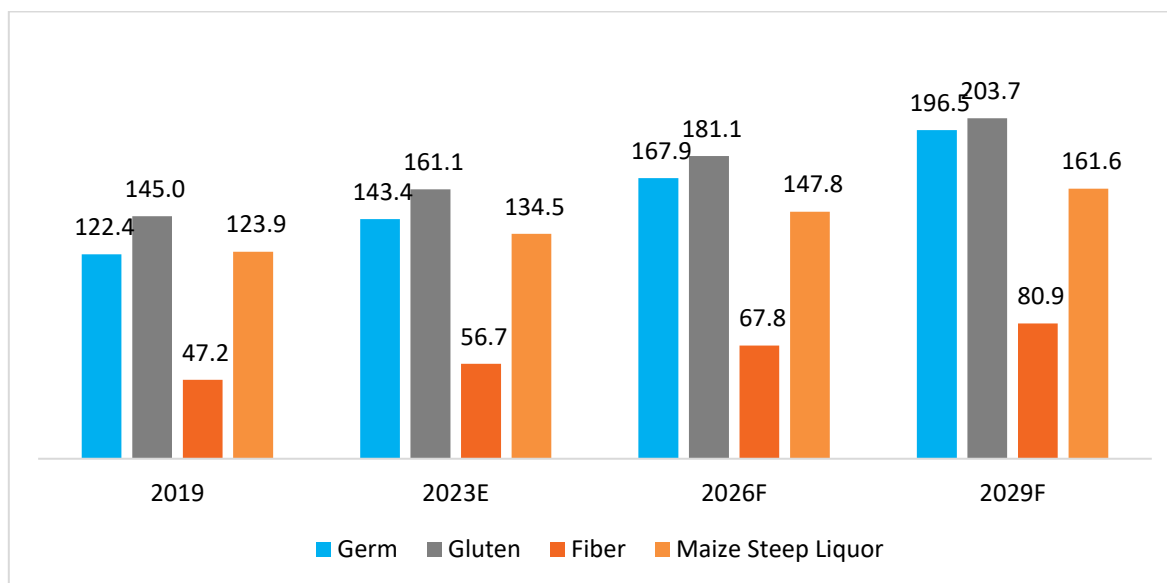


Exhibit 41: Indian Maize Starch Co-products Market Size, Million Tons



Source: Industry sources, Frost & Sullivan

These co-products are sold directly to dealers or end users by maize-based speciality products and ingredient solutions companies. Due to their low profit margins, the industry is moving towards selling these co-products directly to consumers.

Applications of Co-Products: -

- **Germ-** Maize germ can be processed into maize oil, which can then be further processed in manufacturing of oil, margarine, mayonnaise, salad dressing, soaps, and a variety of other products. Food & beverage application for germ i.e., maize oil will be ~40-45%. After the extraction of the maize oil from the germ, the residue is used in maize germ meal as animal nutrition which contributes to ~50-55%.
- **Gluten-** Maize gluten is 100% used for the cattle nutrition products. It is also used in poultry industry as a meal for broiler, chickens and laying hens.
- **Fiber-** Maize Fiber is ~95 % used in animal nutrition. It can be mixed with concentrated steeping liquor for making animal nutrition products. It is also used to thicken processed foods like cereals, baked goods, dairy products, protein bars, and salad dressings but on very limited occasions.
- **Maize Steep Liquor-** It is used in combination with other ingredients in maize gluten feed and widely used in complete nutrition products for dairy and beef cattle, poultry, swine, and pet foods. ~70% application is in animal nutrition products with remaining 30% used in pharma industry as good additive for microbial growth media.

4.10. Comprehensive study and analysis of restraints and opportunities influencing the growth of the segment.

Opportunities

- Low per capita consumption of starch compared to North America and Europe
- Increasing demand for ready to eat foods which uses maize starch in large quantities.
- India is amongst top exporters of maize starch, and demand keeps increasing.

- Uncertainty in sugar prices along with side effects has led to increasing use of maize based specialty products and ingredients solutions such as liquid glucose, sorbitol, maltitol, etc.
- The acetates and alcohols (derived from petroleum) used to help laminate graphics onto cardboard and the latexes that are used as binders in paper coatings are being replaced by adhesives derived from maize starch.
- When maize starch and polymers are mixed, a super absorbent is produced that is used in bandages, sanitary napkins, disposable diapers, and baby powders. It may also be used to clean up pesticide spills and extract water from gasoline.
- Increasing health-conscious consumers is leading to increased demand for vitamins and nutraceutical products in form of swallowable tablets, hard capsules, blends, granules and pellets premix. Maize starch is vital ingredient in production of these products.
- Demand for the maize is so high in fact that buyers, such as poultry feed makers, pay in advance before collecting maize directly from the growers.

Restraints

- Increasing demand for maize by different sectors- Feed manufacturers, Ethanol manufacturers, F&B industry leads to put strain on supply of demand for maize starch industry.
- Increasing competition by local unorganized player in maize-based speciality products and ingredient solutions industry.
- Capacity to dry maize up to the level of 14% is limited which leads to wastage and loss to farmers.
- Quality concerns may hinder export opportunities.
- Price fluctuation of maize due to global volatility in supply demand scenario increases risk for maize based speciality products and ingredient solutions providers.

4.11. Organic Starch

Organic Starches are naturally forming hydrocarbons whose raw material sources are organic certified, kosher – HALAL approved and processed by organic, non-GMO seeds. Some of the common raw material sources of organic starch are - potatoes, maize, waxy maize and wheat. These are further processed by mechanical processes at starch mills to produce starch without the use of any chemical, solvent and additives.

Starch being an important thickening agent in puddings, soups, sauces, snacks and gum or jelly products among many other instant/ ready to eat products, serves as an important commodity in the organic food industry. Apart from this, organic starch is used for several downstream processing industries such as confectionery, nutraceutical, and pharmaceutical industries. Rising demand for organic food including organic instant soups, sauces, and gravies has been on the rise to ensure that these products have the right consistency and taste, while catering to the clean label conscious consumers.

The Global Organic Starch market is estimated at ~ USD 33.84 billion in the year 2023. Global companies such as Agrana have been promoting the use of organic starch from potato, maize and waxy maize feedstocks for 25 years. This has enabled them to cater to the organic & GMO-free trend that promotes clean label and set themselves apart to cater to production of organic maize starch, maltodextrin, and dextrose. Company offers organic wheat starch and wheat protein from their production facility in Pischelsdorf, Lower Austria to cater to the European

market. In recent years, Wheat Starch and Wheat Gluten have transformed into specialty, value-added products.

In the Indian scenario, the consumption of Organic Starch and Syrups is still at a nascent stage. Only a handful of players such as Sanstar Ltd., Aryan International and Ekta International among few others are operating in this niche market with few takers. Sanstar Ltd. is one of the pioneers in Organic Starch Production with production capacity of around 1,000 MT/month of Organic Starch as of 2023. In terms of procurement, company buys certified organic maize on trace net; and do separate processing of the same; and product again a transaction certificate certified by APEDA and SGS and tested by labs for the organic certification of the product.

The Indian market is expected to gain traction toward Organic Starch uses and exports to markets including USA & Australia. This will put Sanstar at a favourable position to cater to the Indian & Exports Market when the consumer focus shifts and demand increases.

Growth Drivers for Organic Starch

- Increased use of organic starches in plant-based foods market/ Alternative meat market is showing exponential growth
- Increasing consumer consciousness for clean label food products
- Stringent regulations on synthetic additives in food, pharma, and nutraceutical industry
- Changing consumer lifestyles and food preferences along with growth in per capita income.
- Increased adoption of non-GMO sustainable practices among manufacturers

4.12. Regulatory Landscape including Subsidies (India)

- The FSSAI states that modified maize starch may be used up to a maximum concentration of 0.5% by weight in coatings, confections, flavors, dairy products (where the use of an emulsifier or stabilizer is permitted by laws), glazes, icings, gravies, sauces, soups, and glazes.
- Modified Starches can be utilized at a maximum concentration of 5% by weight in salad dressing/mayonnaise, baked goods, snack foods, and frozen potato products.
- To reduce hazardous pollutants, the Indian government has mandated the installation of ETPs (effluent treatment plants) for the maize processing industry. Using the treated water for agricultural uses is allowed up to a BOD level of 30 PPM. The Indian government's Ministry of Environment and Forests is also able to provide financial assistance in the form of a capital subsidy.
- Acid treated starch may be utilized in sugar confectionery on a GMP basis. • In some products, the statutory permissible limit of usage of starch is still very low in India compared to the permissible limits in other American and European countries. The government may consider and thereby make necessary amendments in the permissible limits.
- Although shifting trade barriers and changes in agricultural policy are frequently seen as factors influencing business change, they are typically of secondary importance because they are frequently an attempt to shield local interests from the pressures of supply and demand brought on by these variations in growth patterns.
- The Food Safety and Standards Authority of India (FSSAI) altered the laws governing the use of modified starches in food in the course of 2016. The previous dosage limit of 0.5 percent for

modified starches in processed foods can now be replaced by GMP (good manufacturing practice) dosages under the new legislation.

5. Native Maize Starch Based Derivatives Products Industry Overview

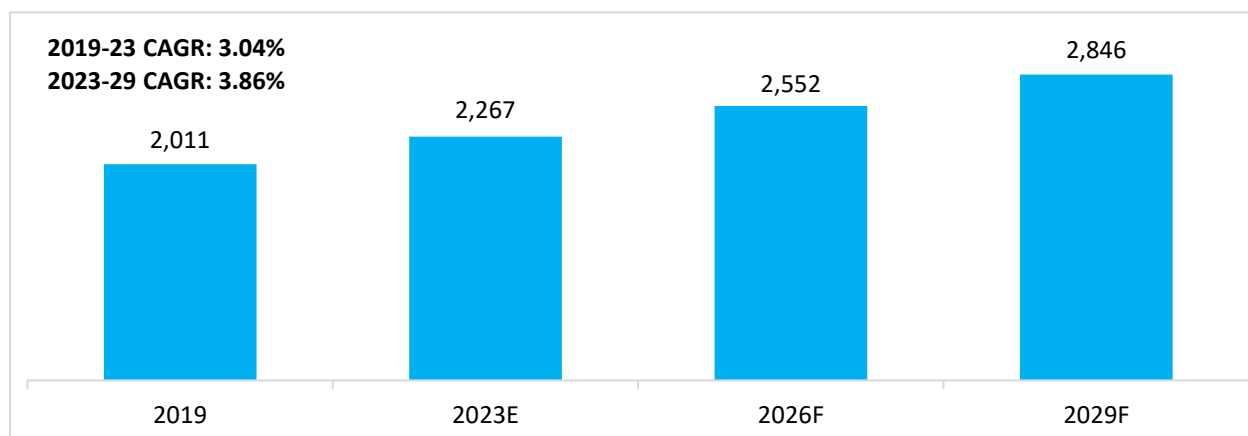
A] Global Derivatives Market

5.1. Global Glucose Market

The global glucose market size is estimated at USD 2,267 Mn in 2023 and is expected to expand at CAGR of 3.86% from 2023 to 2029 to reach USD 2,846 Mn by 2029. In value terms the market is around 4.7 Mn MT in 2023 and will grow to 5.8 Mn MT recording a CAGR of 3.57%.

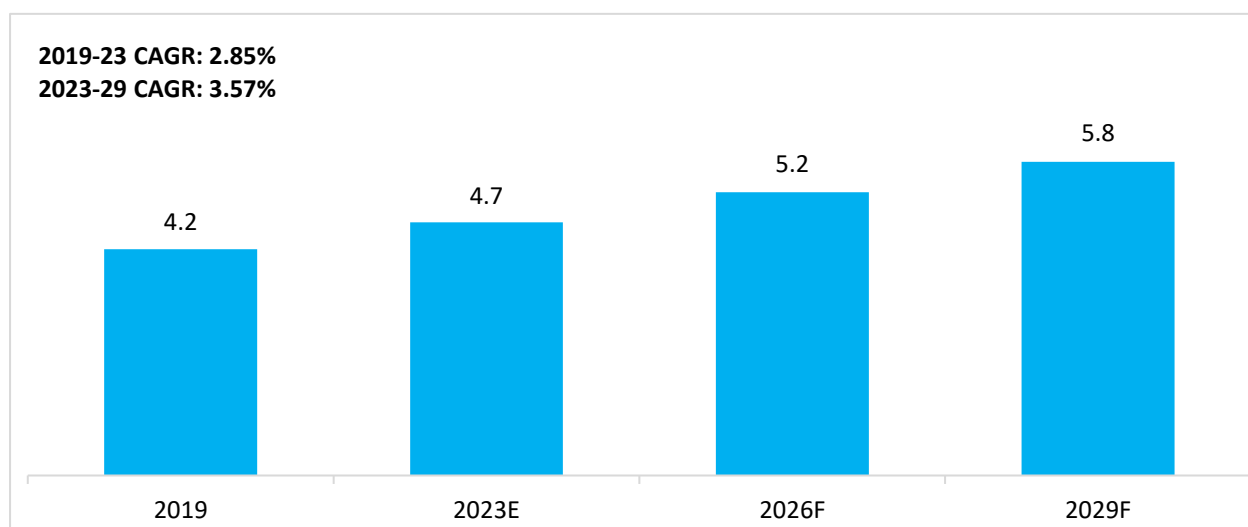
Liquid Glucose is majorly used as sweetener. It is also used as a texturant, volume enhancing agent, and flavorant and also helps in the prevention of sugar crystallization of sugar molecules in F&B products. The increasing demand for soft drinks, confectionery and bakery products in the food and beverages sector is fuelling the growth of this market. Further, increasing demand for aerated and non-aerated drinks drives the demand for Liquid glucose, as it is widely used as a sweetener in these beverages.

Exhibit 42: Global Liquid Glucose Market, USD Million, 2019-2029F



Source: Frost & Sullivan Primary Research & Analysis

Exhibit 43: Global Liquid Glucose Market, Million Tons, 2019-2029F

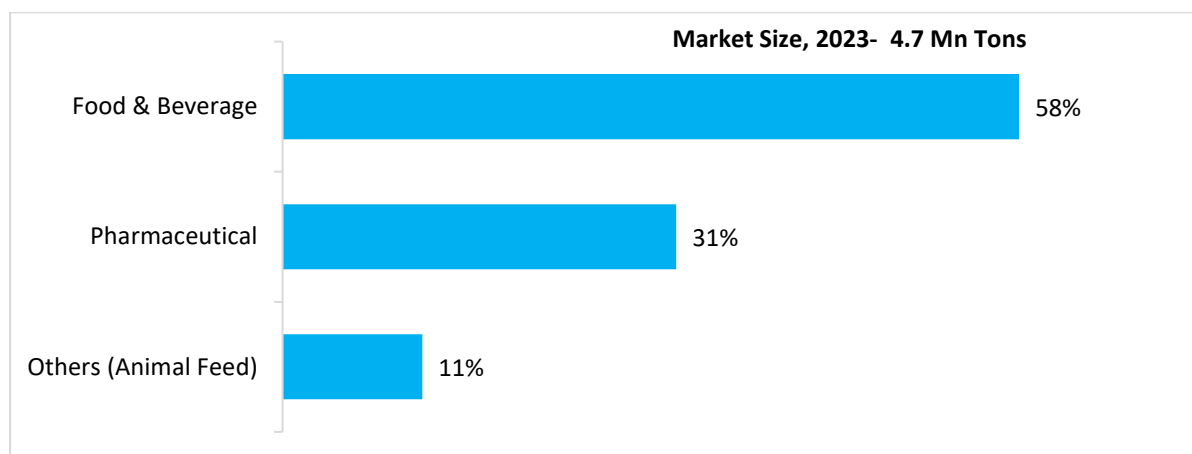


Source: Frost & Sullivan Primary Research & Analysis

Liquid Glucose has wide application in Food & Beverage sector. It is used in the production of frozen desserts and candy. It is also used to add sweetness to baked goods. In some confectionary items it can be used as a necessary ingredient up to the extent of around 40%. It is generally used in the production of homogeneous confectionary products such as chewing gums and chocolates. Liquid glucose also has good preservative qualities, imparts a smooth texture to the end products, and enhances the shelf life of the end product. This has led to increased demand for glucose in the confectionary product segment.

Apart from F&B, glucose has high demand across pharmaceutical industry. It is used as flavour enhancer, adjuncts, texture enhancer, humectants, stabilizer, preservative, and coating and bulking agent. It is also used as a humectant in personal care products. It helps bind moisture to skin, adds flavor to facial cleansers and lip balms, and is also a part of many prebiotics that help reinforce skin's microbiome.

Exhibit 44: Global Liquid Glucose Market, By Application, 2023



Source: Frost & Sullivan Primary Research & Analysis

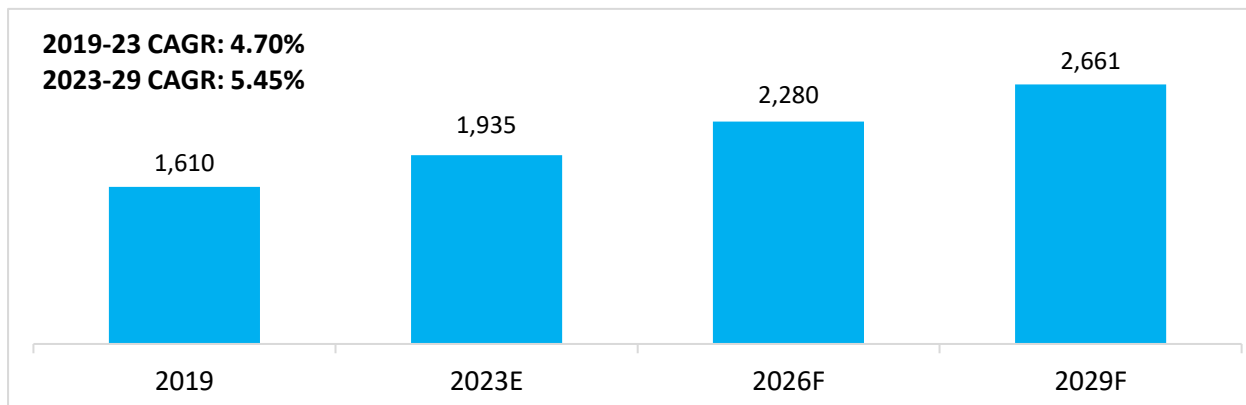
Cargill, Agrana, ADM, DGF Service, Ingredion, Karo Syrup, Dr. Oetker, Grain Processing Corporation, MEFSO, Queen Fine Food, Roquette and Tate and Lyle among others, are the major players in the global liquid glucose market.

5.2. Global Maltodextrin Market

Maltodextrin is a natural food ingredient, which is easily digestible, being absorbed as rapidly as glucose and is either moderately sweet or almost flavourless. It has vast applications in infant baby foods, instant food products, dairy products, confectionary, soups, and salad dressings. It is extensively used as a stabilizer, thickener, and filling agent. Maltodextrin is composed of maltose, polysaccharides, oligosaccharides, and glucose. Hydrolysis of starch, refinement, and spray-drying are all steps in the production of maltodextrin, which is 15-20% equal to dextrose. Maltodextrin is one of the artificial sugars with a mild, sweet taste.

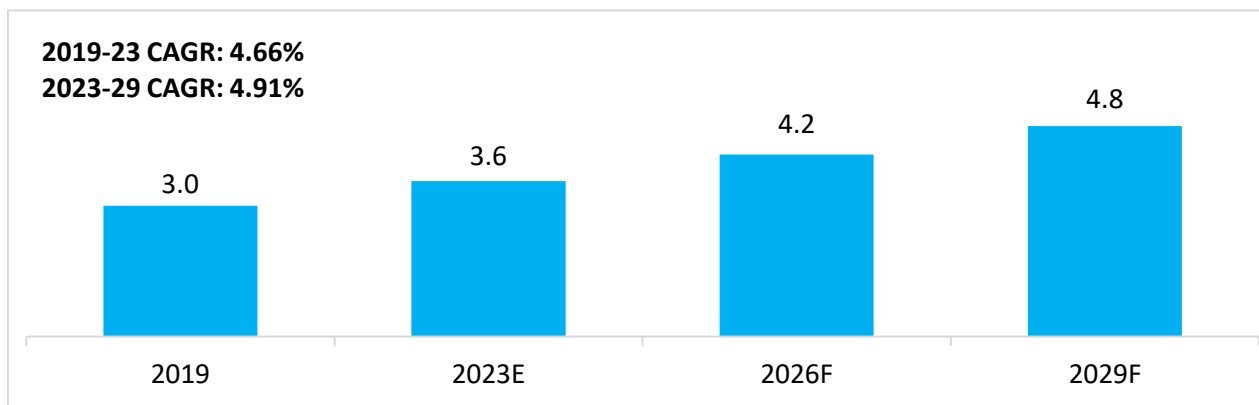
Global Maltodextrin market was valued at USD 1,935 Mn in 2023. The market has been projected to expand at a CAGR of 5.45% to reach the value of USD 2,661 Mn in 2029. In volume terms the market is around 3.6 Mn MT in 2023 and will grow to 4.8 Mn MT recording a CAGR of 4.91% in 2029.

Exhibit 45: Global Maltodextrin Powder Market, USD Mn, 2019-2029F



Source: Frost & Sullivan Primary Research & Analysis

Exhibit 46: Global Maltodextrin Powder Market, Mn Tons, 2019-2029F



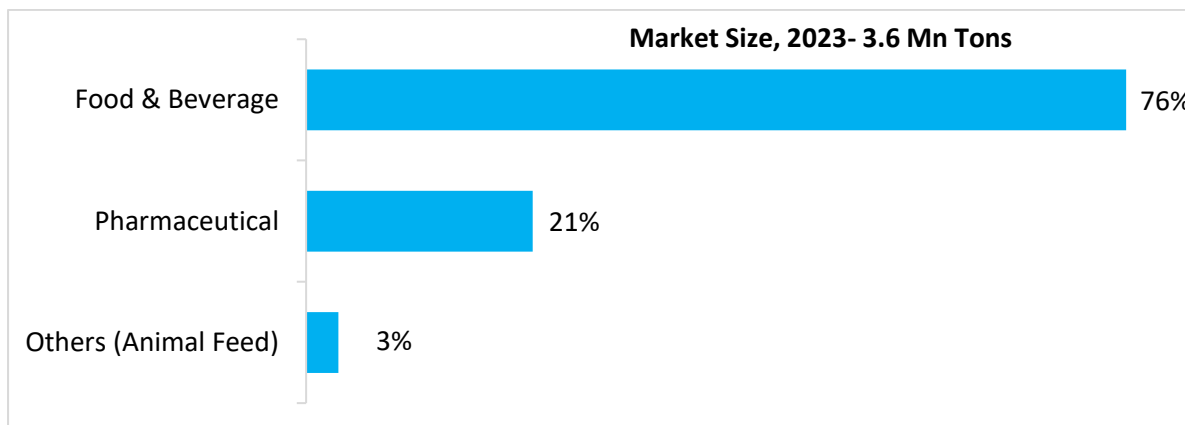
Source: Frost & Sullivan Primary Research & Analysis

Maltodextrin is commonly used as a food additive and is present in various packaged foods such as seasonings, cereal, potato chips, desserts, soups & sauces, canned fruits, snacks, spice mixes, baked goods, instant pudding, salad dressings, nutrition bars, sauces, yogurt, sugar-free sweeteners, cake mixes, and meal replacement shakes among others. In comparison to sugar, maltodextrin has fewer calories, owing to which it finds application as a sugar substitutes. In addition, maltodextrin is also being used as binding, crystal inhibition, and plasticizing in confectionary for candy coating, soft-centre candies, glazing, and frosting, for snack and nut coating. Maltodextrins are also being used to improve the hygroscopic features in hard candies. To produce any food or beverage items, it is used in very small quantities, so that it does not cause any hindrance to the fat, fibre, and protein content of that product. Moreover, maltodextrin is also considered a multi-functional ingredient in the food and beverage industry owing to which it is facing very higher demand across the globe.

Apart from the food and beverage industry, maltodextrin is also used in the pet food, and Animal Nutrition industry owing to its functional properties such as stabilizing, thickening, anticaking, and bulking. Maltodextrin is also being used to produce various products associated with livestock feed and their health. Maltodextrin-based food products support the digestive health of cattle and pets, owing to which it is widely being used to produce pet food and animal nutrition products.

It also has applications in pharmaceutical and supplements industry where it is majorly used as diluents. It is also used as tablet Binder, Coating Agent, and Viscosity- Increasing Agent.

Exhibit 47: Global Maltodextrin Powder Market - Application, 2023



Source: Frost & Sullivan Primary Research & Analysis

The APAC region is projected to be the fastest growing Maltodextrin market for F&B segment, owing to the rising demand for low-caloric food in the region and the large-scale availability and affordability of Maltodextrin in the region. Furthermore, the rapidly growing convenience food and personal care industries in APAC region have led to an increase in the consumption of Maltodextrin products.

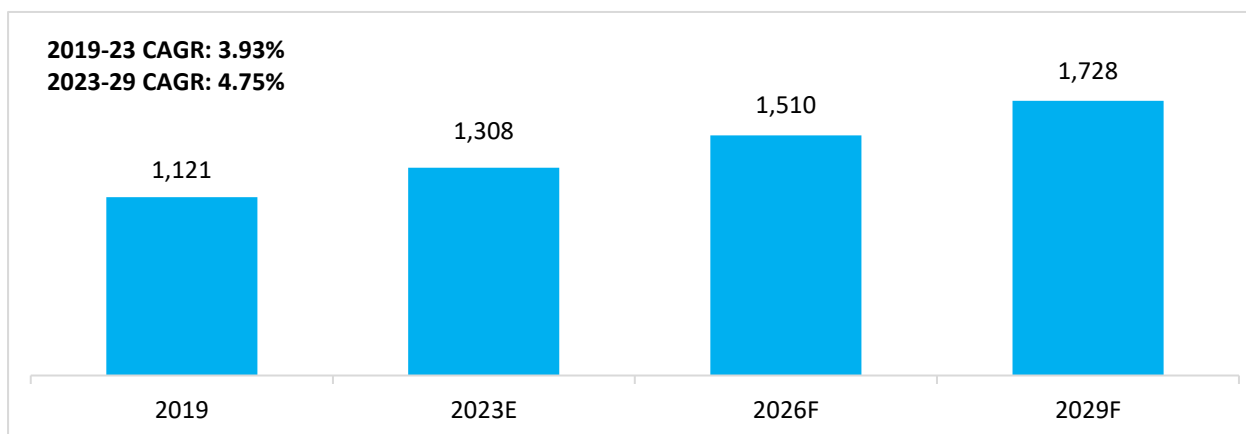
Some of the key players in maltodextrin industry are Cargill, Archer Daniels Midland Company, Ingredion Incorporated, Roquette, Tereos, Tate & Lyle, Agrana, Tate & Lyle, AGRANA, Matsutani Chemical Industry Co., Ltd. and Global Sweeteners Holdings Limited

5.3. Global Dextrose Monohydrate Market

Dextrose Monohydrate (D-glucose) is a sugar that's a stable, odourless, white crystalline powder or colourless crystal. In its pure form, it has a dextrose equivalency (DE) of 100, which indicates that it's 100% pure Dextrose, not a mixture with other substances as well. Dextrose Monohydrate is the monohydrate form of D-glucose, a natural monosaccharide and carbohydrate. Pharmaceutical is the major application for Dextrose Monohydrate.

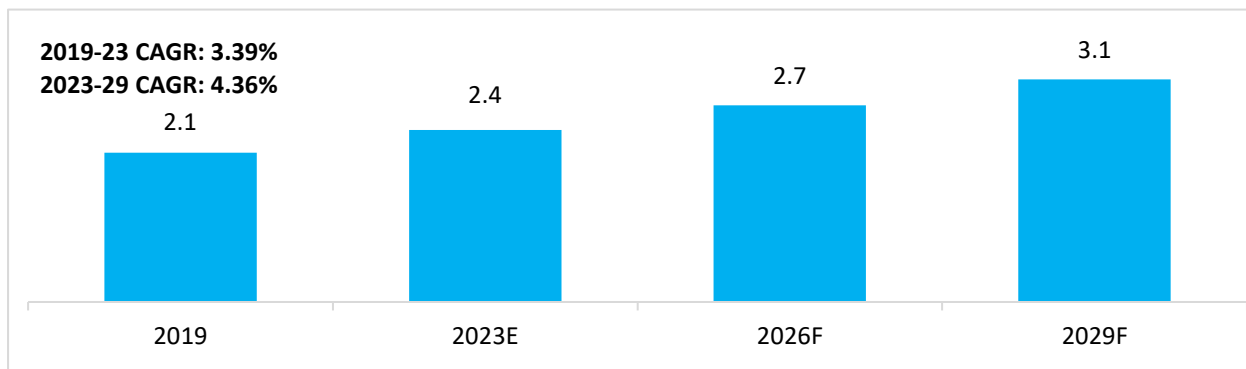
The global dextrose monohydrate market was valued at USD 1,308 Mn in 2023 and is forecasted to expand at a CAGR of 4.75% to reach valuation of USD 1,728 Mn by 2029. In volume terms the market was around 2.4 Mn MT in 2023 and will grow to 3.1 Mn MT recording a CAGR of 4.36%.

Exhibit 48: Global Dextrose Monohydrate Market, USD Mn, 2019-2029F



Source: Frost & Sullivan Primary Research & Analysis

Exhibit 49: Global Dextrose Monohydrate Market, Mn Ton, 2019-2029F



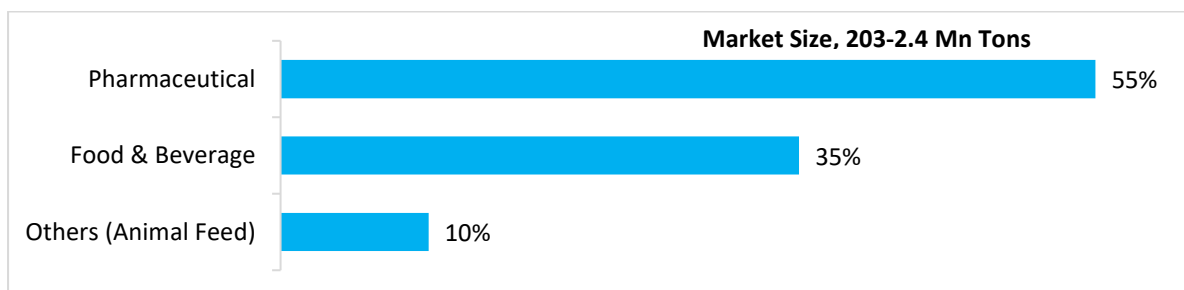
Source: Frost & Sullivan Primary Research & Analysis

In pharmaceutical application, Dextrose serves to replenish lost nutrients and electrolytes. The agent provides metabolic energy and is the primary ingredient in oral rehydration salts (ORS) and is used in intravenous (IV) fluids to provide nutrients to patients under intensive care who are unable to receive them by the oral route. Solutions containing dextrose restore blood glucose levels, provide calories, may aid in minimizing liver glycogen depletion and exerts a protein-sparing action. Dextrose also plays a role in the production of proteins and in lipid metabolism. Dextrose has a caloric value of 4 Kcal/g which produces a rapid glycaemic response. It provides an immediate source of energy for the organs, muscles and brain.

It is also used in food industry and can provide support in replacing sucrose in baking, dairy products, canned products, chewing gum and preserves. Dextrose monohydrate is widely used in confectionery, beverages, biscuits, bakery products, gum, creams, and frozen dairy products alcoholic beverages, jarred and canned foods for better taste and quality. Other than this, it is also used in beverage powders, in caramel colouring and other compositions where it supports extended shelf life of the products. The presence of dextrose also supports keeping powdered beverage drinks free flowing.

To increase the taste and shelf life of the products, manufacturers of beverages, confectionary, and bakery goods are focusing on natural ways to keep their portfolios fresh for a longer amount of time. Dextrose made from natural ingredients plays a crucial part in the preservation process as it does not hydrolyse in the same way as sucrose does, allowing many food products to have a longer shelf life.

Exhibit 50: Global Dextrose Monohydrate Market, By Application, 2023



Source: Frost & Sullivan Primary Research & Analysis

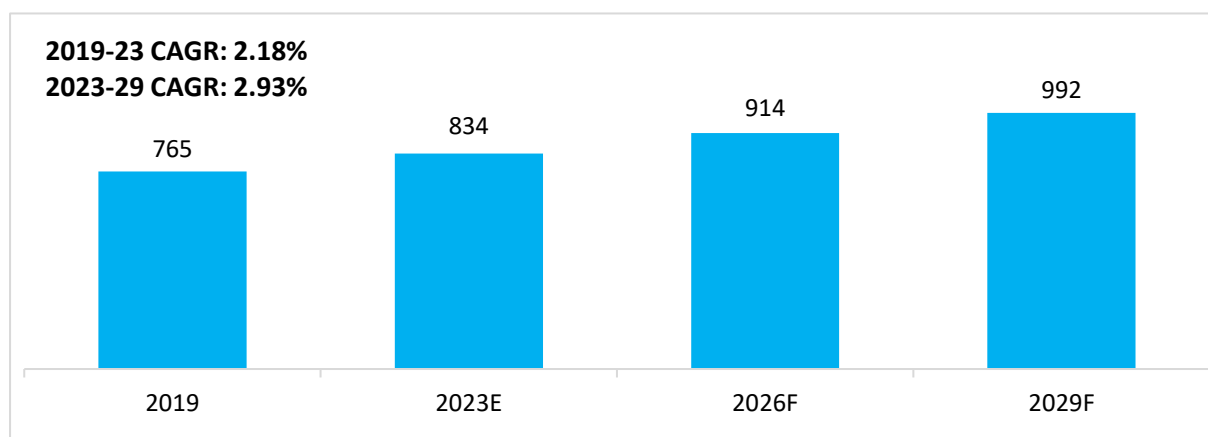
Among the key players- Archer Daniels Midland Company, Cargill, Tate & Lyle, Roquette, Tereos, Sinofi ingredients, Belgosuc, Penta Manufacturing Company, Global Sweeteners Holdings Limited and Foodchem International Corporation are the major ones.

5.4. Global Dextrose Anhydrous Market

Anhydrous Dextrose is the anhydrous form of D-glucose, a natural monosaccharide and carbohydrate. This product has a natural low water content compared to dextrose monohydrate thereby providing superior stability. It is majorly used in nutrition supplement and as sweetener in food & beverage industry. Apart from food, it is also used in animal nutrition and pharmaceutical industry. It is also used in infant formula to improve nutrition value.

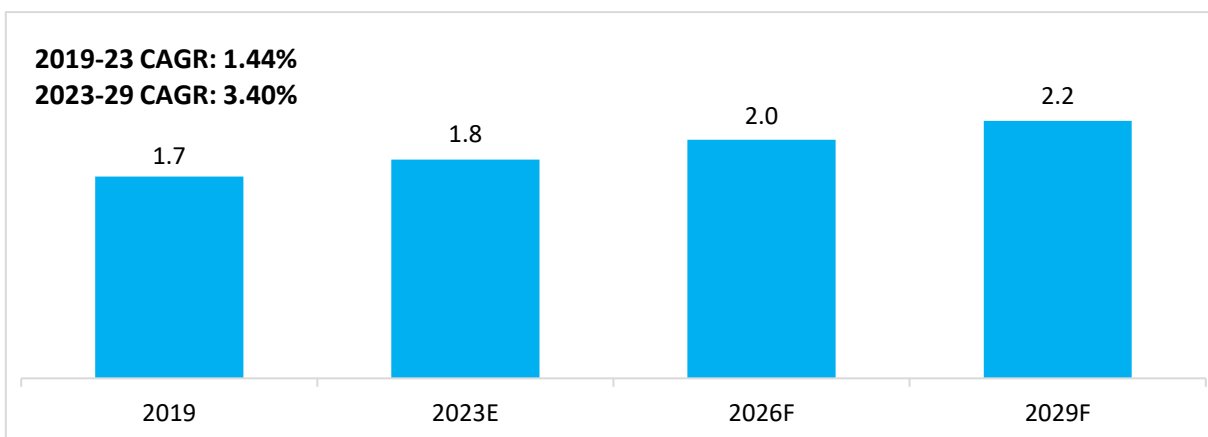
The global dextrose anhydrous market was valued at USD 834 Mn in 2023 and is forecasted to expand at a CAGR of 2.93% to reach valuation of USD 992 Mn by 2029. In value terms the market was around 1.8 Mn MT in 2023 and will grow to 2.2 Mn MT recording a CAGR of 3.40%.

Exhibit 51: Global Dextrose Anhydrous Market, USD Mn, 2019-2029F



Source: Frost & Sullivan Primary Research & Analysis

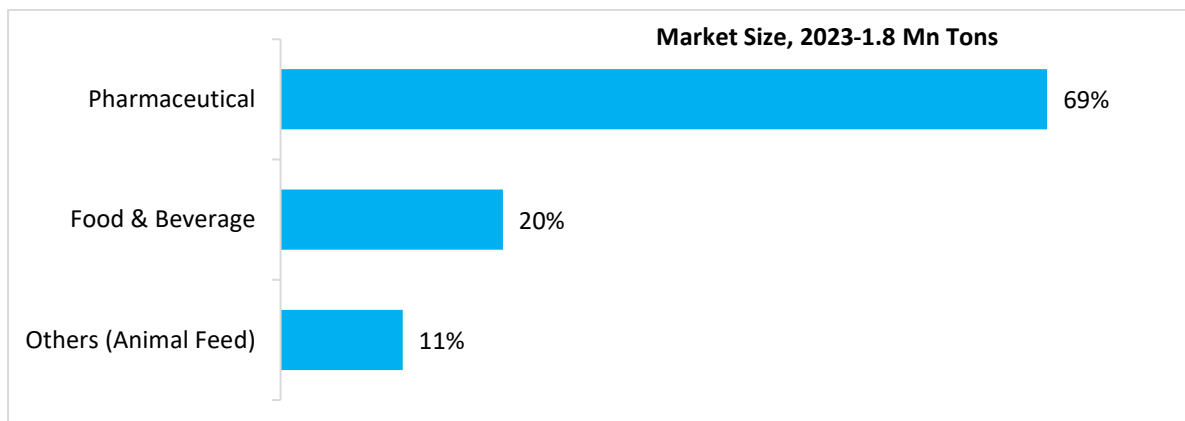
Exhibit 52: Global Dextrose Anhydrous Market, Mn Tons, 2019-2029F



Source: Frost & Sullivan Primary Research & Analysis

Dextrose Anhydrous has a wide application in pharmaceutical products by way of Excipient as filler or binder. It is used as buffering agent in veterinary medicine and animal nutrition industry. It is also used as antioxidant and fermentation substrate in production of various vitamins, amino acids, and other organic products. Dextrose anhydrous can provide benefit to swallowable tablets, chewable tablets, effervescent tablets, and medicated confectionaries.

Exhibit 53: Global Dextrose Anhydrous Market - Application, 2023



Source: Frost & Sullivan Primary Research & Analysis

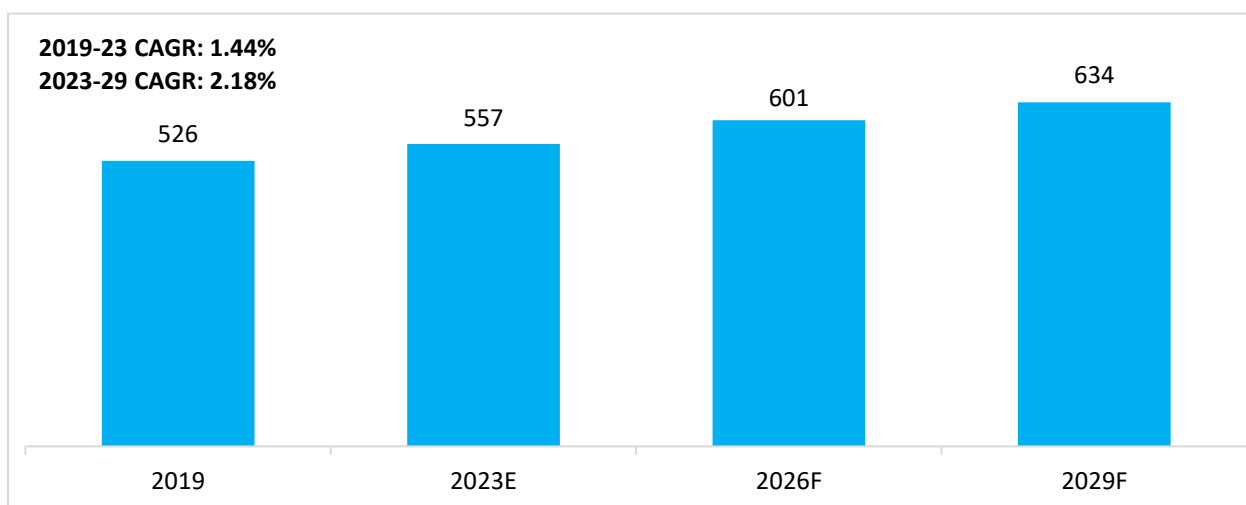
Archer Daniels Midland Company, Cargill, Tate & Lyle, Roquette, Tereos, Sinofi ingredients, Belgosuc, Penta Manufacturing Company, Global Sweeteners Holdings Limited and Foodchem International Corporation are among the key players.

5.5. Global Liquid Sorbitol Market

Sorbitol is a sugar alcohol and is identified as a potential key chemical intermediate from biomass resources. It is used as sweetener, humectant, sequestrant, texturizer, stabilizer, and bulking agent in various industries such as food & beverage, pharmaceuticals, cosmetics & personal care, etc. It is majorly used as preservative, additive, and sweetener in the food industry, as a carrier in the pharmaceutical industry and as an emulsion stabilizer in cosmetics.

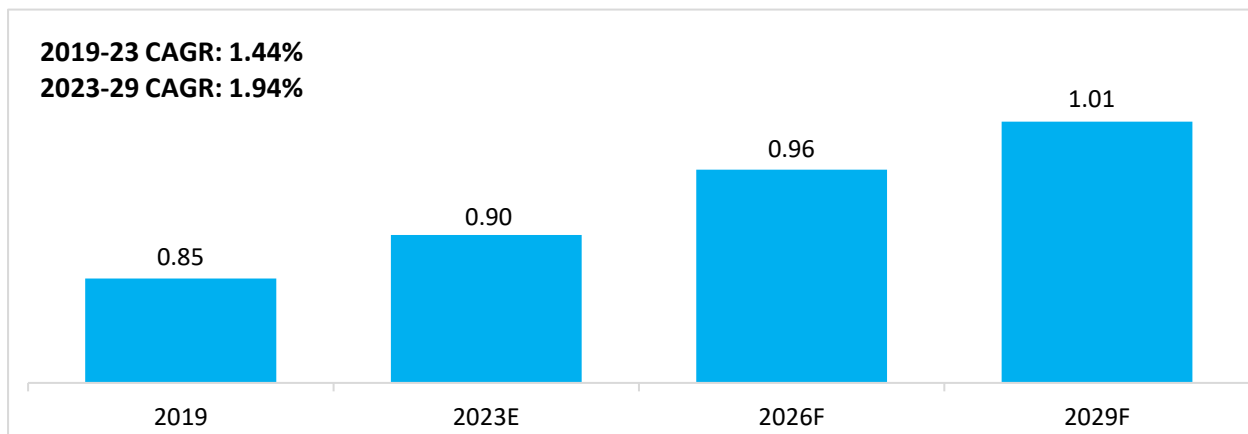
The global liquid sorbitol market size was valued at USD 526 Mn in 2019 and is projected to reach USD 634 Mn by the end of 2029, exhibiting a CAGR of 2.18% in the forecast period 2019-2029. In volume terms the market was around 0.9 Mn MT in 2019 and will grow to 1.0 Mn MT recording a CAGR of 1.94%.

Exhibit 54: Global Liquid Sorbitol Market, Industry, USD Mn, 2019-2029F



Source: Frost & Sullivan Primary Research & Analysis

Exhibit 55: Global Liquid Sorbitol Market, Mn Tons, 2019-2029F

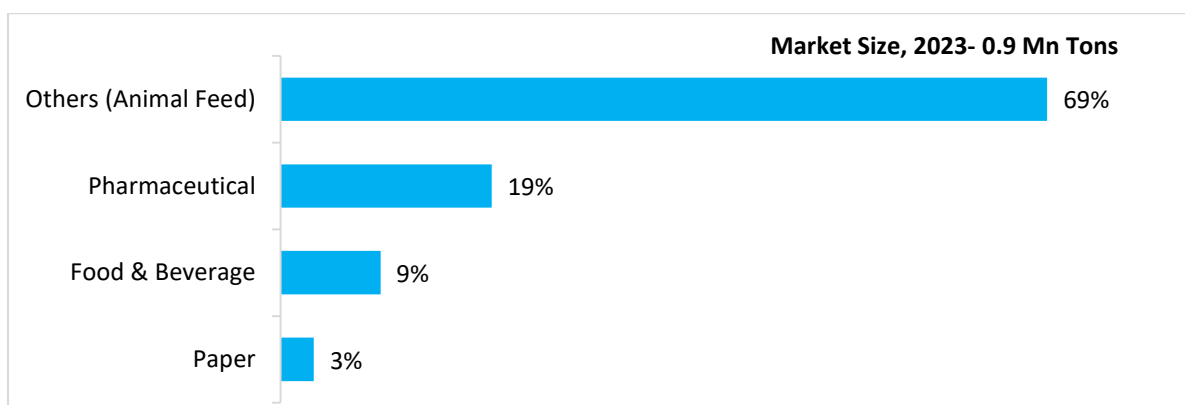


Source: Frost & Sullivan Primary Research & Analysis

The market is expected to witness significant growth over the forecast period owing to the rising usage of diabetic and dietetic food and beverages. The growing product demand as a substitute for sugar in consumer food products is also expected to drive demand for the product over the next few years. Sorbitol is also increasingly being used in oral care products as it is metabolized at a slower rate as compared to other sugar alcohols, preventing dental problems such as cavities and tooth decay. The benefits of the same are expected to propel industry growth over the forecast period. Additionally, the trend of shifting production capacities to the Asia Pacific due to low production and labour costs has resulted in low costs for sorbitol, therefore causing rising demand for non-food applications.

The increasing use of the product in chocolates and confectionary products owing to its textural, moisture-stabilizing, and non-carcinogenic properties is expected to positively affect the overall demand of the market. Sorbitol is chemically relatively inert and is a stable chemical, which is expected to result in high demand for the product as it is easy to incorporate into other food products without hampering the recipe. Due to the unique and useful texture-enhancing properties of sorbitol, it has varied applications, including the manufacturing of cosmetics.

Exhibit 56: Global Liquid Sorbitol , By Application, 2023



Source: Frost & Sullivan Primary Research & Analysis

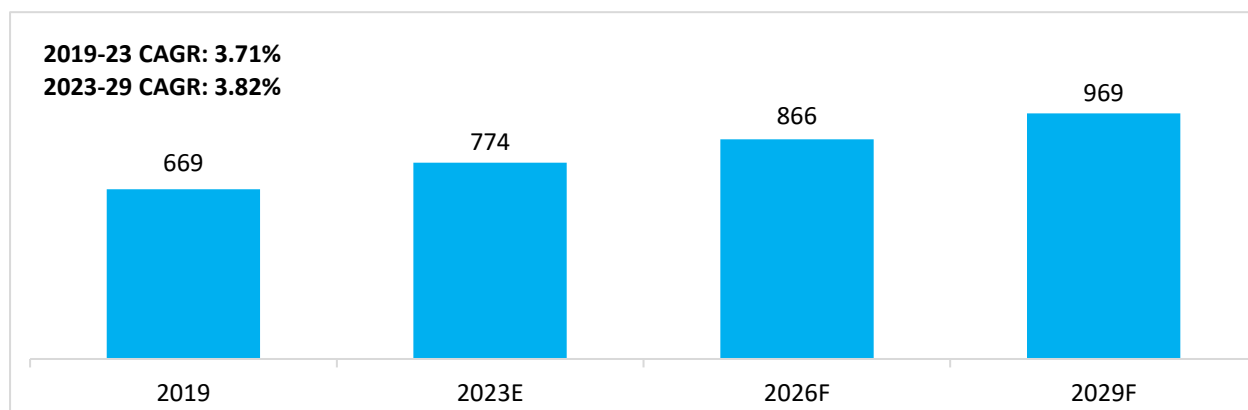
Roquette, Cargill, Ingredion, ADM, Tereos, Merck group, Ecogreen Oleochemicals Pte, Gulshan Polyols are some of the major players in sorbitol market.

5.6. Global Dried Glucose Solids (Powder) Market

The glucose market is segmented based on form – Syrups (Liquid) and solids (Dried). The liquid segment held the majority of share in 2023. Dried glucose, also known as spray dried glucose syrup, is a powder form of glucose syrup that is produced by rapidly drying a liquid glucose solution. Dried glucose solids are Ideal bulking agent and drying carrier, Moisture Conditioner, Crystallization Inhibitors, Stabilizers, among others. The Global dried glucose market is penetrating with the faster pace and potential over the past few years and is estimated to expand substantially in the forecasted period that is 2023 to 2029.

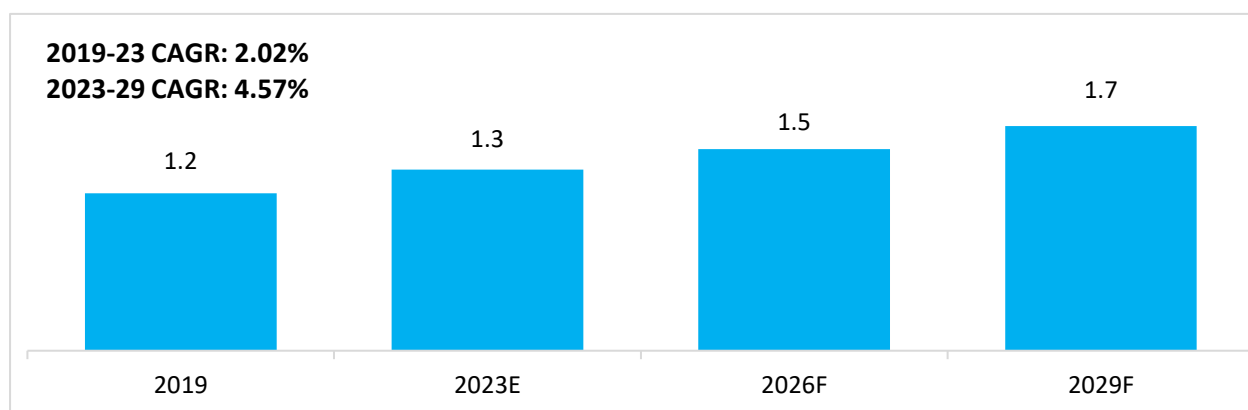
The global glucose solids market size was valued at USD 774 Mn in 2023 and is projected to reach USD 969 Mn by the end of 2029, exhibiting a CAGR of 3.82% in the forecast period 2023-2029. In volume terms the market was around 1.3 Mn MT in 2023 and will grow to 1.7 Mn MT in 2029 recording a CAGR of 4.57%.

Exhibit 57: Global Dried Glucose Solids (Powder) Market, USD Mn, 2019-2029F



Source: Frost & Sullivan Primary Research & Analysis

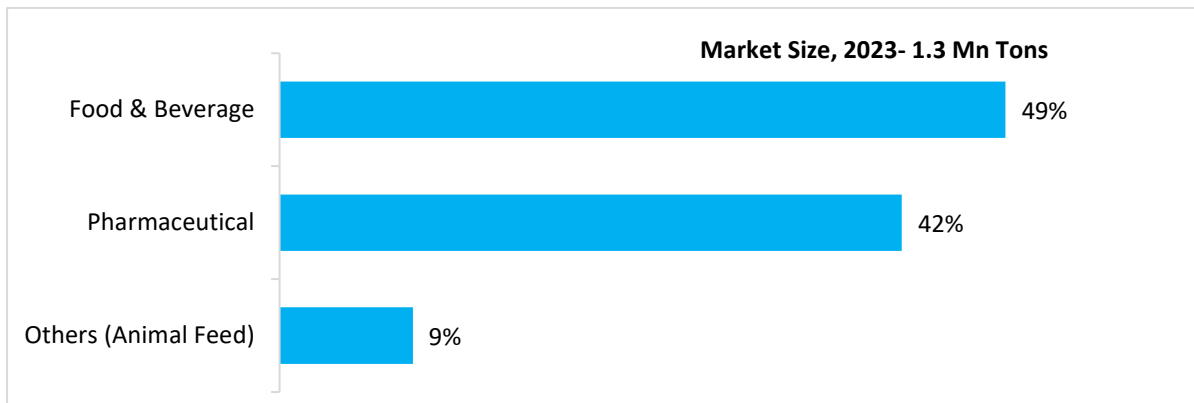
Exhibit 58: Global Dried Glucose Solids (Powder) Market, Mn Tons, 2019-2029F



Source: Frost & Sullivan Primary Research & Analysis

It is a widely used ingredient in various food and beverage products as a sweetener, texture enhancer, and moisture control agent. Dried glucose syrup is soluble in water and has a longer shelf life compared to liquid syrup. The increasing demand for convenience foods and processed snacks is driving the growth of the market. Dried glucose is extensively used in these products to enhance taste, improve texture, and increase shelf life. Additionally, the rising health-consciousness among consumers is leading to a shift towards natural and organic ingredients, which is further driving the demand for dried glucose syrup derived from natural sources.

Exhibit 59: Global Dried Glucose Solids (Powder) Market – By Application, 2023



Source: Frost & Sullivan Primary Research & Analysis

Moreover, the growing consumer preference for clean-label and natural products with reduced sugar content is also expected to boost the market growth. Dried glucose serves as a suitable alternative to conventional sugar in such products, providing sweetness without adding excessive calories. Furthermore, the expanding food and beverage industry, particularly in developing economies, is creating lucrative opportunities for the dried glucose market. The increasing disposable incomes, changing dietary patterns, and growing urbanization are key factors propelling the demand for processed food and beverages.

B] Indian Derivatives Market

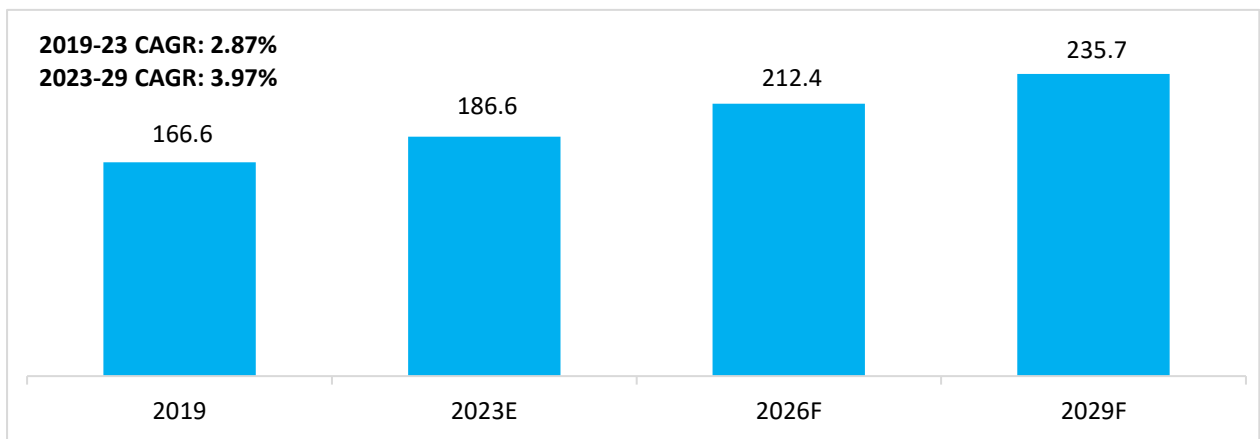
5.7. India Liquid Glucose Market

Liquid Glucose is produced by partial hydrolysis of starch slurry by acid or enzyme. It is clear, colourless and viscous solution which makes it suitable to be used as ingredient in many food and beverage products.

The India glucose market size is estimated at USD 186 Mn in 2023 and is expected to expand at CAGR of 3.97% from 2023 to 2029 to reach USD 236 Mn by 2029. In volume terms the market is around 0.38 Mn MT in 2023 and will grow to 0.48 Mn MT recording a CAGR of 3.97%.

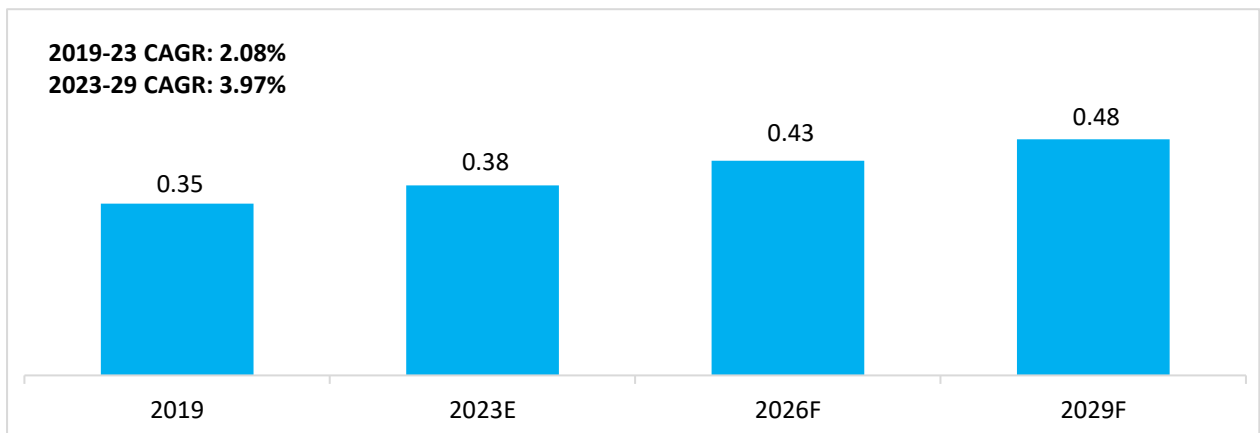
India exports most of its liquid glucose to Indonesia, Kenya and Sri Lanka and is the largest exporter of liquid glucose in the world. Liquid glucose is exported by more than 10-15 India exporters to nearly 1,500 buyers.

Exhibit 60: India Liquid Glucose Market, USD Mn, 2019-2029F



Source: Frost & Sullivan Primary Research & Analysis

Exhibit 61: India Liquid Glucose Market, Mn Tons, 2019-2029F



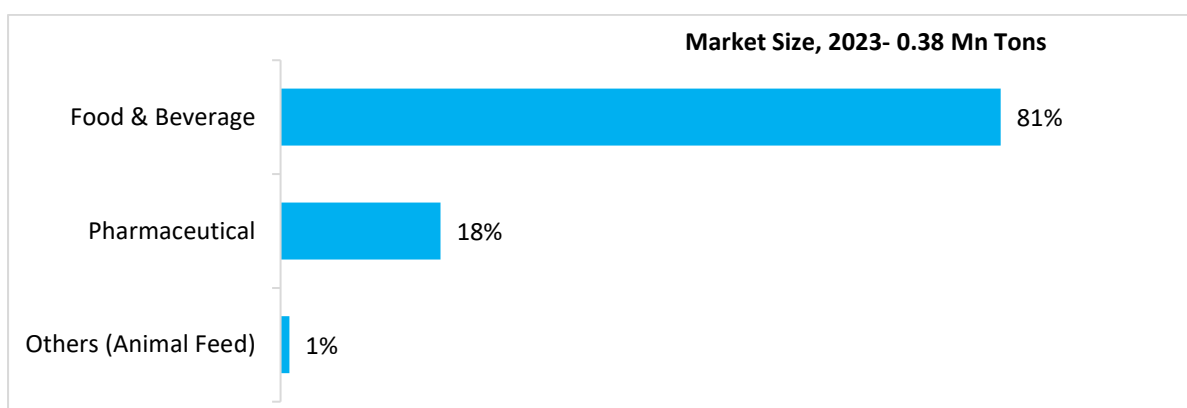
Source: Frost & Sullivan Primary Research & Analysis

Liquid Glucose has wide application in Food & Beverage sector. Liquid glucose is used to manufacture flavoured candies and chocolates. It is used in the preparation of glucose biscuits. Liquid Glucose also helps to keep products soft and fresh and acts as a preservative which makes it suitable for using in Jams, jellies, chewing gums and canned fruits. It is also used as a base for preparing artificial honey.

Liquid Glucose is also used in pharmaceutical industry particularly in cough syrup and vitamin-based tonics. It is also used as a granulating agent for tablet coating.

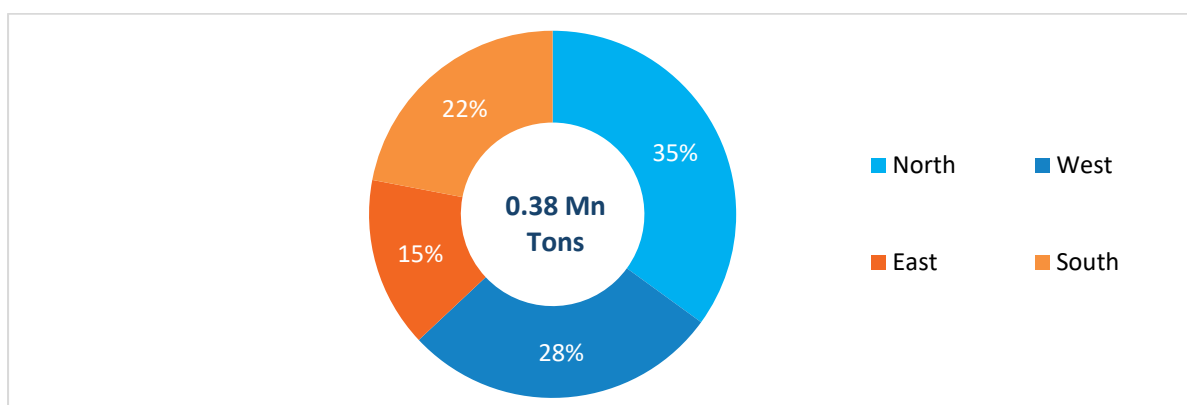
Liquid glucose also has its use in curing and imparting flavour in tobacco. Liquid Glucose is added to shoe polish to prevent which helps avoid caking and gives better shine. It is also used in tanning to get softer texture and enhance weight.

Exhibit 62: India Liquid Glucose Market, By Application, 2023



Source: Frost & Sullivan Primary Research & Analysis

Exhibit 63: India Liquid Glucose Market, By Geography, 2023



Source: Frost & Sullivan Primary Research & Analysis

Cargill, Agrana, ADM, DGF Service, Ingredion, Karo Syrup, Dr. Oetker, Grain Processing Corporation, MEFSCO, Queen Fine Food, Roquette and Tate and Lyle among others, are the major players in the India liquid glucose market.

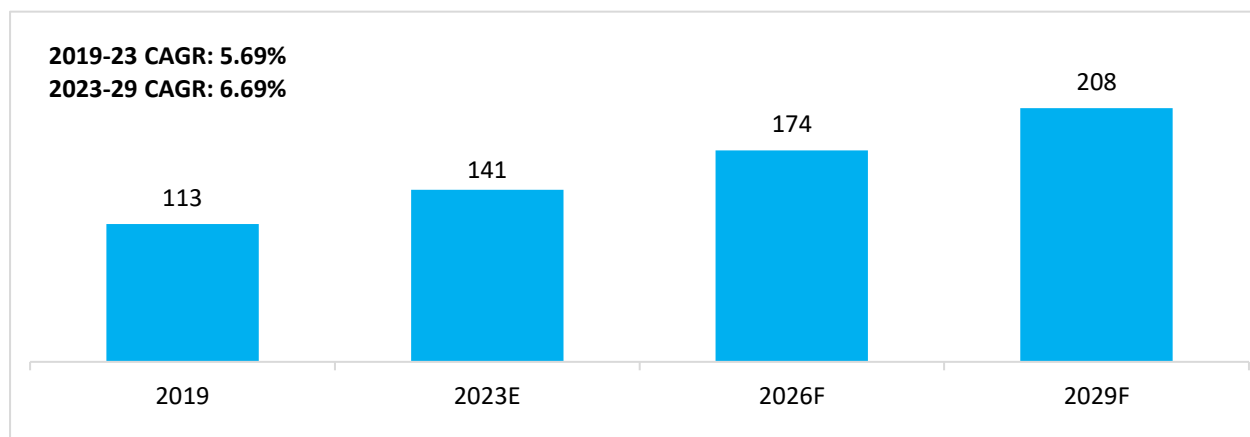
5.8. Indian Maltodextrin Powder Market

Maltodextrin Powder is produced by enzymatic hydrolysis of Maize starch, a lightly hygroscopic in nature. It is a fine white powder produced by spray drying partially hydrolysed starch, it has a dextrose equivalent (DE) of 10-25% it provides a convenient and nutritionally sound way to replete energy reserves. Maltodextrin is a complex carbohydrate combination that provides long-lasting energy. Maltodextrin powder has a rapid rate of digestion, allowing it to supply additional calories without causing the abdominal discomfort that can be experienced with simple sugars. The body gets energy from maltodextrin gradually easily and evenly, so it is ideal for carbo loading.

Maltodextrin Powder is highly recommended for those whose metabolic rate and appetite is the limiting factor in their ability to gain weight use of maltodextrin will speed the rate of recovery after exercise by inhibiting proteolysis. Carbohydrate supplementation is one of the most reliable and inexpensive ways to increase exercise performance.

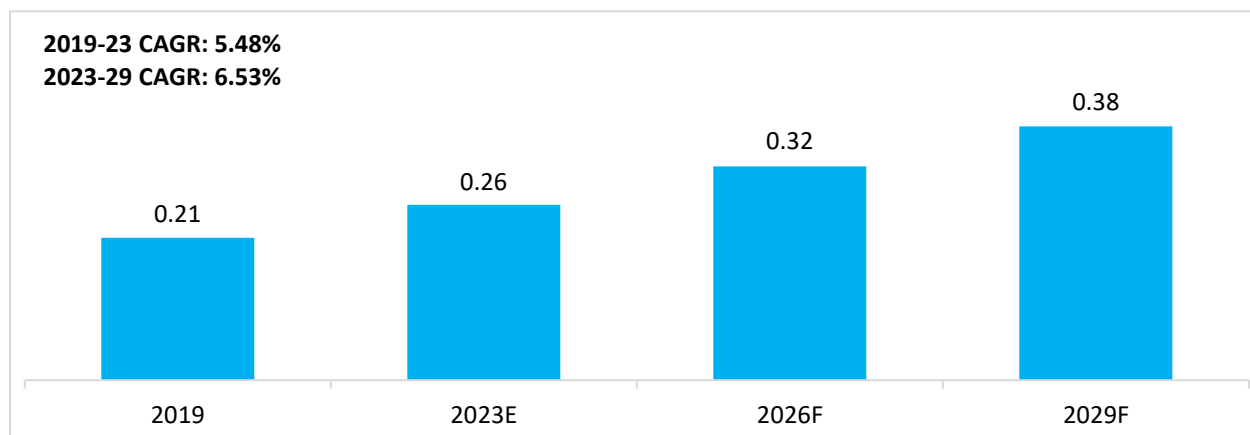
India Maltodextrin market was valued at USD 142 Mn in 2023. The market has been projected to expand at a CAGR of 6.69% to reach the value of USD 208 Mn in 2029. In volume terms the market is around 0.26 Mn MT in 2023 and will grow to 0.38 Mn MT recording a CAGR of 6.53%.

Exhibit 64: India Maltodextrin Powder Market, USD Mn, 2019-2029F



Source: Frost & Sullivan Primary Research & Analysis

Exhibit 65: India Maltodextrin Powder Market, Mn Tons, 2019-2029F

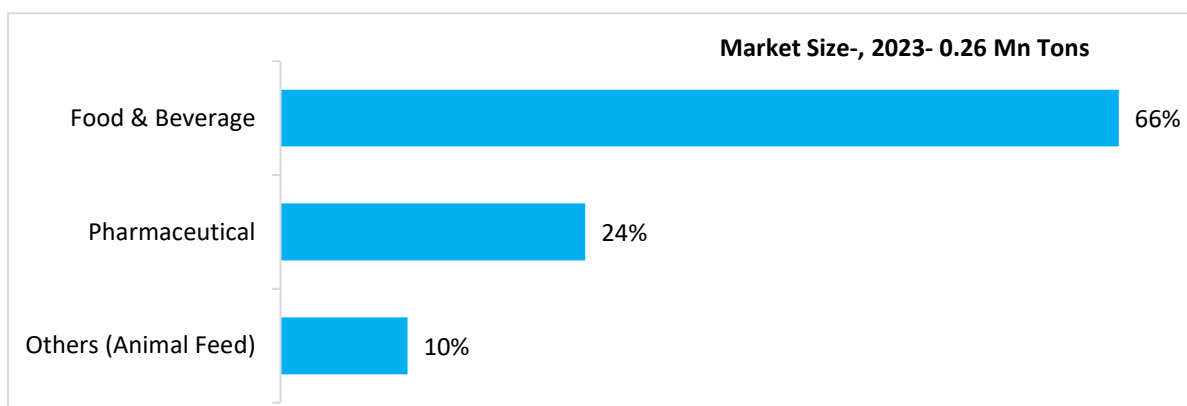


Source: Frost & Sullivan Primary Research & Analysis

Maltodextrin is commonly used as a food additive and is present in various packaged foods such as seasonings, cereal, potato chips, desserts, soups & sauces, canned fruits, snacks, spice mixes, baked goods, instant pudding, salad dressings, nutrition bars, sauces, yogurt, sugar-free sweeteners, cake mixes, and meal replacement shakes among others.

In tablet manufacturing Maltodextrin is used as a direct tablet excipient. As a fat replacer it is used in manufacturing of ice-creams, salad dressings and desserts. Other uses include oil well drilling fluids and other niche industrial applications. Key end users in India include- Zydus, Nestle, Danone, P&G and Wockhardt among others.

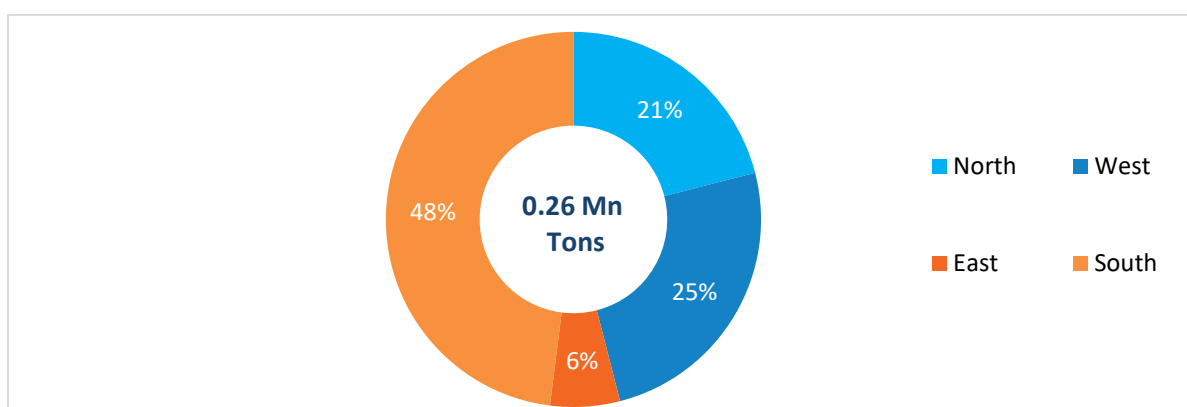
Exhibit 66: India Maltodextrin Powder Market, By Application, 2023



Source: Frost & Sullivan Primary Research & Analysis

Approximately 60-65% of production is undertaken for regular maltodextrin followed by low DE maltodextrin. Low maltodextrin used in India is imported. Other maltodextrin demand is mostly filled by Indian producers. It is available in 25- 50 Kg HDPE bags with the inner liner of LDPE & 25 kg Kraft Multiply Paper Bags.

Exhibit 67: India Maltodextrin Powder Market, By Geography, 2023



Source: Frost & Sullivan Primary Research & Analysis

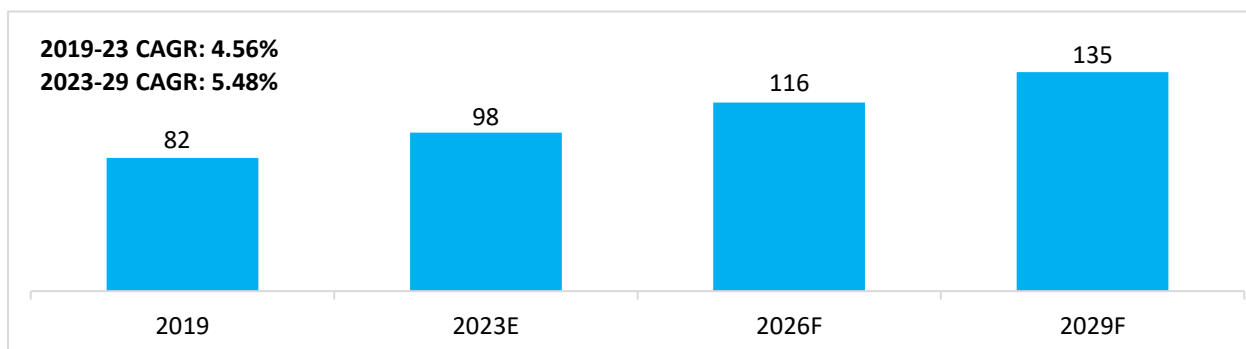
Major players in maltodextrin market in India are Blue Ocean Biotech, Blue Kraft Agro, Sanstar Ltd, Cargill India, Gujarat Ambuja, Gulshan Poly, Roquette India, Sahyadri Starch, ShreeGluco Biotech and Sukhjit Starch.

5.9. Indian Dextrose Monohydrate Market

Dextrose Monohydrate (D-glucose) is a sugar that's a stable, odourless, white crystalline powder or colourless crystal. Dextrose Monohydrate is moderate in sweetness which is 65-70% sweet as sucrose. In its pure form, it has a dextrose equivalency (DE) of 100, which indicates that it's 100% pure Dextrose, not a mixture with other substances as well. It is freely soluble in water at room temperature and also in boiling alcohol. It has a greater depression of freezing point than that of cane sugar which helps in a smoother and creamier texture of frozen food products.

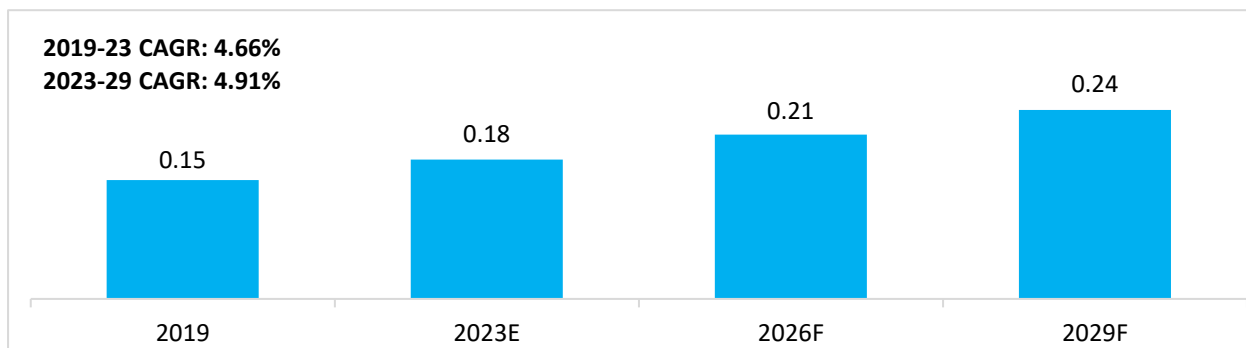
The India dextrose monohydrate market was valued at USD 98 Mn in 2023 and is forecasted to expand at a CAGR of 5.48% to reach valuation of USD 135 Mn by 2029. In volume terms the market was around 0.18 Mn MT in 2023 and will grow to 0.24 Mn MT recording a CAGR of 4.91%.

Exhibit 68: India Dextrose Monohydrate Market, USD Mn, 2019-2029F



Source: Frost & Sullivan Primary Research & Analysis

Exhibit 69: India Dextrose Monohydrate Market, Mn Tons, 2019-2029F



Source: Frost & Sullivan Primary Research & Analysis

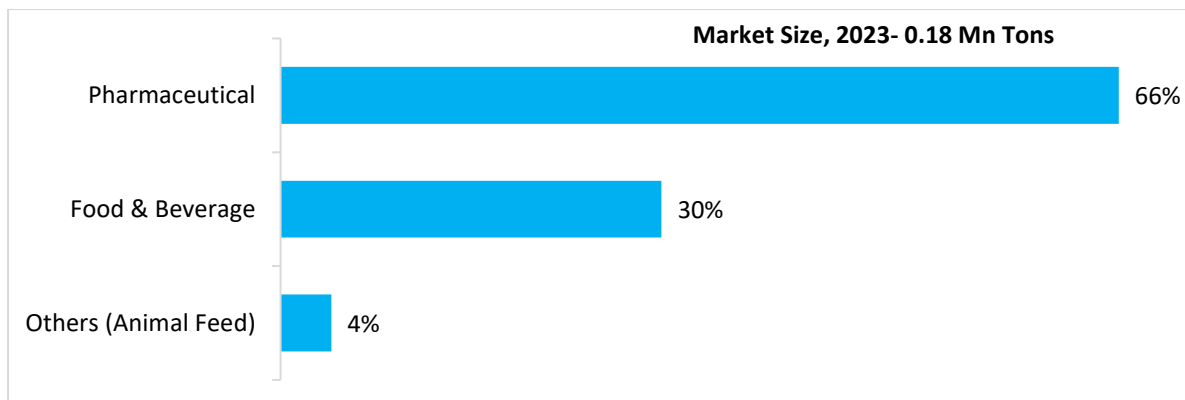
In pharmaceutical application, Dextrose serves to replenish lost nutrients and electrolytes. The agent provides metabolic energy and is the primary ingredient in oral rehydration salts (ORS) and is used in intravenous (IV) fluids to provide nutrients to patients under intensive care who are unable to receive them by the oral route. Solutions containing dextrose restore blood glucose levels, provide calories, may aid in minimizing liver glycogen depletion and exerts a protein-sparing action.

Strong demand from Food and beverage industry is fuelling the growth of market. It is used in bakery products such as breads and buns to supply fermentable carbohydrates for raising the products. In biscuits, it is used as sucrose replacement for cream fillings and fondants as it gives smooth texture to product. Large volume pf application of Dextrose Monohydrate is in confectionaries for sweetening and coating, chewing gum and bubble gum as it helps to improve gloss and colour. It also imparts whip ability and sweetness in applications like nougat and marshmallow. It is also used in frozen desserts to control ice crystal formation.

To make food products more shelf stable, manufacturers of beverages, confectionary, and bakery goods are focusing on natural ways to keep their portfolios fresh for a longer amount of time. Dextrose made from natural ingredients plays a crucial part in the preservation process as it does not hydrolyse in the same way as sucrose does, allowing many food products to have a longer shelf life.

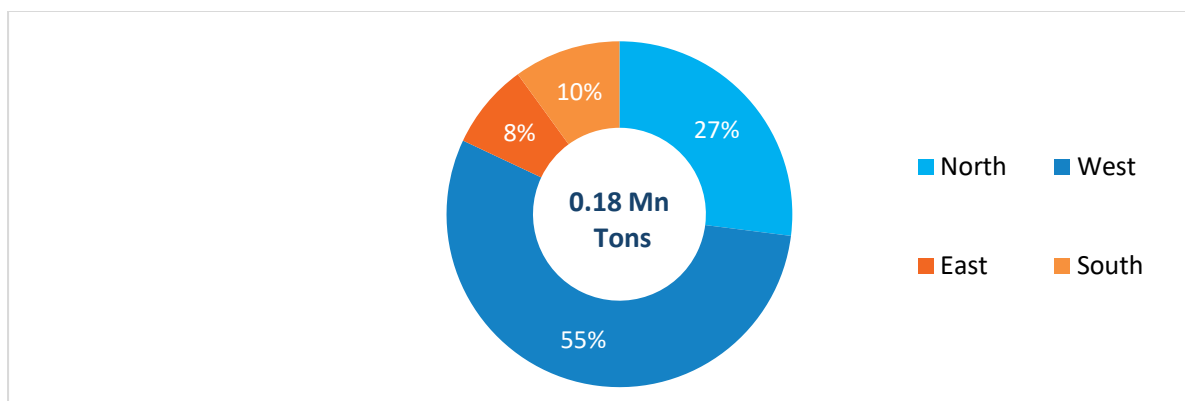
Dextrose monohydrate is also used in canned fruits and vegetables for controlling preserving and sweet properties. It is also used for its high fermenting and low-calorie ability in alcoholic beverages.

Exhibit 70: India Dextrose Monohydrate Market, By Application, 2023



Source: Frost & Sullivan Primary Research & Analysis

Exhibit 71: India Dextrose Monohydrate Powder Market, By Geography, 2023



Source: Frost & Sullivan Primary Research & Analysis

Major players in dextrose monohydrate market are Cargill, Bluecraft Agro, Sanstar Ltd, Gujarat Ambuja Exports, Sayaji maize products, Roquette and Sukhjit starch products.

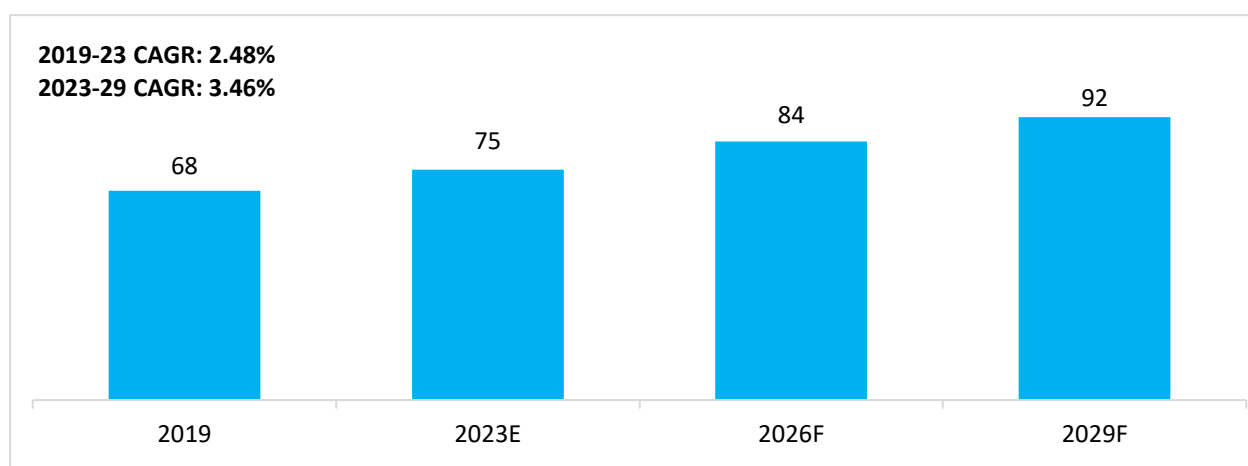
5.10. Indian Dextrose Anhydrous Market

Dextrose is a simple sugar, which is remarkably like glucose or blood sugar. With the hydrolysis of starch, dextrose is industrially extracted whereas naturally it is extracted from the fruits. Dextrose is developed during the process of photosynthesis from carbon dioxide and water and is prepared by plants and algae. Dextrose is primarily employed as a sweetener. It is purified and crystallized D-glucose and the total solids content is not less than 98.0 percent m/m. It has a glycaemic index of 100%

Anhydrous Dextrose is the anhydrous form of D-glucose, a natural monosaccharide and carbohydrate. It is majorly used in nutrition supplement and as sweetener in food & beverage industry. Apart from food, it is also used in animal nutrition and pharmaceutical industry. It is also used in infant formula to improve nutrition value.

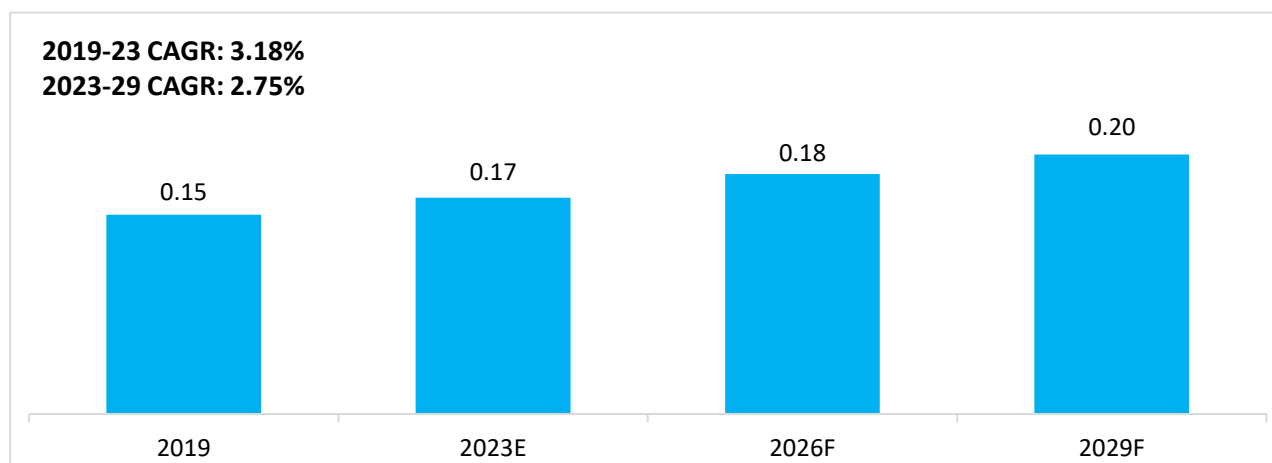
The India dextrose anhydrous market was valued at USD 75 Mn in 2023 and is forecasted to expand at a CAGR of 3.46% to reach valuation of USD 92 Mn by 2029. In volume terms the market was around 0.17 Mn MT in 2023 and will grow to 0.2 Mn MT recording a CAGR of 2.75%.

Exhibit 72: India Dextrose Anhydrous Market, USD Mn, 2019-2029F



Source: Frost & Sullivan Primary Research & Analysis

Exhibit 73: India Dextrose Anhydrous Market, Mn Tons, 2019-2029F

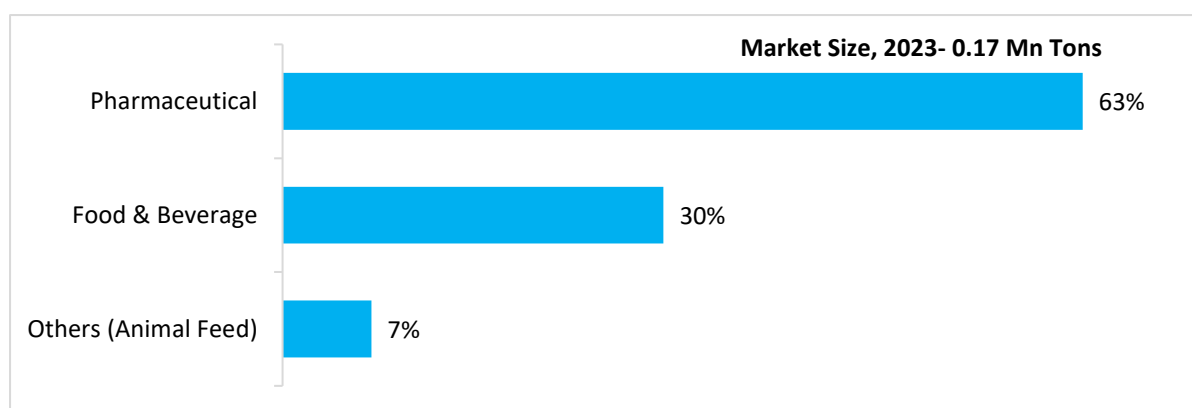


Source: Frost & Sullivan Primary Research & Analysis

Dextrose Anhydrous can be used in a wide variety of industries including pharmaceutical, food and beverage products and animal nutrition. Dextrose Anhydrous has a wide application in pharmaceutical products by way of Excipient as filler or binder. It is purified and crystallized D-glucose which is directly absorbed into blood. It is used for oral ingestion for enhancing nutrition in patients. It is also widely used in human infusion and injection. It is also used as fillers, diluents & binders for tablets, capsules, and sachets. Dextrose anhydrous can provide benefit to swallowable tablets, chewable tablets, effervescent tablets, and medicated confectionaries. As Parenteral Aids / Vaccine Adjuvants it is Suitable for use in cell culture applications.

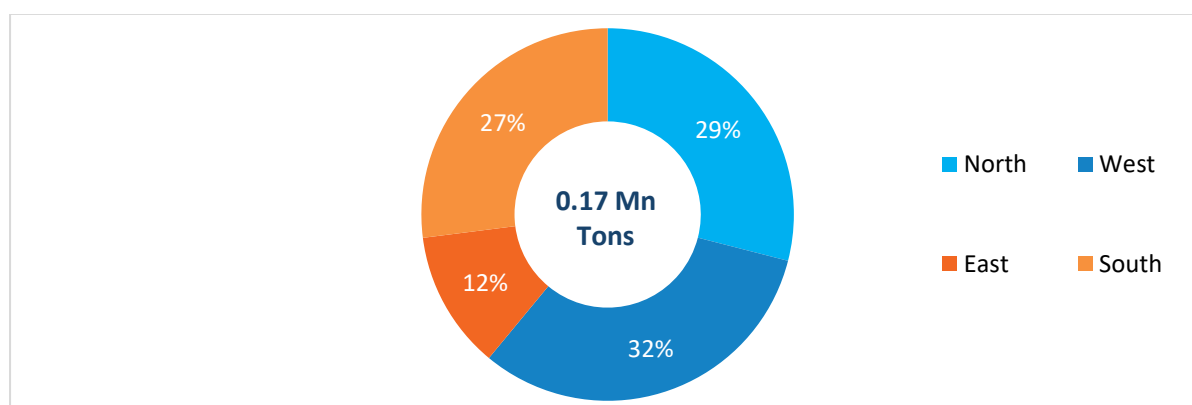
In food industries, dextrose anhydrous can be used as sweetener in candies, gums, baked goods, ice-creams, frozen yogurts, canned foods, cured meats etc. It is also used in energy drinks, low calorie beer products to reduce source of calories.

Exhibit 74: India Dextrose Anhydrous Market, By Application, 2023



Source: Frost & Sullivan Primary Research & Analysis

Exhibit 75: India Dextrose Anhydrous Powder Market, By Geography, 2023



Source: Frost & Sullivan Primary Research & Analysis

Sukhjit Starch Products, Gujarat Ambuja Exports, Sayaji maize products and Tirupathi Starch Products are some of the major producers of dextrose anhydrous.

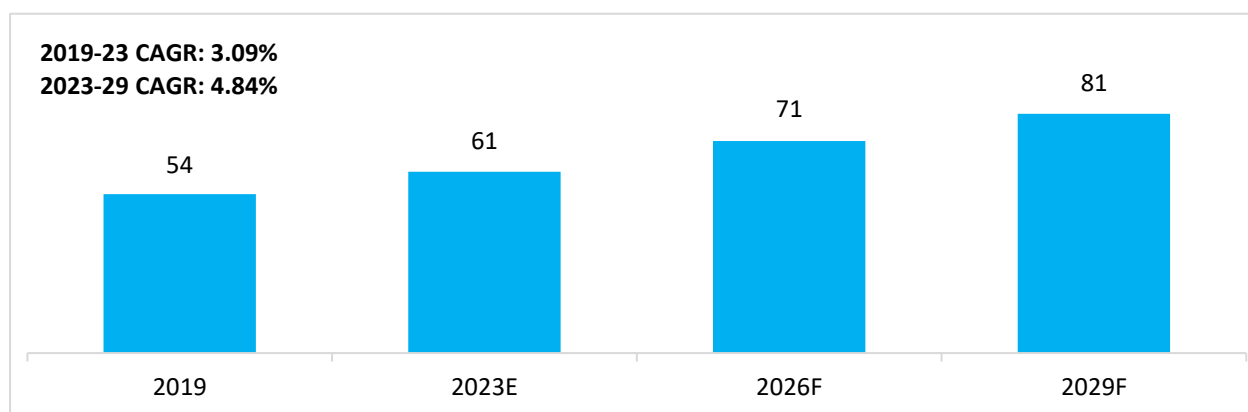
5.11. Indian Liquid Sorbitol Market

Sorbitol is a sugar alcohol and is identified as a potential key chemical intermediate from biomass resources. It is used as sweetener, humectant, sequestrant, texturizer, stabilizer, and bulking agent in various industries such as food & beverage, pharmaceuticals, cosmetics & personal care, etc.

The India liquid sorbitol market size was valued at USD 61 Mn in 2023 and is projected to reach USD 81 Mn by the end of 2029, exhibiting a CAGR of 4.84% in the forecast period 2023-2029. In volume terms the market was around 0.10 Mn MT in 2023 and will grow to 0.13 Mn MT recording a CAGR of 4.47%.

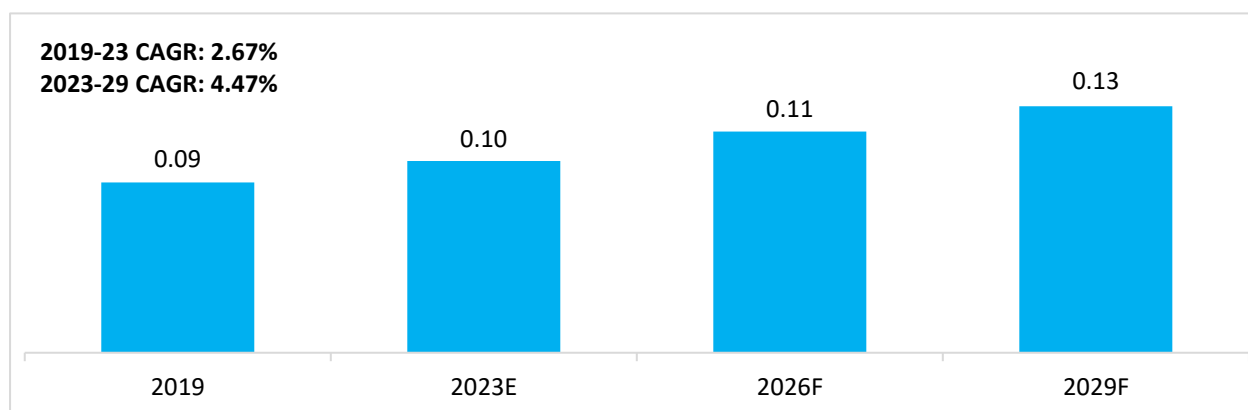
The increasing adoption of diabetic and dietetic food and beverages, the rising product demand as a substitute for sugar, the growing product utilization in oral care products, and the escalating demand from the food and beverage industry for nutritive sweeteners are some of the major factors propelling the market.

Exhibit 76: India Liquid Sorbitol Market, USD Mn, 2019-2029F



Source: Frost & Sullivan Primary Research & Analysis

Exhibit 77: India Liquid Sorbitol Market, Mn Tons, 2019-2029F



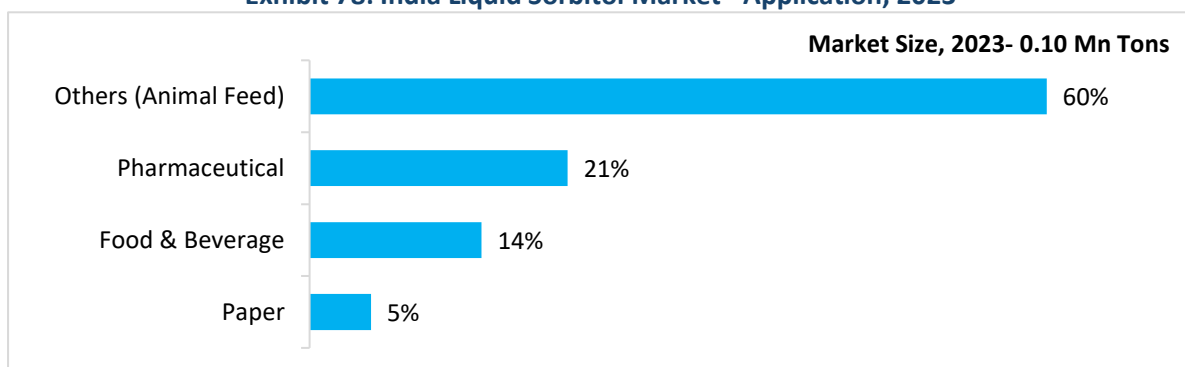
Source: Frost & Sullivan Primary Research & Analysis

It is derived from glucose and has a sweet taste with about 60% of the sweetness of sucrose (table sugar). One of the key characteristics of sorbitol is its ability to attract and retain moisture. It is commonly used as a humectant in food products to prevent them from drying out while maintaining their freshness. It also acts as a thickening agent in certain food formulations, enhancing their texture and mouthfeel.

It is widely used in the pharmaceutical industry as an excipient in producing tablets, syrups, and other oral medications. It helps improve the taste, stability, and palatability of these products. It also finds extensive applications in oral care products, such as toothpaste and mouthwash. Sorbitol is known for its low-calorie content, making it a popular choice in sugar-free or reduced-sugar products. It provides sweetness without the same caloric impact as regular sugar, making it suitable for individuals with diabetes or those intending to reduce their caloric intake. Additionally, it is used to produce cosmetics, personal care products, and certain types of paper.

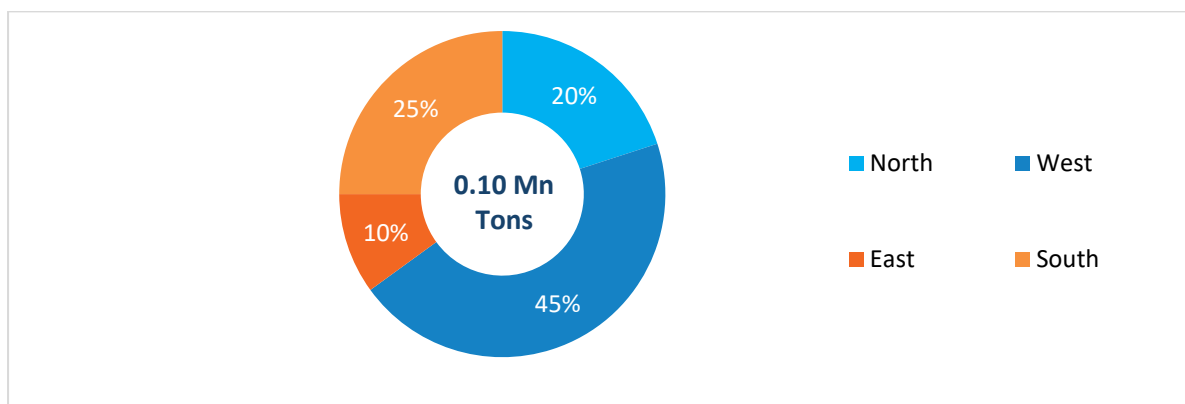
Companies such as Unilever, Patanjali, Wipro and Colgate are the major end use consumers for sorbitol. It is also used in papers, explosives, tobacco and mortar & concrete industry to some extent.

Exhibit 78: India Liquid Sorbitol Market - Application, 2023



Source: Frost & Sullivan Primary Research & Analysis

Exhibit 79: India Liquid Sorbitol Market - Geography, 2023



Source: Frost & Sullivan Primary Research & Analysis

The market in India is majorly driven by the increasing awareness of sugar-related health issues. This can be attributed to the escalating demand for low-calorie alternatives. In line with this, India has a significant diabetic population, and sorbitol's low glycaemic index makes it a suitable sweetener for diabetic-friendly products. Furthermore, the expanding food and beverage industry is significantly contributing to the demand for sorbitol as a sweetener and ingredient in various products. In addition to this, the confectionery industry is also witnessing considerable growth.

Some of the other factors driving the market include the rising disposable incomes of the consumers, export potential of sorbitol-based products from India, growing demand for functional foods and wellness-oriented products, rapid expansion of organized retail and e-commerce platforms, and ongoing research and development activities focusing on sorbitol applications and production techniques.

Increasing government initiatives and subsidies: The Indian government plays a significant role in driving the growth of the sorbitol market through various initiatives and subsidies. The government's focus on promoting the food processing industry and encouraging investments in the sector benefits the sorbitol market. Numerous initiatives such as the Food Processing Fund, support and incentivize companies involved in producing food ingredients like sorbitol and processing sorbitol-based food products. These initiatives help attract investments, foster innovation, and create a favourable business environment for sorbitol manufacturers across the country. The availability of government subsidies, tax incentives, and infrastructure support further drive the growth of the sorbitol market in India.

Rising awareness regarding oral health among the consumers: Growing awareness regarding oral health and hygiene among consumers in India is contributing to the demand for sorbitol-based oral care products. Sorbitol's ability to act as a humectant and enhance the mouthfeel of oral care products makes it a preferred ingredient in toothpaste, mouthwash, and other dental formulations. Consumers are becoming more conscious of the benefits of using oral care products that contain sorbitol, such as improved plaque control, fresh breath, and reduced risk of dental caries. The dental industry's emphasis on preventive oral care and the recommendation of sorbitol-based products by dental professionals drive the growth of the sorbitol market in India.

Expansion of the personal care and cosmetics industry: India's personal care and cosmetics industry is experiencing significant growth, driven by increasing disposable income, changing consumer lifestyles, and a focus on personal grooming. Sorbitol has applications in various personal care and cosmetic products due to its moisturizing and skin-conditioning properties. It is used in lotions, creams, moisturizers, and hair care formulations. As the need for personal care and cosmetic products continues to rise, the demand for sorbitol as an ingredient in these formulations also increases. The expansion of the personal care and cosmetics industry and the introduction of new and innovative sorbitol-based products contribute to the growth of the sorbitol market in India.

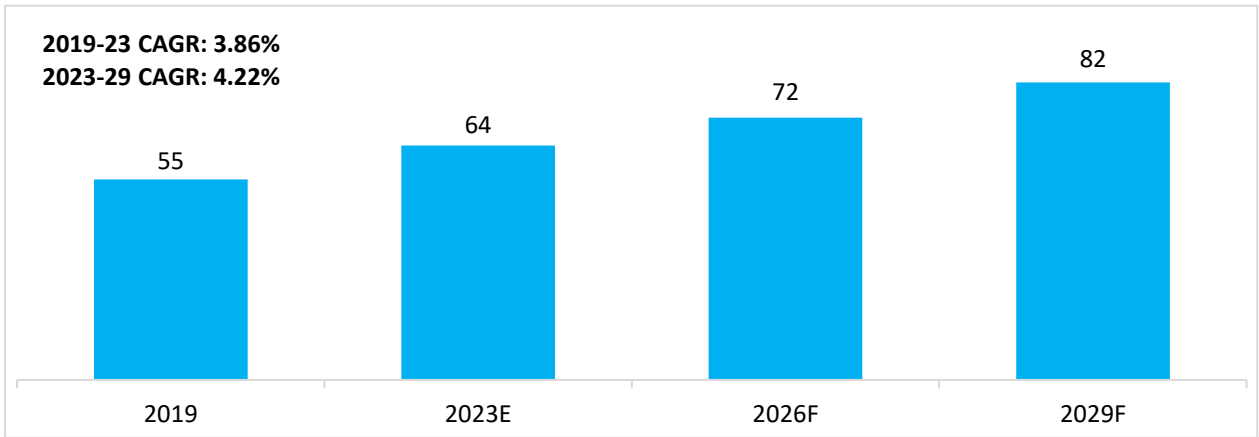
Roquette, Cargill, Ingredion, ADM, Gulshan Polyols are some of the major players in sorbitol market.

5.12. Indian Dried Glucose Solids (Powder) Market

The glucose market is segmented based on form – Syrups (Liquid) and solids (Dried). The liquid segment held the majority of share in 2023. Dried glucose, also known as spray dried glucose syrup, is a powder form of glucose syrup that is produced by rapidly drying a liquid glucose solution. Dried glucose solids are Ideal bulking agent and drying carrier, Moisture Conditioner, Crystallization Inhibitors, Stabilizers, among others.

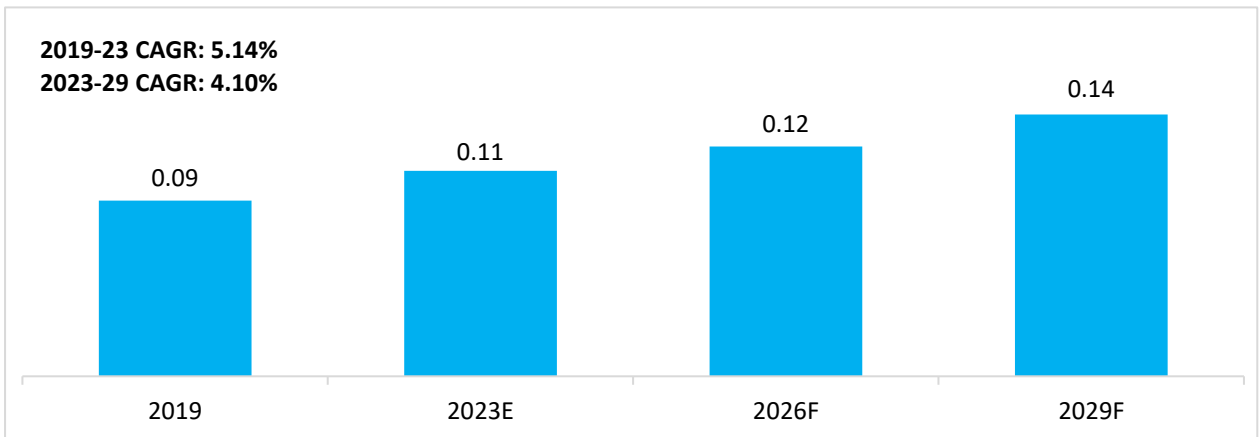
The India glucose solids market size was valued at USD 64 Mn in 2023 and is projected to reach USD 82 Mn by the end of 2029, exhibiting a CAGR of 4.22% in the forecast period 2023-2029. In volume terms the market was around 0.11 Mn MT in 2023 and will grow to 0.14 Mn MT in 2029 recording a CAGR of 4.1%.

Exhibit 80: India Dried Glucose Solids (Powder) Market, USD Mn, 2019-2029F



Source: Frost & Sullivan Primary Research & Analysis

Exhibit 81: India Dried Glucose Solids (Powder) Market, Mn Tons, 2019-2029F



Source: Frost & Sullivan Primary Research & Analysis

It is a widely used ingredient in various food and beverage products as a sweetener, texture enhancer, and moisture control agent. Dried glucose syrup is soluble in water and has a longer shelf life compared to liquid syrup. The increasing demand for convenience foods and processed snacks is driving the growth of the market.

Exhibit 82: India Dried Glucose Solids (Powder) Market, By Application, 2023



Source: Frost & Sullivan Primary Research & Analysis

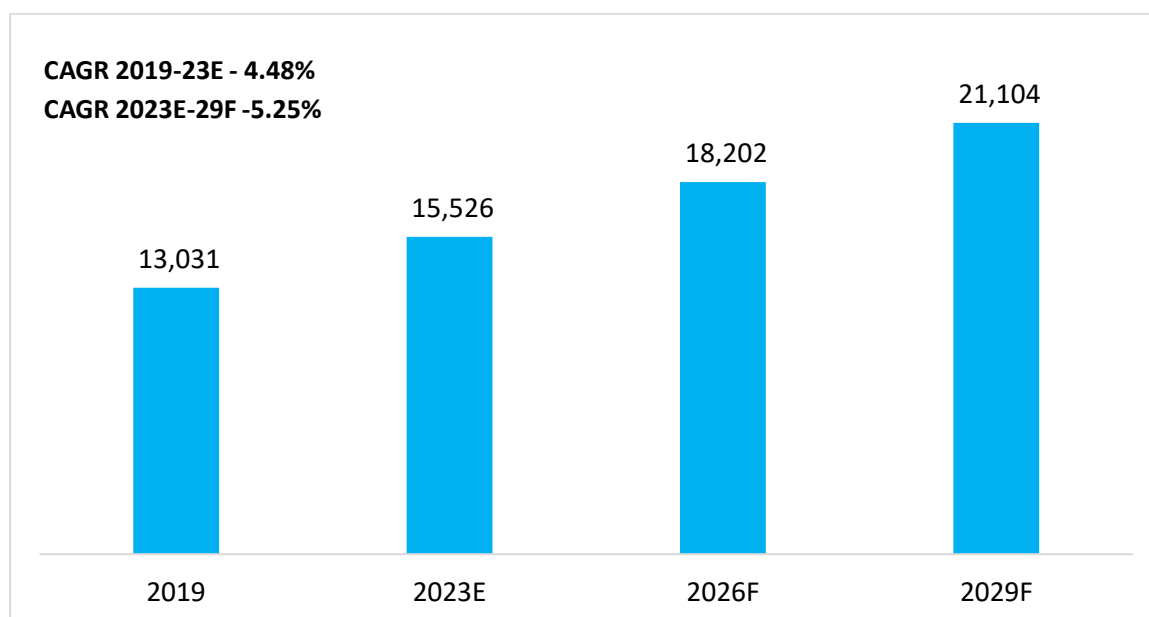
6. Modified Maize Starch & Value-Added Products Industry Overview

6.1. Global Modified Starch Market

Starch holds an important place among the flexible food ingredients that provides value addition for several industrial applications. Many of its chemically modified derivatives offers high technological value in both food and non-food applications. Modified starches are designed to overcome the shortcomings of native starches such as loss of viscosity and thickening power upon cooking and storage, particularly at low pH, retrogradation characteristics, syneresis, etc.,

The global modified starch market is estimated at USD 15,526 million in 2023 growing at an estimated CAGR of 5.25% through 2023-2029. Modified starch has numerable specific applications resulting in higher efficiency and better quality of end products. Usage of modified starch in the manufacturing of ethanol and packaging industry is driving the demand for modified starch. In the paper industry, modified starch imparts lower fiber loss, better printability. The key consideration for the growth of modified starch industry is its GMO-free nature and strong organic focus.

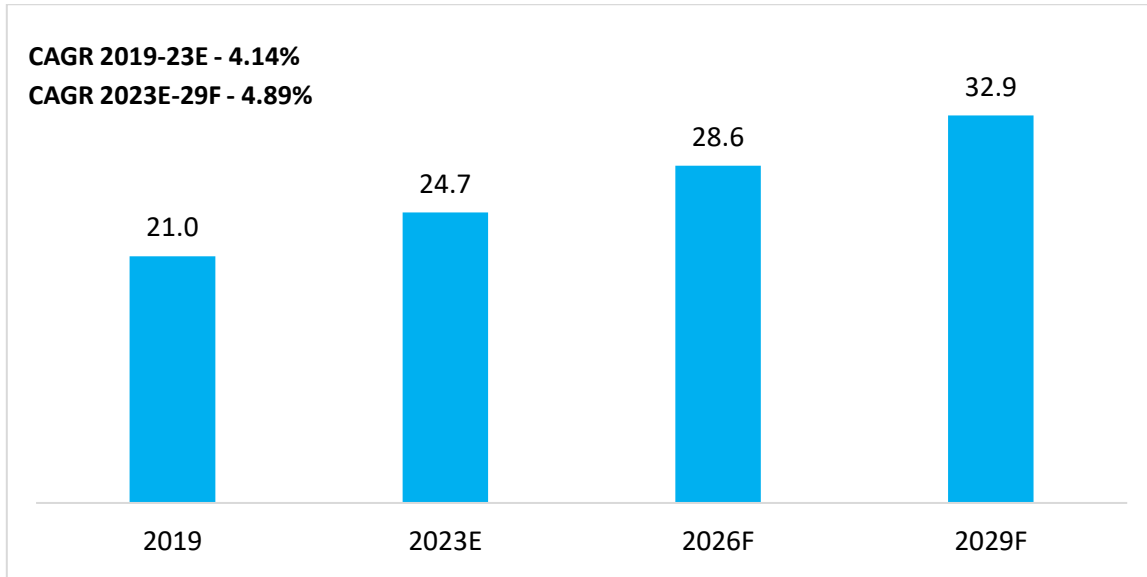
Exhibit 83: Global Modified Starch Market Size, USD Million



Source: Industry sources, Frost & Sullivan

In volume terms, the global maize starch market is estimated at 24.7 million tons in 2023. The market is expected to grow at a CAGR of 4.89% from 2023 through 2029.

Exhibit 84: Global Modified Starch Market Size, Million Tons



Source: Industry sources, Frost & Sullivan

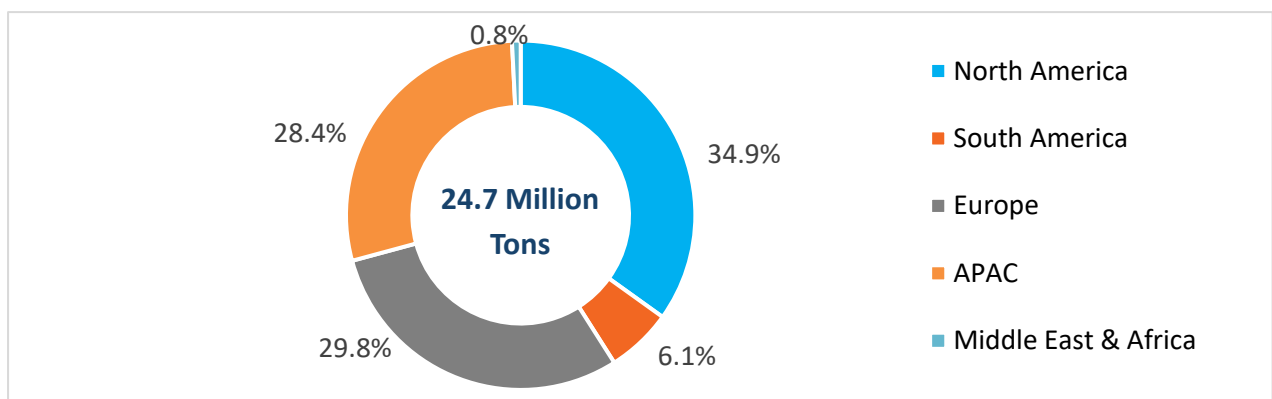
6.2. Geography-wise breakup of Modified Starches Industry (volume)

Some of the key markets in terms of production are U.S.A., Argentina, Brazil and Ukraine. These regions put together account for ~80% of the total maize production in the world, while also holding the positions of some of the largest consumers and exporters.

North America is expected to lead the global modified starch market with share of 35% percent followed by Europe (29.8%) and APAC (28.4%) in terms of consumption. Modified starch consumption per capita has been comparably low in emerging markets, representing scope for a strong growth opportunity. Austria and Germany are the key countries in the Central and Eastern European sector while specialty markets include USA and UAE.

In the past, trade barriers had kept starch markets largely regional. Over time, trade barriers in food and food products such as that of modified starches are being reduced as a result of trade liberalizations and forward-looking agricultural policy reforms to promote global integration of in agricultural and food markets. Certain countries such as USA and Thailand have a comparative advantage in commodity production. Positive policy reforms are likely to increase exports from these countries, while imports by Japan, China, and other APAC countries are likely to increase.

Exhibit 85: Global Modified Starch Market Size, By Geography, 2023E



Source: Industry sources, Frost & Sullivan

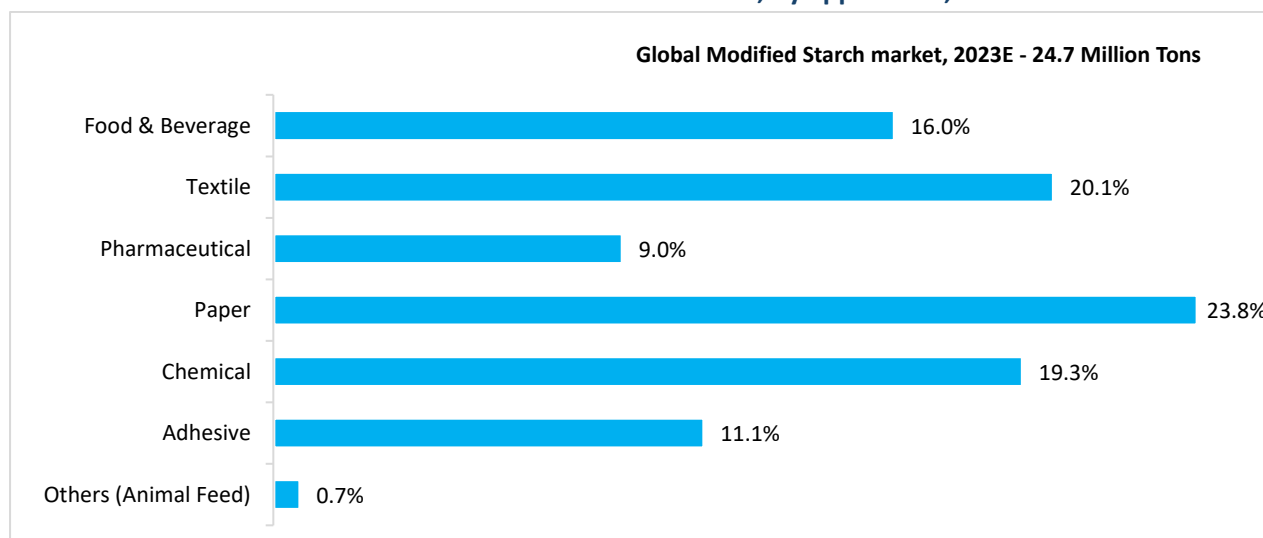
6.3. Application wise breakup of the Global Modified Starch Industry (Volume)

The food industry is very mindful of safety of chemical residues hence not all types of native or modified starches are used in the foods. Some modified starches are used as binder in assaulted foods, ready-made meat and snack seasonings. Others are used as anti-sticking agents and dustings for chewing gum and bakery products, crisping coating for fried snacks, fillers to replace fats and in sauces or creams to enhance lusciousness in ice cream and salad dressings. Modified starches are also used as flavour encapsulating agents and emulsion stabilizers in beverages. They are used as creamers, in canned foods, foam stabilizer in marshmallows, gelling agents in gum drops and jelly gum, and as expanders in baked snacks and cereal meals. Starch derived products are used for the production of animal nutrition. About 10–15% of maize produced in the US is processed annually for starch derived products by maize refiners. These starch derived products are used in across the food, beverage, healthcare, pharmaceutical and other sectors. This has a dominant multiplier effect on the United States economy.

The global Modified Starch market is driven by an increasing demand for healthy, nutritious, and convenience food products. Modified starch allows modifying of basic properties of native starch and obtaining certain functional properties to fit a wider range of industrial applications in food and beverages, paper, textile, pharmaceuticals, pet food, soap, laundry, and cosmetics industries. modified starch provides a variety of functionalities – as thickeners, texture agents, fat replacers and emulsifiers. Due to the sophisticated technology available, the ingredients can be fine-tuned to meet most formulating trials. Maize starch is also going to be an important ingredient in biodegradable plastic packaging.

The Global Modified Starch market is largely dominated by Paper, Textile and Chemical industries. Paper industries as End use Industry accounts for highest revenue share of almost around 23% and is predicted to remain stable in terms of revenue share and volume during the forecasted period. Modified starch is used in large volumes in the papermaking process. It aids in the production of paper by providing functional characteristics and acting as a processing aid for paper and pulp industry. The Paper mills use Starches derived from a variety of sources, including Waxy Maize, Regular Maize, Tapioca, Wheat, and Potato. Starch is also used as a binder in paper coating, improving the firmness and whiteness of the paper, thereby improving the printing characteristics.

Exhibit 86: Global Modified Starch Market Size, By application, 2023E

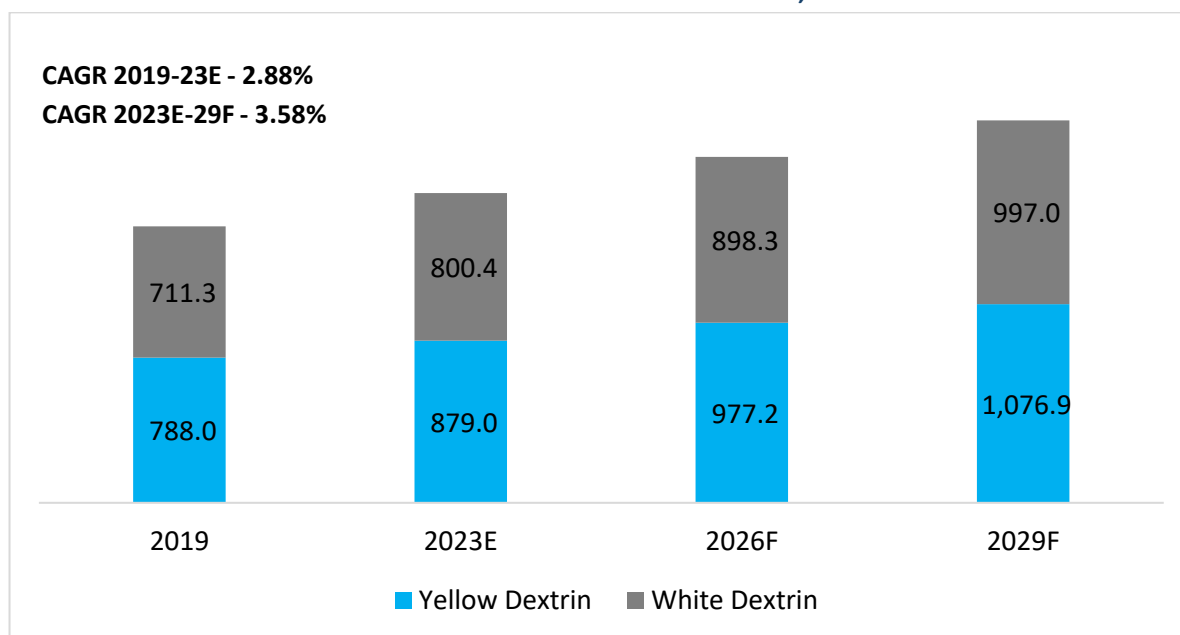


Source: Industry sources, Frost & Sullivan

6.4. Global Dextrin and Value-added Products Market

The industry produces many types of modified starches, including acid thinned (Mixed with water), oxidized, cationic, hydroxyethyl, acetate, succinate, and phosphate starches. Acid thinned starches are thinned by treatment with dilute mineral acid, resulting in pastes with decreasing viscosity. Oxidized starches have reduced viscosity due to oxidation, primarily with sodium hypochlorite. Cationic and hydroxyethyl starches are stabilized against felling by reacting with monofunctional reagents, giving the starch more strength. Hydroxyethyl starch is produced by adjusting the pH of the starch and adding a salt, increasing its stability and resulting in a clear paste. Starch acetates are produced by acetylating the slurry with acetic anhydride or vinyl acetate, reducing the tendency of the starch to congeal. Starch succinates are made by using succinic anhydride instead of acetic anhydride, thereby improving the thickening quality of the starch. Starch phosphates are produced by esterifying starch with orthophosphate or sodium triphosphate to increase the stability of the starch. In addition, the starch slurry can be passed through a starch dryer and then be dry-heated or roasted, with or without an acid or alkaline catalyst, to produce dextrin. This process gives the dextrins a low viscosity, more cold-water solubility, less tendency to gel, and more reducing power than common starch, leading to the use of dextrins as adhesives.

Exhibit 87: Global Dextrins Market Size – Value, USD Million

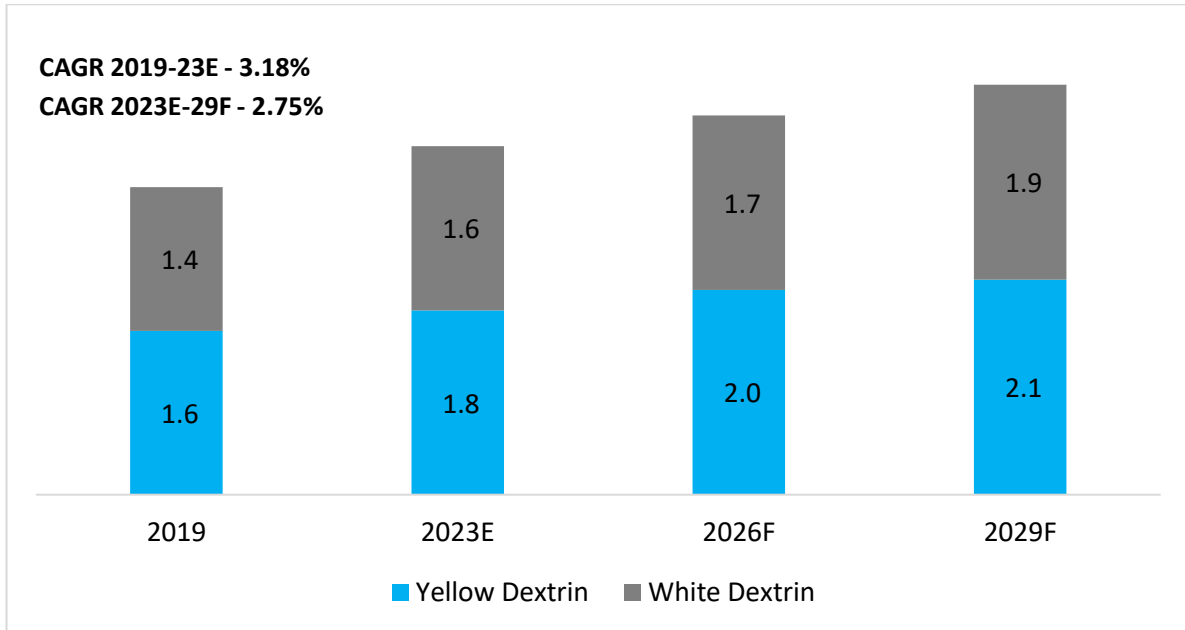


Source: Industry sources, Frost & Sullivan

A. Dextrin

The Global Dextrins market is estimated to be USD 1,679.4 million in 2023 and is expected to grow at CAGR of ~3.58% to reach USD 2,073.9 million in 2029. Dextrin’s are primarily made in two categories i.e., Yellow Dextrin, and white dextrin. These are mainly available in dried powdered form, which makes it easy for handling and transportation. Yellow dextrin accounted for ~52% of dextrin market with 1.8 million Tons in volume. It is majorly used as a thickener, adhesive and glazing agent in the food industry, and as a binder in paper and cardboard manufacturing. It also has applications in pharmaceutical industry, where it is used for tablet coating and as a stabilizer in emulsions. It is also used in the manufacture of paints, adhesives, coatings, and inks.

Exhibit 88: Global Dextrins Market Size – Volume, Million Tons

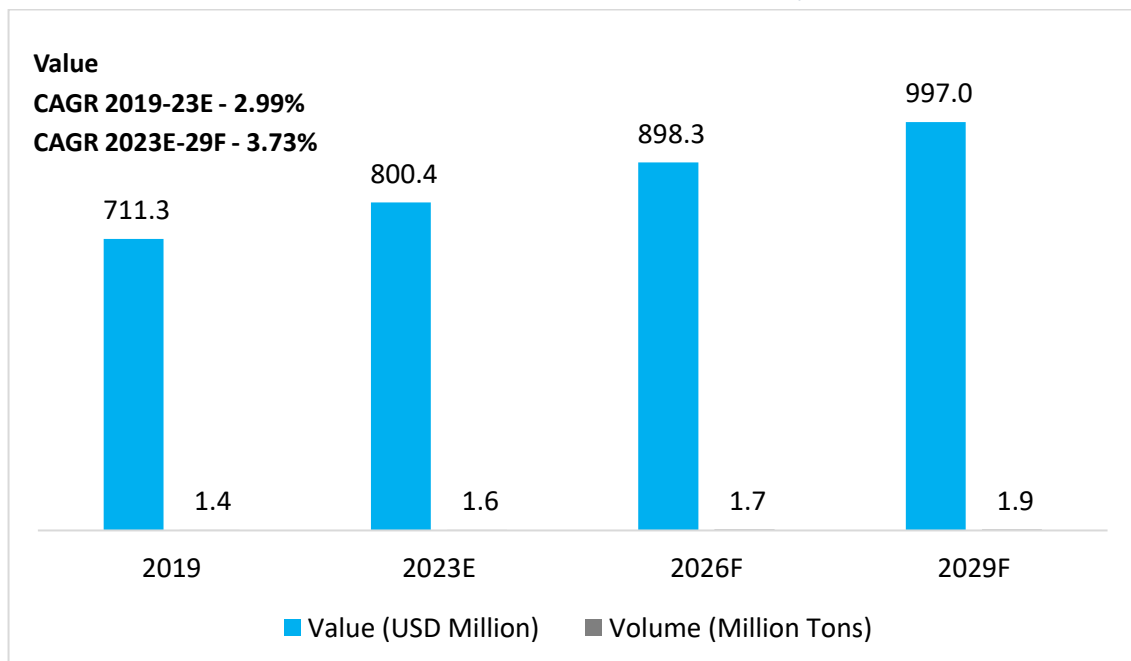


Source: Industry sources, Frost & Sullivan

High quality papers such as magazine covers, brochures & catalogues production used yellow dextrin not only as an aesthetic ingredient but also to provide support for glossy pages thereby enhancing the print quality. The Mining industry uses yellow dextrin as foam control agents to improve the efficiency of ore separation processes and, in the textile industry, yellow dextrin is used as blanket adhesives when screen-printing fabrics.

The Yellow Dextrin market is projected to grow at a CAGR of 3.1 % from 2023 to 2029 with volumes reaching to 2.14 million tons in 2029 from 1.8 million tons in 2023. The growth in Yellow Dextrin market is fuelled by increasing demand for food-grade and industrial-grade yellow dextrin from applications such as envelope adhesive, paper application.

Exhibit 89: Global White Dextrin Market Size - Value, Volume

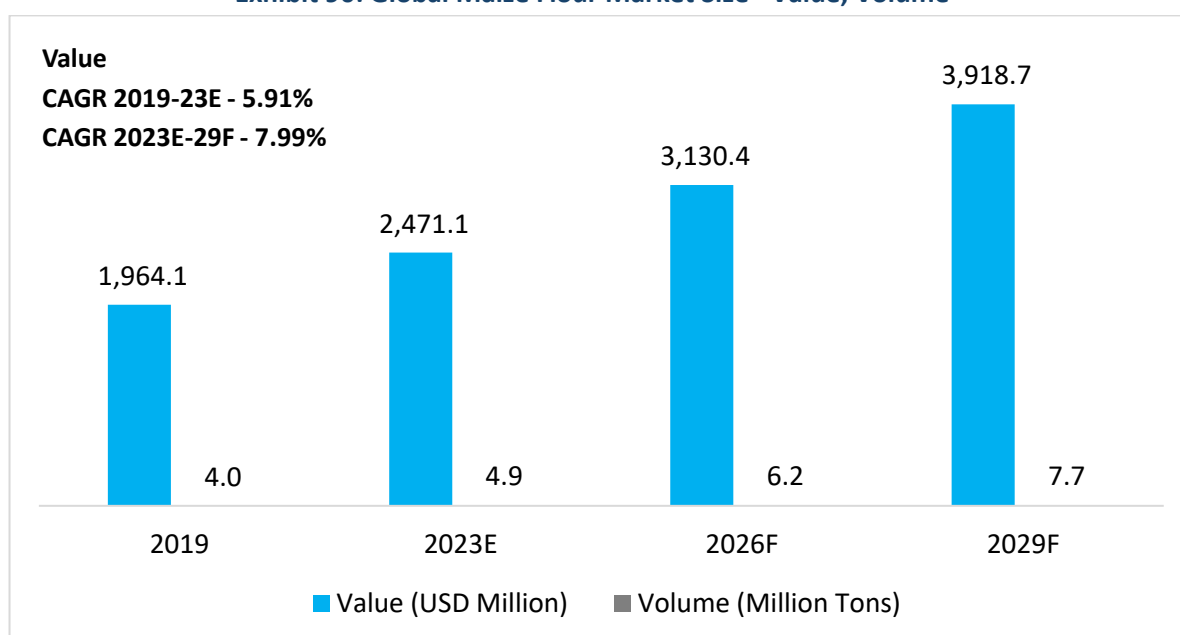


Source: Industry sources, Frost & Sullivan

B. **White Dextrin** is used extensively in making adhesives for paper converting. It is mostly employed with starches and ingredients such as alkaline materials, borax, fillers, latices, resins, salts, and defoamers. The Global market for White Dextrin was valued at USD 800.4 Million in 2023 and it is projected to reach USD 997 million by 2029, expanding at a CAGR of 3.73% during the forecast period.

White dextrin is especially useful in paper sizing when thin viscosities are required. White dextrin also has its applications as dough improvers in baking of breads and rolls. They area also added to increase the crispness of batters for breading fish and poultry. Some of the key players in the Yellow and White Dextrin market are Agrana, Tate & Lyle, Cargill, Sunar group, and Roquette.

Exhibit 90: Global Maize Flour Market Size - Value, Volume

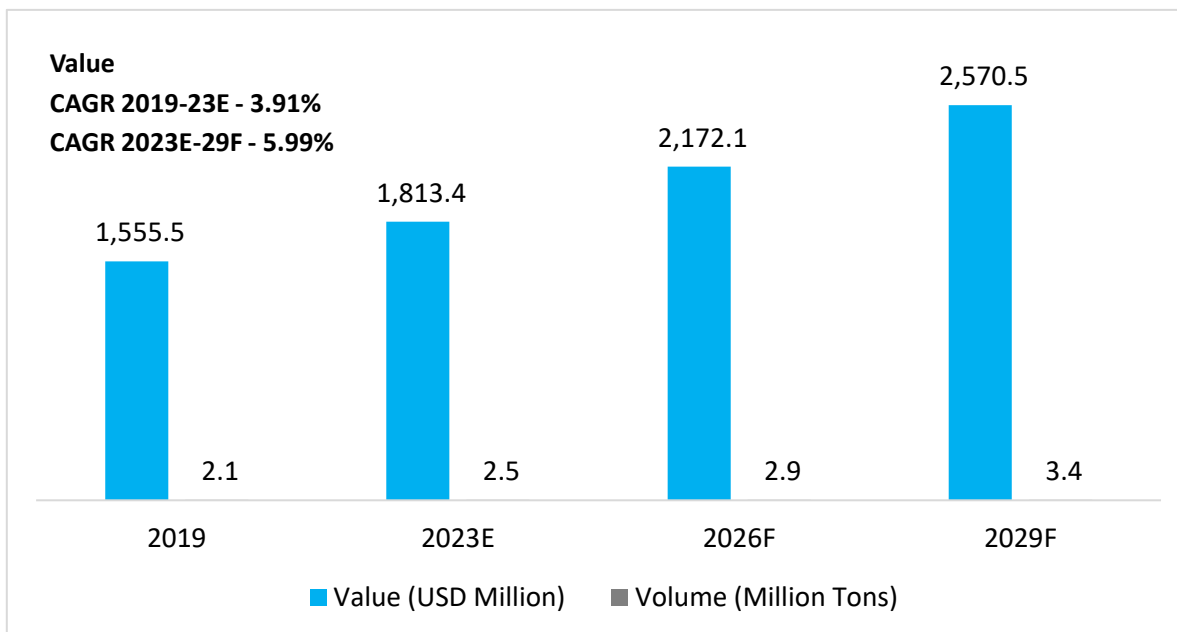


Source: Industry sources, Frost & Sullivan

C. **Maize Flour:** - The Maize Flour market is estimated to grow at a CAGR of 7.99 % between 2023 and 2029 owing to growth in bakery industry, ready to eat products and increasing demand from developing markets. The size of the market in 2023 was USD 2,471.1 million and is forecasted to reach USD 3,918.7 million by 2029. The market for Maize flour is highly unorganised in Asian countries whereas North America and Europe’s market is dominated by players like Cargill, Bunge, and ADM. Many retailers and supermarkets sell their products under private labelling which increases the profitability as these products are priced lower than the branded products. This increases chances of price sensitive customers buying the private labelled products. Cargill and Bunge have Maize Flour product portfolio which wide selection of products and granulations for use in chips, taco shells, tortillas, and other innovative snacks. ADM sells coarse, medium and fine maize flour which can be used for extrusion, bakery products, breads, batters and dusting. ADM also has pregelatinized maize flour in their product portfolio. Gruma has maize flour brands- Maseca, Masa Rica, Tortimasa with its presence in Latin America, North America, Europe, Middle East, Africa, Asia and Oceania. International Grains and Cereal has Maize Flour brand named P.A.N which is popular across USA. Bob's Red Mill Natural Foods offers 100% stone ground maize flour.

Semo Milling has yellow maize flour in their product portfolio. Associated British Foods Plc. through its company Westmill sells maize flour with Green Dragon brand name.

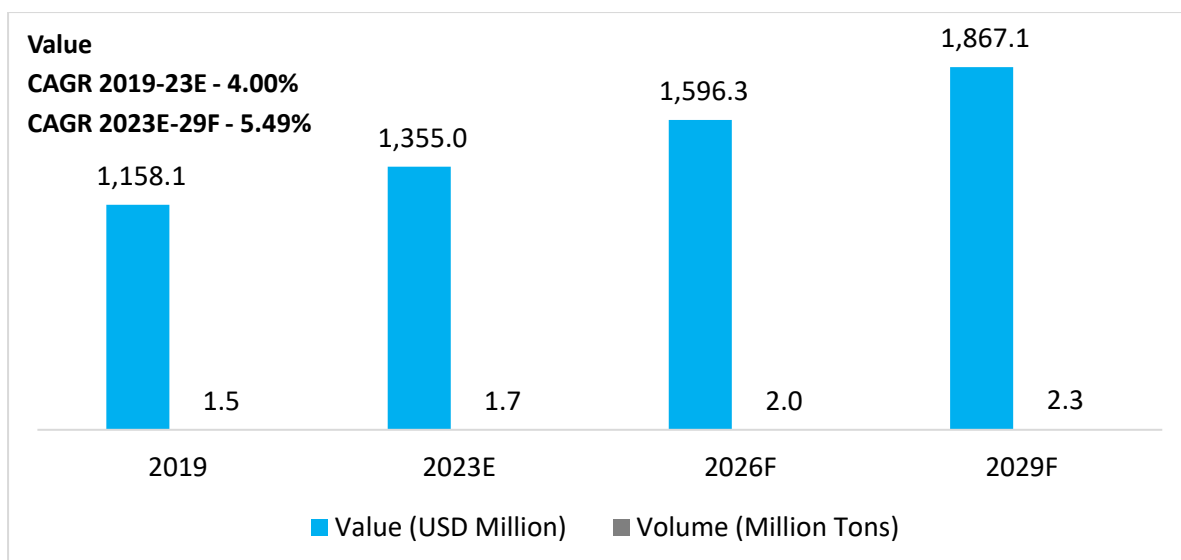
Exhibit 91: Global Baking powder Market Size - Value, Volume



Source: Industry sources, Frost & Sullivan

D. **Baking Powder:** Baking Powder consists of baking soda, an acid salt, and Maize Starch. It is used to leaven baked goods by reacting with the acidic components in the dough or batter to produce carbon dioxide gas bubbles which expand during baking and make the baked goods rise and become light and fluffy. Baking powder is essential ingredient in cakes, breads, tarts, pastries, and biscuits. The global Baking Powder market is projected to grow at a CAGR of 5.99% from 2023 to 2029. The growth is attributed to the increasing demand for bakery products, especially in developing countries. Baking powder can be segmented based on – phosphorus, anhydrous phosphorus, sodium aluminium sulphate phosphate, tartrate, aluminium free and phosphate free. The phosphate-based segment is projected to dominate the baking powder market owing to its high leavening power and good volume stability.

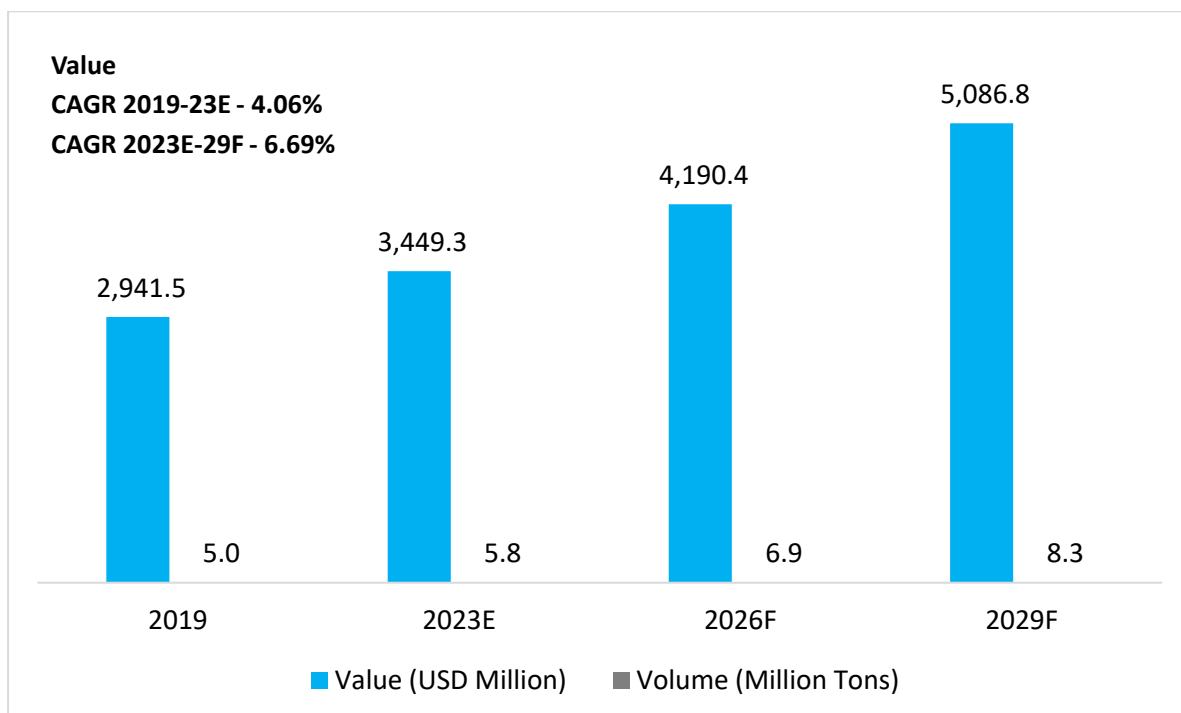
Exhibit 92: Global Custard Powder Market Size - Value, Volume



Source: Industry sources, Frost & Sullivan

- E. **Custard Powder:** - Custard powder has replaced the conventionally used egg for custard preparation. Global custard powder market was valued at USD 1,355 million in 2023 and is expected to grow at CAGR 5.49% till 2029. Manufacturers are offering variety of flavours and types in custard powder which include baked custard, stirred custard, refrigerated custard, Ultra Heat-Treated custard, rose flavoured, vanilla flavoured, pista flavoured, chocolate flavoured and so on. Swiss Bake, GD Foods, Premier Foods, Kraft Foods, Pillsbury, Goodman Fielder ITN Food Corporation, Well and Good Pty Ltd. Unilever Food Solutions are some of the key players in custard powder industry.

Exhibit 93: Global Icing Sugar Market Size - Value, Volume



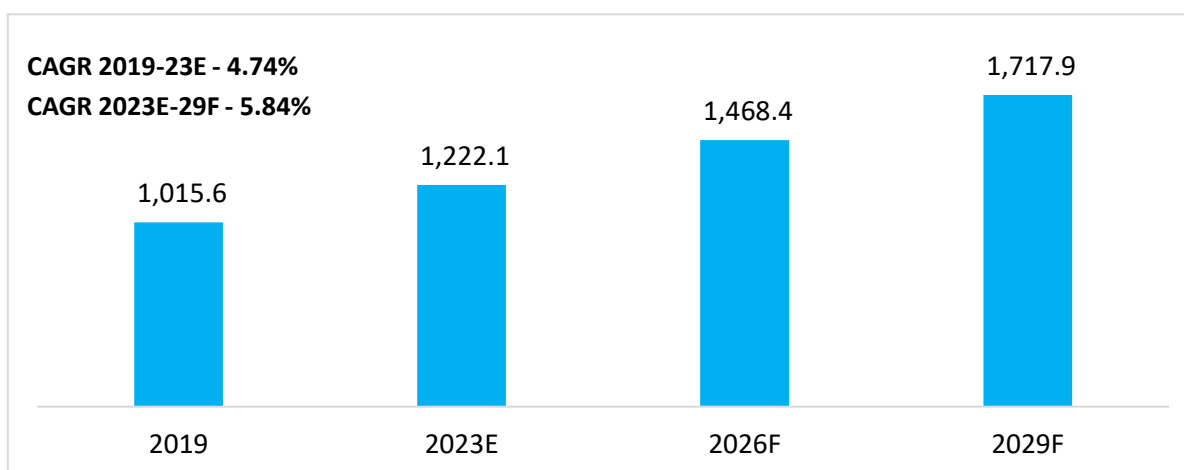
Source: Industry sources, Frost & Sullivan

- F. **Icing Sugar:** Icing sugar also known as confectioners' sugar is finely ground sugar produced by milling granulated sugar into a powdered state. Its fine nature makes it suitable for bakery and confectionary applications. It is majorly used for preparing frosting and icing on baked items, desserts, and sweets. The global icing sugar market was valued at USD 3,449.2 million in 2023 and expected to grow at CAGR 6.69% till 2029. Need of fine texture in food, increasing demand for confectionary on account of growing population growth will cushion the growth of the icing sugar market. Major players in global icing sugar industry are Associated British Foods Plc, Sudzucker group, Tate Lyle Plc, Thai Flours, Indiana Sugars, NZ sugar company.

6.5. Indian Modified Starch Market

The Indian Modified Maize Starch Market has witnessed significant changes in the past few years. The industry outlook looks promising for coming years as many manufacturers are investing in the modified starch value line. Modified starch usage is listed in chemicals considered emulsifiers, thickeners, and stabilisers under Food Safety and Standards Authority (FSSAI). When modified starches are added to food, they act as emulsifying and stabilising agents, which means they facilitate uniform dispersion of oils and fats in aqueous media or vice versa and/or stabilising the resultant emulsions. Modified maize starches are preferred because they overcome shortcomings of native starches such as loss of viscosity/thickening power upon cooking and storage and retrogradation characteristics. Modified starches greatly affect the textural features of these snacks, including crispiness, uniformity, and puffing. The awareness level of modified starch usage in food products is increasing steadily in India.

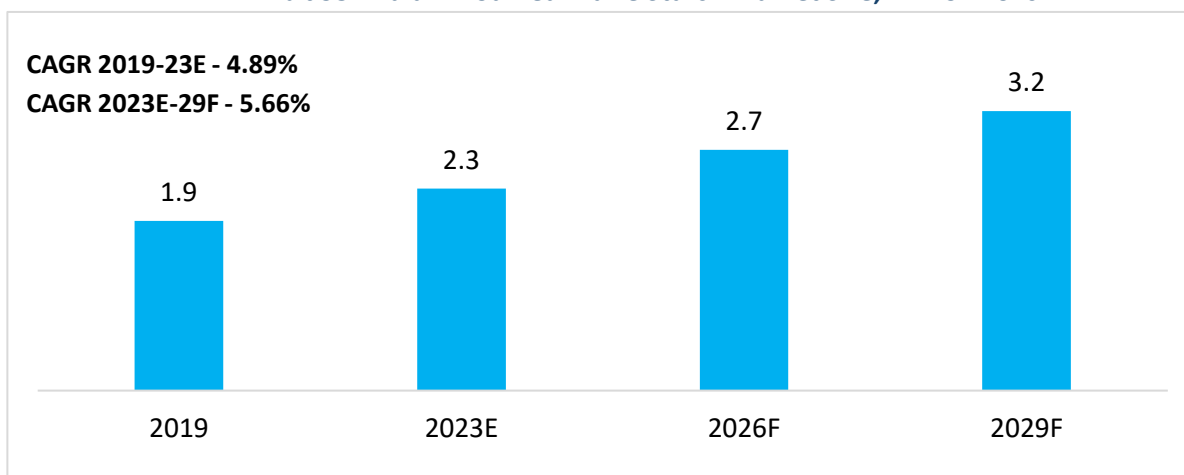
Exhibit 94: Indian Modified Maize Starch Market Size, USD Million



Source: Industry sources, Frost & Sullivan

The Indian market for Modified Maize Starch was valued at USD 1,222.1 Million in 2023 and is expected to reach USD 1,717.9 Million in 2029. Though the pace of growth is quite good, Indian market is very price-sensitive market, cost is a significant criterion while choosing suppliers as it has a domino effect on the price of the end-product.

Exhibit 95: Indian Modified Maize Starch Market Size, Million Tons



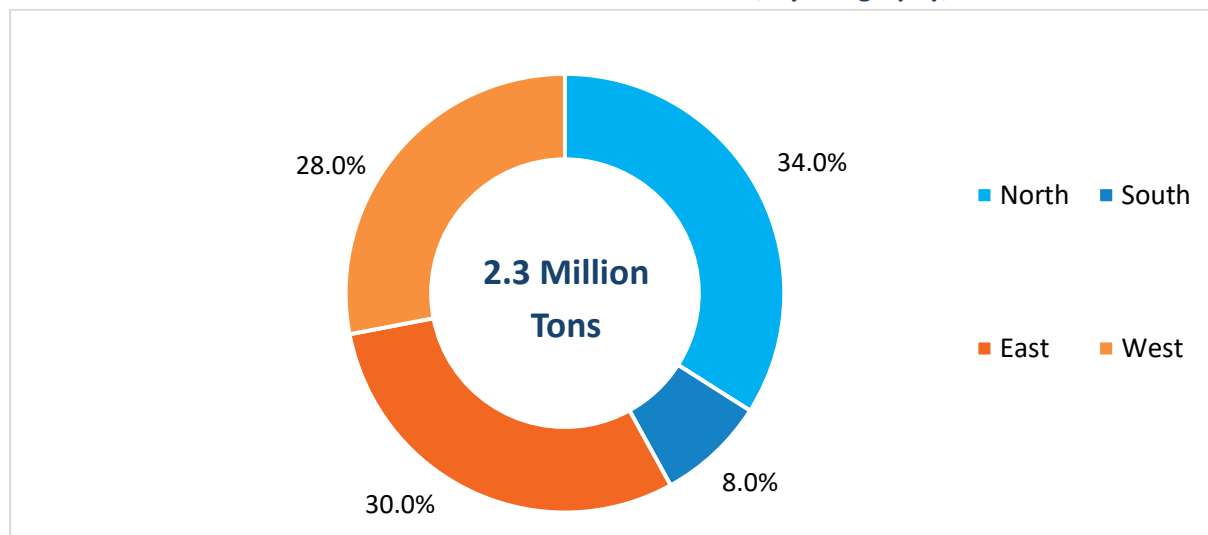
Source: Industry sources, Frost & Sullivan

The recent change in regulation of Modified Starch i.e., dosage in processed foods can be considered under GMP (Good Manufacturing Practice) by the producer instead of the earlier dosage limit of 0.5% has not only increased the dosage of the ingredient in current applications but also paved the way for new applications, which has positively affected Indian starch demand in recent years.

6.6. Geography-wise Breakup of the Indian Modified Starch Industry

The consumption in India is nearly one fourth in comparison to China, thereby indicating enormous scope of growth.

Exhibit 96: Indian Modified Starch Market Size, By Geography, 2023E



Source: Industry sources, Frost & Sullivan

6.7. Application wise breakup of the Indian Modified Starch Industry (Volume)

Industrial sectors which are demand driver for the starch industry are doing extremely well & expected to continue the uptrend in 2023. Modified Starch is majorly used in Paper industry, Textile industry and Food and beverage industry. The demand for modified starches in different food and beverage segments is expected to grow rapidly in coming years. Sauce, salad dressings, and spreads are key end sectors for modified starch, accounting for more than 35-40% of modified starch demand and are expected to fuel demand of specifically modified starches. Next emerging segment is bakery and snacks. Modified starch is used to provide the desired hardness to cookies and impart texture and stability for bars. Thus, the demand for modified starch in snack preparation has been significantly growing. Also, other key food applications for Modified Starch are processed meat, spice mix, etc. Other minor sectors such as dairy, confectionery, food service, noodles, RTE, and beverages are trying modified starches for its various applications.

Modified Maize starch is also widely used in the paper industry which give good quality final product along with efficiency in production. They are used in different stages of manufacturing such as wet end, spraying, surface sizing, etc. Usage of oxidized maize starch- type of modified starch is increasing in pharmaceutical and nutraceutical industry. It is well known as a disintegrant filler and binder in dosage forms. It is used in a variety of dosage forms including swallowable tablets, hard capsules, blends, granules, and pellets premix. Manufacturers such as Roquette and Cargill offer a whole range of modified starches to meet the adhesive industry's needs.

Pharmaceutical Industry

- Dusting media for various type of coating as well as binder & filler for capsules & tables
- An efficient dry – binder in dry granulation techniques

Textile Industry

- Provide stiffness & add weight to clothes.
- Used in conjunction with thermoplastic or thermosetting resins to obtain a permanent finish.

Paper Industry

- Used for sizing as well as to increase the paper strength.
- An adhesive in pigmented coating for paper and paper board to enhance the printability and appearance of the paper.

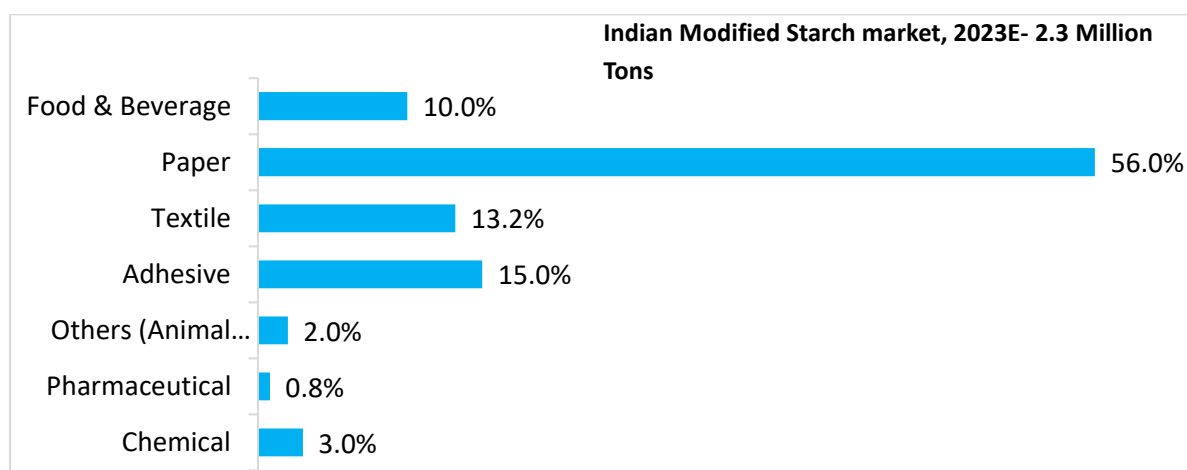
Food Industry

- Used for thickening sauces, gravies, puddings, and pie fillings.
- Numerous applications in baking industry, provides strength to ice cream cones.
- Ketchup - As a thickener Soups, As a thickener Sauces Improves appearance.
- Mayonnaise - As a thickener
- Noodles - Increases viscosity, consistency, mouthfeel.

Subproducts

- **Baking**
 - Maltose - Improves moisture retention and colour control.
 - Dextrose - Improves crust and dough properties.
 - Low fat foods as a sweetener
- **Beverages** - Beer Maltose - HFS is an excellent fermentation substrate.
- **Soft drinks** IIFCS DE 42 and DE 55 are used as sweeteners.
- **Alcohol** Very high DC glucose syrups are used as fermentation boosters.

Exhibit 97: Indian Modified Starch Market Size, By application, 2023E



Source: Industry sources, Frost & Sullivan

6.8. Indian Dextrin and Value-Added Products

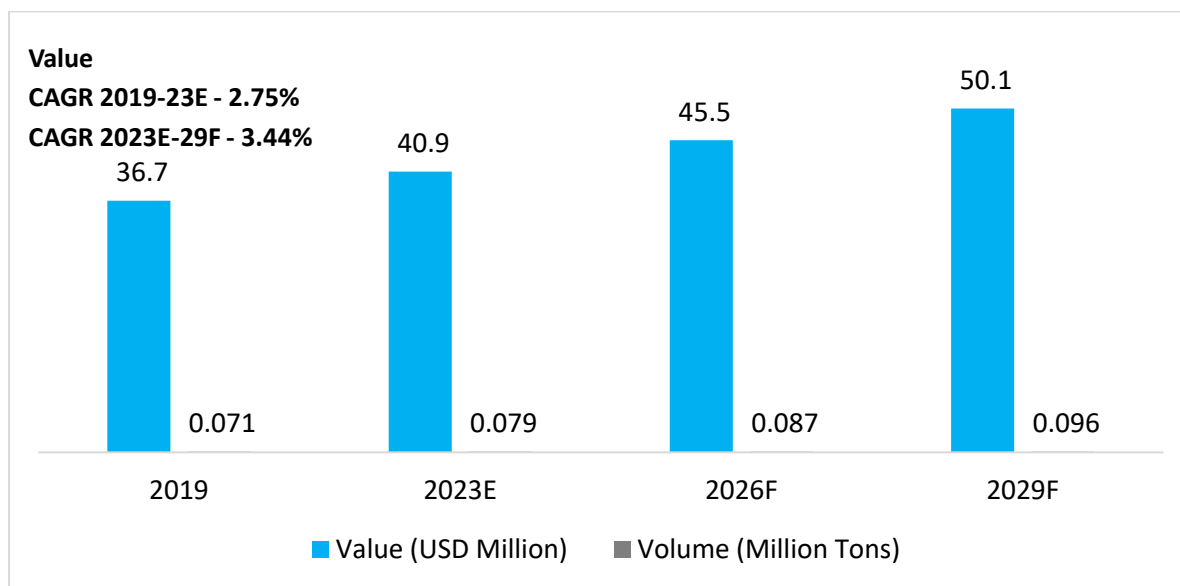
A. Dextrin

Dextrins are majorly used for their coating, adhesive and binding properties in Indian market. Textile and Paper industries in India use dextrin's on large scale followed foundries and firework industry.

White Dextrin Powder is used as coating and finishing agent which helps to increase weight and stiffness of fabrics. It is also used as a carrier in colour and dyes industries. In paper industry when thin viscosities are required, white dextrin is used. White dextrin is also used as carbohydrate nutrient sources in the preparation of certain antibiotics by fermentation. It is also used in biscuit industry to enhance the shelf life and crispiness. It can be used as an active ingredient in food flavours.

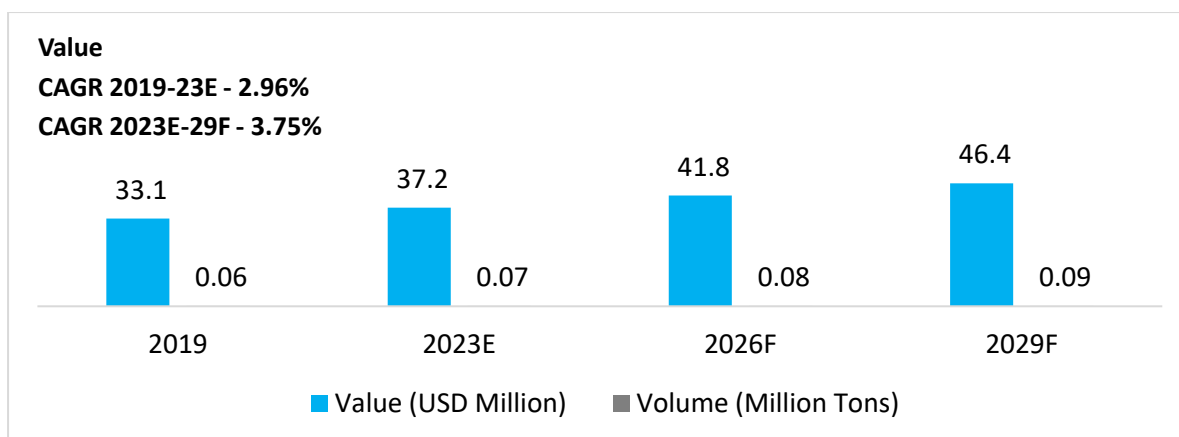
The Indian market for white dextrin powder stood at USD 37.2 million in 2023 and expected to reach USD 46.4 million in 2029, with a CAGR of 3.59%. Growth in white dextrin can be attributed to its demand in foundries, pharmaceutical companies, food and confectioneries companies, construction chemicals, paint industry and leather chemicals. Some of the key players in the yellow and white dextrin market in India are Universal Star Chem Allied Ltd, Sahyadri Starch and Industries Pvt Ltd, Gujarat Ambuja Exports limited and Paramesu Biotech Private Limited.

Exhibit 98: Indian Yellow Dextrin Market Size - Value, Volume



Source: Industry sources, Frost & Sullivan

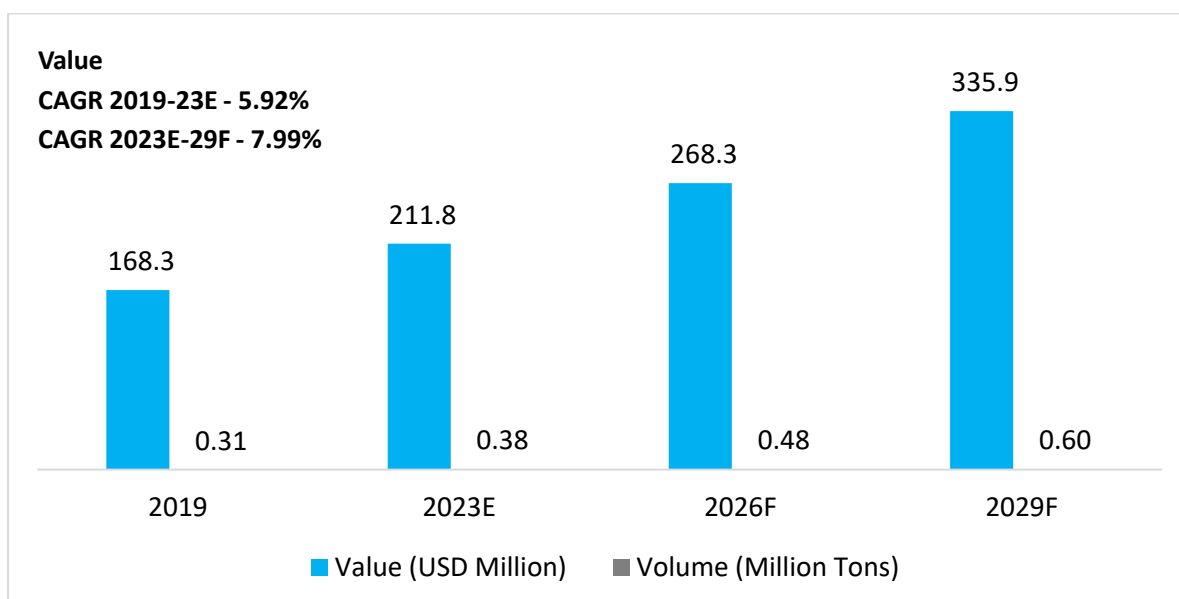
Exhibit 99: Indian White Dextrin Market Size - Value, Volume



Source: Industry sources, Frost & Sullivan

B. Maize Flour: The Indian maize flour market size is expected to be valued at USD 335.9 million in 2029 from USD 211.8 million in 2023. Increasing demand for ready to eat products, noodles, pasta, chips, nachos, bakery products, soups and similar products is creating incremental opportunities for maize flour producers. The overall demand for maize flour is projected to grow at a CAGR of 7.99% between 2023 and 2029. Maize Flour is dusted on vegetables, paneer or chicken before deep frying to achieve perfect crispiness, especially while cooking desi-Chinese meals. It is also used in Indian households to thicken the gravies, soups and add crispiness to fried food products. Indian maize flour market is highly fragmented and unorganised with existence of many private labelling players as well. On an average, price for maize flour in Indian retail market ranges from Rs 25-30 for 100-200 gm of packet with shelf life of 18-24 months. Bulk purchasers buy maize flour at Rs 25-35 per kilogram. Some of the key brand available in retail market are Top, Brown & Polson, Blue Bird Foods Pvt Ltd., Weikfield, Ruchi, Aahar, Dr RBL, SFT, Mr Kool, Mojan Impex, Khushi and so on. Many players such as Burly Field, Organic Tattva, Natureland, Radha Govind have also started offering organic- 100% natural maize flour.

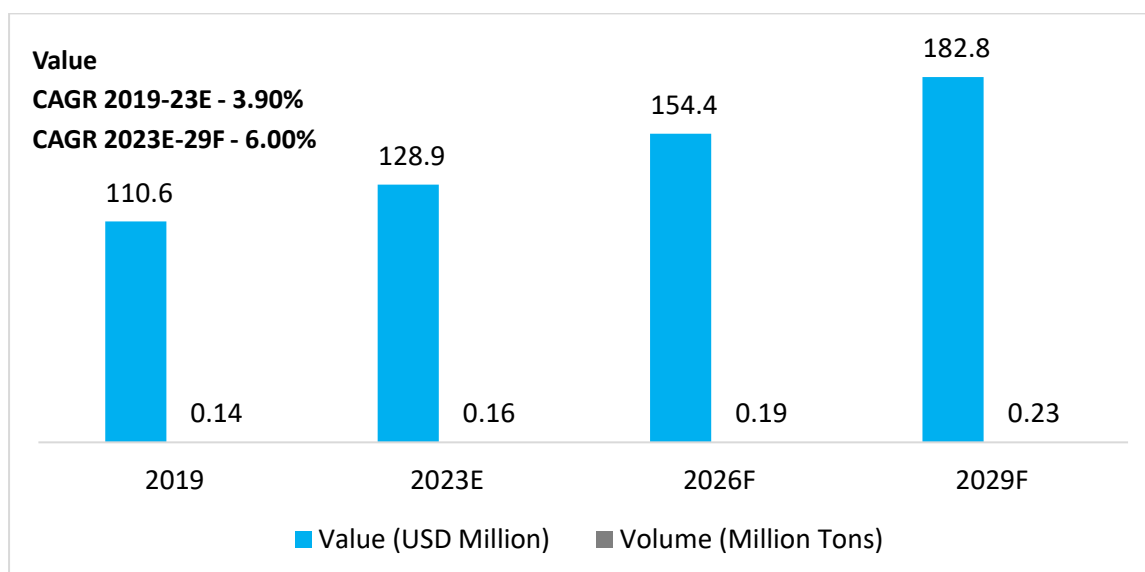
Exhibit 100: Indian Maize Flour Market Size - Value, Volume



Source: Industry sources, Frost & Sullivan

C. Baking Powder: Baking powder market in India is valued at USD 128.9 million in 2023 with expected growth of 6.0% till 2029. In the production of bakery goods such bread, tarts, pies, pastries, biscuits, and cakes, baking powder is a crucial ingredient. A good quality baking powder is necessary for improved baked goods in terms of flavour, colour, and texture. Because of this, the market has seen continuous demand over the past few years. The widespread use of baking powder in the food processing sector has persisted even as customers' preferences for healthier food have increased. As a result, the market for baking powder has historically been remarkably stable. Blue Bird Foods (India) Private Limited, Amrut International, Swiss Bake Ingredients Pvt. Ltd., Ajanta Food company, RB Foods, Urban Platter, Weikfield, Indiana, and Mr. Kool are some of the manufacturers of baking powder in India.

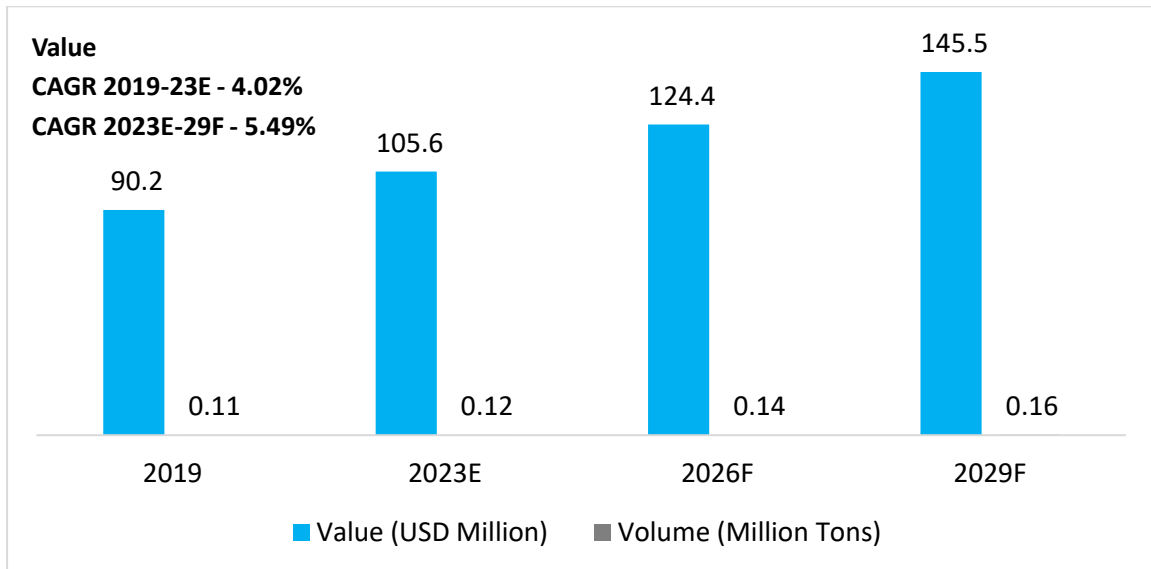
Exhibit 101: Indian Baking Powder Market Size - Value, Volume



Source: Industry sources, Frost & Sullivan

D. Custard Powder: The Indian custard powder market has witnessed a growth from USD 90.2 million to USD 105.6 million from 2019 to 2023. With a CAGR of 5.49%, this market is estimated to reach USD 145.5 million in 2029. With increasing globalization, people have developed taste for food from western countries and are ready to try new products which will help further penetration of custard powder in Indian markets. Some of the company's manufacturing custard powder are Weikfield, Pillsbury, Kraft Foods, GD Foods, Premier Foods, ITN Food Corporation, Well and Good Pty Ltd, Unilever Food and General Mills Inc.

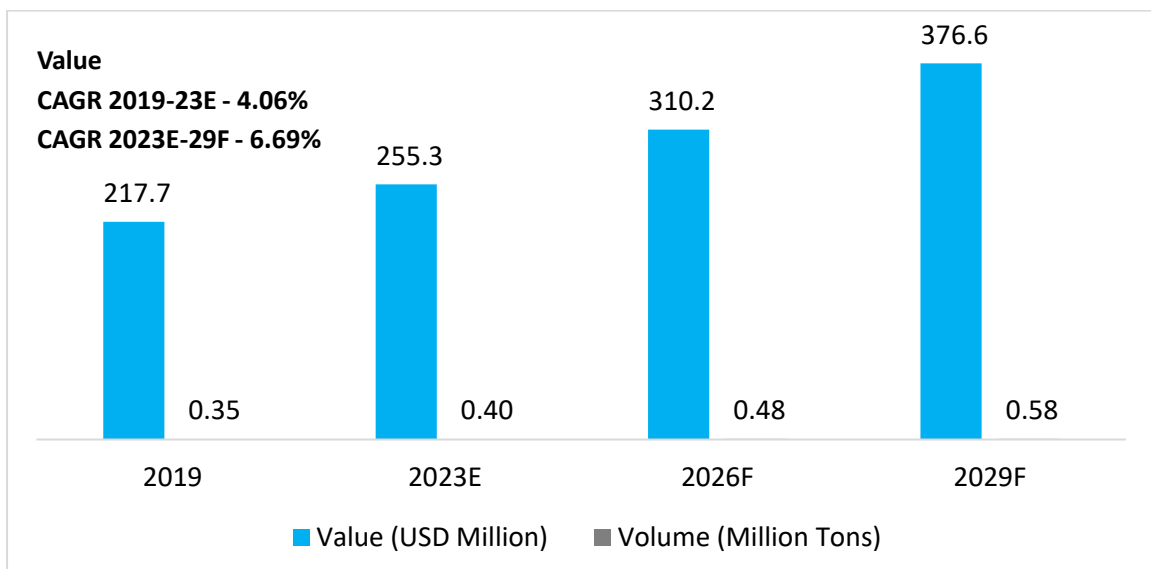
Exhibit 102: Indian Custard Powder Market Size - Value, Volume



Source: Industry sources, Frost & Sullivan

E. Icing Sugar: Icing sugar is majorly used by commercial bakeries, confectionary manufacturers, and beverage producers. Icing sugar's fine texture makes it perfect for dusting over cakes, pies, and pastries to sweeten and add a lovely decorative touch. Indian market for icing sugar is valued at USD 255.3 million and is expected to grow at CAGR of 6.69% till 2029.

Exhibit 103: Indian Icing Sugar Market Size - Value, Volume



Source: Industry sources, Frost & Sullivan

The food industry uses an increasing amount of modified starches. Acid-modified starches have a lower viscosity, higher gel strength, and improved clarity compared with native starch and these products are used in cakes and gum confections. Oxidized starch, made using hypochlorite, provides gels of low strength but improved clarity and these are used for candy production. Cross-linked starches have reduced stringiness and are best suited to pie fillings and canned pie

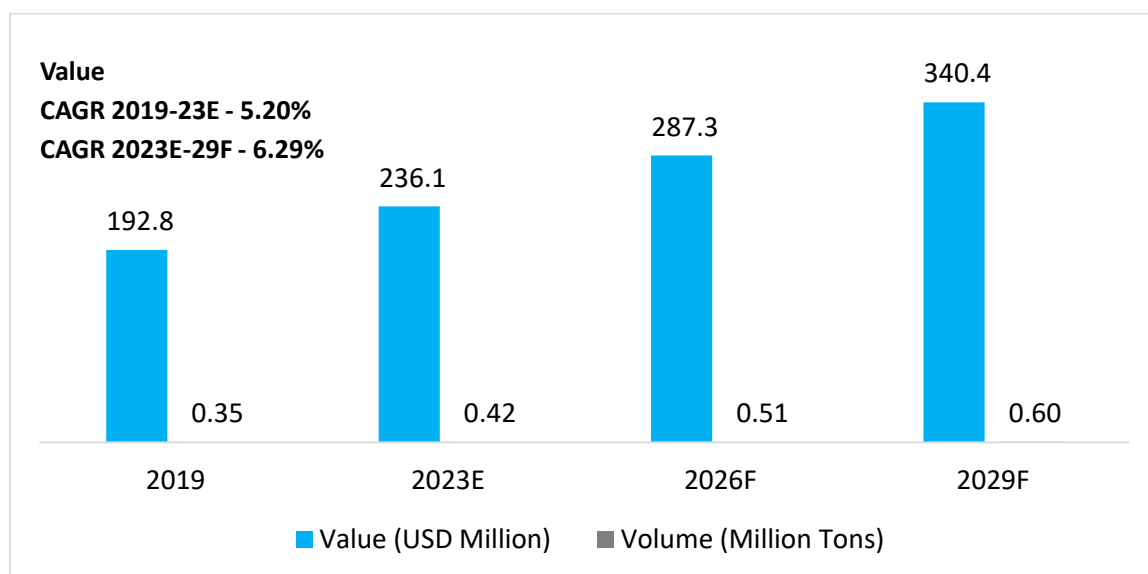
fillings. Esterified starches are highly stable and do not retrograde on repeated freeze-thaw cycles. These are used in frozen dessert products and pudding starches. Acetylated starch has good stability at low temperatures and is used in canned, frozen, baked, and dry foods.

F. Other starches

1. Oxidised Starch

The market for oxidized starch is anticipated to expand at a CAGR of 6.29% till 2023. The industry is expected to value around USD 340.4 million by 2029 up from USD 236.1 million in 2023. The chain length of oxidized starch is shorter than that of native starches which helps in providing range of viscosity and fluidity to suit the requirement of paper processing in the application of surface sizing. It helps in improving oil absorbency quality of paper and imparts smoothness to paper.

Exhibit 104: Indian Oxidized Starch Market Size - Value, Volume



Source: Industry sources, Frost & Sullivan

It is also used as coating in industries including food, pharmaceuticals, textile, construction. Oxidized starch is also used as stabilizers in milk and ice-cream dessert, pudding and dessert. In confection and confectionary industry as organization and structure creators for preparation of deserts, fillings, soufflé and jellies.

Additionally, it is employed in the manufacture of acoustic tiles, wafer cups, and isolation cardboard for the building sector.

Indian manufacturers are providing customized oxidized starch where the viscosity is adjusted as per the customer requirement. It is available in 50 Kg. HDPE bags with inner liner. However, special packing like Jumbo bags or Paper bags with 25 Kg SKU is also arranged as required. Some of the key end users of oxidized starch are Emami group, Century, Khanna Paper, and Trident group.

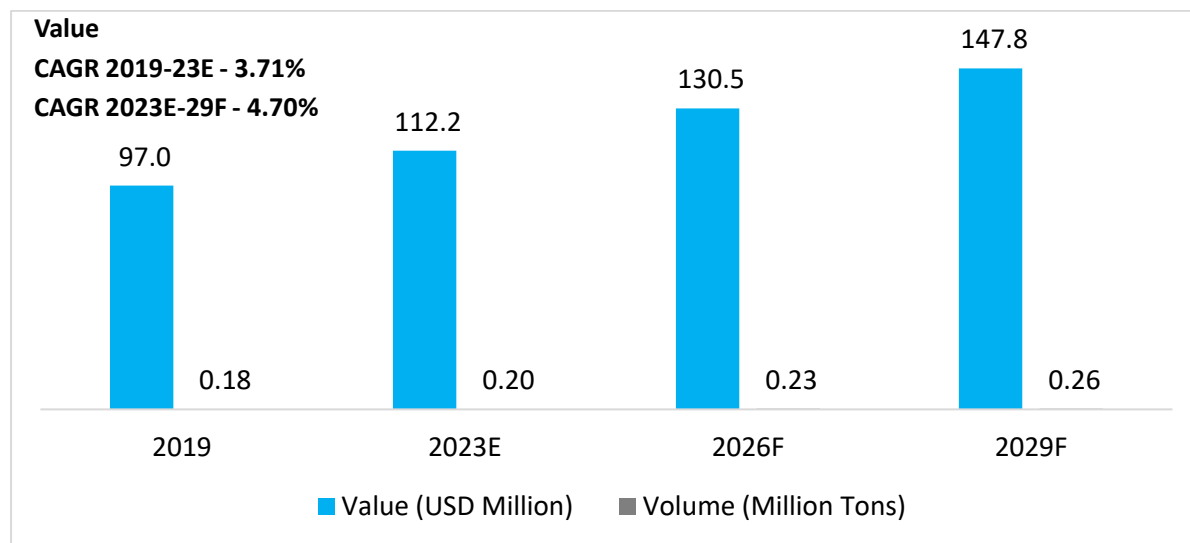
2. Cationic Starch

Cationic starches signify high performance starch derivatives which have affinity towards negatively charged substance which include cellulose, slimes, macromolecules, and aqueous suspensions of minerals. Because of this property of cationic starch, it has gained wide

commercial applications. Cationic starch is majorly used in paper industries' wet end applications to improve retention of fines and fillers, to improve strength by addition of fiber bond and for better sheet formation with good drainage. Cationic starches are effective for improving physical properties of paper as bursting and tensile strength, elongation, fold endurance, and pick resistance. They are often used in manufacturing high grade printing papers, fine writing papers, light weight papers such as bread wraps and glassine.

Cationic starch also has application in detergent soaps & powder, paint & emulsion, wall putty and disposable diapers industry.

Exhibit 105: Indian Cationic Starch Market Size - Value, Volume



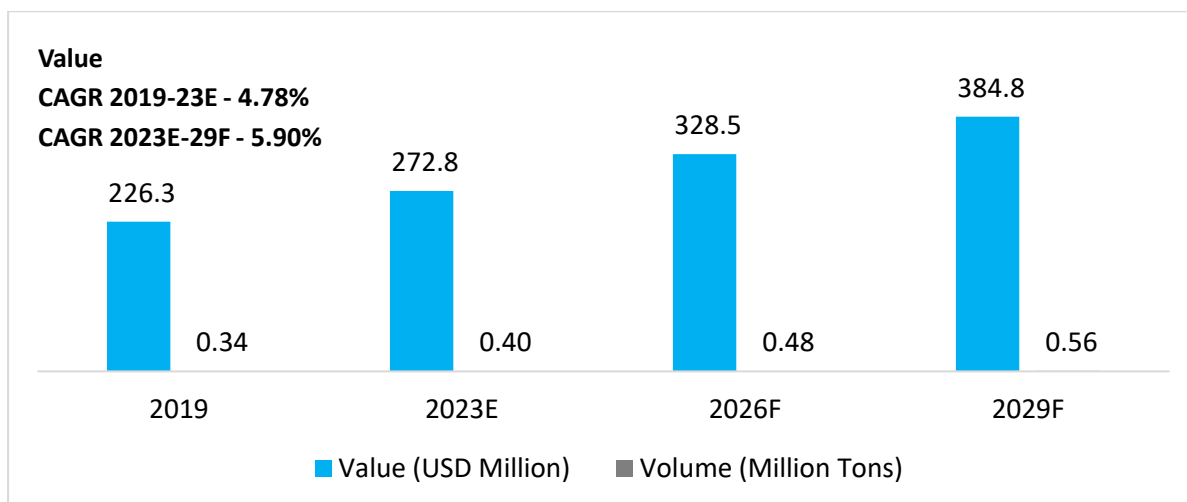
Source: Industry sources, Frost & Sullivan

The Indian cationic starch market was valued at USD 112.2 million in 2023 and is expected to grow at CAGR of 4.7% to reach USD 130.5 million in 2029. Indian manufacturers are providing cationic starch, which is fine, white, odourless, dry powder with less than 12% moisture content in 50 kg SKU packed in HDPE bags with inner liner or Jumbo bags as per client's requirement.

3. Pregel Starch

Pregelatinized maize starch is type of modified starch which is soluble in cold water as it easily absorbs water and swells at room temperature. It has characteristics like strong water absorption and high viscosity. It helps in the development of viscosity during the manufacturing processes either without cooking or with processing at very low temperatures and it is intended for instant cold preparation applications. Pregelatinized starch has its applications in dairy products, beverages including less sugar variants, confectionery, cold mixes such as fruit and cream fillings, glazes, frostings and icing for bakery products and snacks, instant foods, soups, sauces, dressings.

Exhibit 106: Indian Pregel Starch Market Size - Value, Volume



Source: Industry sources, Frost & Sullivan

There are also other industrial and pharmaceutical applications for pregelatinized starches. Pharmaceutical grade pregelatinized starch is widely used as a binding and disintegrating agent for tablets, pills and granules, also used as filler for capsules.

It is used as a binder for briquettes in coal, foundry, incense stick and mosquito coil industry. It is also used as fluid loss control additive in oil well drilling industries. Pregelatinized maize starch is also widely utilized in the fish feeding industry as binding agent or expanding agent.

The market for Pregelatinized starch was valued at USD 272.8 million in 2023 and is expected to grow at CAGR of 5.9% till 2029. Indian manufacturers produce pregelatinized maize starch in range of lower to high viscosity and is available in 25 or 50 Kg SKU in printed or plain HDPE, PP bag, Multiply Paper Bag or Paper & PP Combined bag.

6.9. Comprehensive Study and Analysis of Market Drivers, Restraints, and Opportunities Influencing the growth of the segment.

Growth drivers for Modified Starch Industry in India

- Demand for clean-label products are driving the development of eco-friendly modified starches
- Rising health consciousness among consumers leading to a consumer preference for products using maize based specialty products and ingredients solutions due to their nutritional superiority.
- Growth in pharmaceutical sector
- Growing demand for ready to eat packaged foods and convenient food packaging options
- Novel applications - Modified starch suited for various specific applications resulting in higher efficiency and better quality of end products. E.g. application of cationic starch in paper industry is resulting in lower fiber loss, better printability and use for starch in manufacturing ethanol.

Growth Restraints for Modified Starch Industry in India

- High cost of natural additives
- Lack of adequate infrastructure and capacity to dry up maize to the level of 14% leading to wastage and loss to farmers.
- Maize Cultivation is a Water intensive affair and hence can be a cause of concern during the dry months of the year.
- Consistent quality of maize is not available round the year with high cost of cultivation is high as well as rising post-harvest losses.
- Legal restriction related to the use of modified starches in the country.
- Government regulations limiting the permissible limit of usage of starch in products in India compared to the permissible limits in other American and European countries.

Growth opportunities for Modified Starch Industry in India

- Possibility of forward integration for the production of sorbitol
- Substantial growth opportunities in targeted emerging markets for specialty starch
- Niche Applications – adhesives, textiles

Several types of Modified Starch polymers and their application in bone tissue technology as bone tissue engineering scaffolding, drug delivery system as biodegradable nanomedicine-carrier based delivery system and implants, and hydrogels have been studied by different scientists over the past few years. Starch has also been demonstrated as a viable material for capping of nanoparticles from different metals like Au, Ag and Pt, because of their bio-tolerance and cost effectiveness. It has also been demonstrated to have potentials for use as nanoparticles to stabilize emulsions, Pickering emulsions, which are useful in cosmetics, pharmaceuticals and foods

- **Sustainable Sourcing Practices** - Companies are exploring sustainable sourcing practices, such as upcycling, to reduce waste and environmental impact.

6.10. Noval Application of Starch

The application restrictions posed by native starches has paved the way for modified starch that find numerable applications in generating novel polymers with numerous functional and value-added properties that suit the needs of the various industries.

For instance, most currently used drug delivery systems are based on polylactide-co-glycolide (PLGA) and polylactide (PLA). Starch could provide an alternative for PLGA and PLA because it is already widely used as an excipient in medicinal products and medical devices. A type of starch could be used as an excipient in medicine to improve the treatment of patients. It makes a suitable drug release system and has advantages over already established excipients.

Additionally, it is also used as a common binder, disintegrant, diluent, absorbent, lubricant. Starch finds applications in thickening foods, sizing and coating papers, textile sizing, use in drilling muds, adhesive formulations, among others.

Starch has been the centre of integrating principles of green chemistry, green technology, and green nanotechnology with those of green packaging, resulting in films and coatings that are biodegradable and renewable. Current research in the field of starch-based films is focused on

- Improving existing green production technology, applying the chemistry principles by making the packaging material active or responsive
- Increasing the mechanical properties such as tensile strength and elongation at break

Mock meats

Recently, meat replacing products have gained traction on a global scale and is expected to gain further momentum. As a result, more products are appearing in the market that mimic meat or offer protein-rich alternatives to the consumers. Creating the adequate texture, flavour, and colour is one of the key challenges in the production of mock meat. The mock meat market is expected to be driven by consumer interest in plant-based diets such as eating fruits, vegetables, and nuts, as well as raising awareness of animal rights through various organizations. Plant-based mock meat is becoming an important part of a vegan diet, in which people practice vegetarianism by avoiding animal-based foods. Veganism is gaining popularity among consumers for both health and ethical reasons. The Meat Substitutes market accounts for USD 43.36 million in 2023. The market is expected to grow annually by 13.6% (CAGR 2023-2028).

Gelatinized starch is being used as a functional ingredient added to meat and meat replacing products. Modified starch is preferred for this application over native starch due to improved functionality. Starch is used as an ingredient in commercially available meat replacers and real meat products, though mostly applied in low quantities. In these cases, starch acts as a filler and can increase yield or modify water holding.

In the commercial production of mock meat, thermal pre-treatments can be seen as a potential way to functionalize less-refined raw materials, as there are potential synergies with the functionalization of protein in the same materials. Research progress has been made in terms of quality, sustainability, and cost-efficiency of meat replacers by designing fractionation processes for protein- and starch-rich crops specifically for meat replacers and combining them with treatments to endogenous starch such as to tune the functional properties of the fractions.

Bio-Materials and Biopolymers

Starch is an ideal candidate for edible and biodegradable films for packaging material since it is affordable, available, abundant, and renewable. Applications of biopolymers derived from chemically modified starch include packaging, adhesives, agriculture, superabsorbent and wastewater treatment. Global bioplastics production capacity is set to increase significantly from around 2.23 million tonnes.

Bioethanol

Ethanol is a chemical compound which can be used in different applications such as drinking alcohol in beverages as well as in chemicals, pharmaceuticals, and biofuels. The development of more efficient distillation processes in the nineteenth century led to large increase in industrial trade of ethanol. Presently, the bioethanol market is valued at USD 83.4 Billion in 2023. It is expected to reach USD 114.7 Billion by 2028 growing at an average CAGR of ~6.6%.

Bioethanol can be used for food production and to partially replace fossil fuel. Bioethanol has already been used in large scales in countries such as Brazil, the US, and few other European countries. The production has increased significantly over the few years since countries are looking for reducing oil imports while boosting rural economies and air quality. Additionally, maize and potato starch sources are a preferred renewable feedstock source due to its low-cost nature. Bioethanol is a viable alternative for a time when energy crisis requires more attention. Bioethanol fuel is mainly produced by the sugar fermentation process, although it can also be manufactured by the chemical process of reacting ethylene with steam. The main sources of sugar required to produce ethanol come from fuel or energy crops. These crops are grown specifically for energy use and include maize, maize and wheat crops, waste straw, willow and trees, sawdust, reed canary grass, cord grasses, Jerusalem artichoke, miscanthus and sorghum plants.

Worldwide, most bioethanol is produced from sugar cane (Brazil), molasses and maize (USA), but other starchy materials such as wheat, barley and rye are also suitable. Crops that contain starch have to be converted to sugars first. A feedstock of around 3 tons of grains is needed for the production of 1 ton of ethanol.

Some of the key uses of bioethanol are:

- as a transport fuel to replace gasoline
- as a fuel for power generation by thermal combustion
- as a fuel for fuel cells by thermochemical reaction
- as a fuel in cogeneration systems
- as a feedstock in the chemicals industry

Agriculture

In case of agriculture which heavily relies on plastic-originated mulch films, nets, packaging, piping, silage, among others. The use of biomaterials to design new materials for various applications is a common research topic throughout the world.

Pharmaceuticals

Biomaterials are used extensively in the design of modern dressing kits, implants, surgical sutures, stents, and craniofacial anastomoses.

Consumer products

Companies such as Nike, North Face, Louis Vuitton, and Adidas are jumping on the bandwagon to cater to environmentally cautious consumer segment that are interested in the source of the feedstock and the environmental impact each purchase has. This opens up a large market in the consumer durables segment for biomaterials and biopolymers. Other companies such as Unilever, Bolt thread, Phytolon, and MycoWorks are also creating products that are considered environmentally friendly polymers that are bio sourced.

Construction Chemicals

Starches and its products are used in construction chemicals as well. Starch Ether used in Dry Mix Building Mortar as it increases the performance, sag resistance, and consistency of mortar. Usually, non-modified and modified cellulose ethers are utilized with starch ether.

Flavours and Fragrances

Recently maize starch is being used in manufacturing flavours and fragrances. According to a recent study, flavour compounds with low solubility can form complexes with high-amylose maize starch, providing novel encapsulation and monetary benefits. Modified starches are used in encapsulated perfume particles which are then used in laundry compositions.

6.11. Key Players in the Global & Indian Modified Starch based Value Added Products (also known as Modified Starch Industry)

The Modified Starch Market is moderately fragmented globally. Some of the major players in the market include Archer Daniels Midland Company, Agrana, Emsland-Starle GmbH, Cargill, Inc., Global Bio-Chem Technology Group Co. Ltd., and others. Key players in the market enter strategic partnerships, M&A, and Joint Ventures, and focus on R&D to launch innovative products to cater to the changing preferences of consumers across the world. The industry is witnessing increased investment leading to enhanced capacity and higher M&A.

Global & Indian Modified Starch producing companies		
Emsland-Stärke GmbH	Roquette	Sanwa Starch Co. Ltd.
Nihon Shokuhin Kako Co. Ltd.	ADM	Japan Maize Starch
Global Bio-Chem Technology Group Company Limited	Agrana	China Essence Group Ltd.
Ingredion Incorporated	Cargill	PT Budi Starch & Sweetener Tbk
Tate & Lyle PLC.	Ulrick & Short	Nouryon
Gayatri BioOrganics	Sukhjit Starch and Chemicals Limited	Varalakshmi Starch Industries Private Limited

Global

- 1) Ingredion announced USD 160 Mn of capital investment into specialty starches to expand capacity, optimize its supply chain and further organic growth with a focus on localizing more Asia-Pacific production.
- 2) Agrana invested €200 million in the bioethanol plant in the past and the first wheat starch production facility. It has furthered its investment by additional €100 million in this second wheat starch processing plant in 2019.
- 3) Tate & Lyle offers speciality starches and has a comprehensive portfolio of over 250 maize, tapioca and potato products, offering a range of functionalities such as thickening, film-forming, gelling and emulsifying. It announced its expansion of tapioca-based starches line in 2021.
- 4) In 2019, Nouryon introduced a certified natural starch that can replace petrochemical-based products in a variety of personal care applications.
- 5) Sanwa Starch Co. Ltd produces modified starch used for fish sticks, cutlets, croquettes, fried chicken, and other deep-fried foods applications.

Indian

- 1) Gayatri BioOrganics is into the manufacturing of starch, modified starches, liquid glucose, sorbitol, and its allied products, and trading in maize in South India. Anil is engaged in manufacturing and marketing of maize based specialty products and ingredients solutions to industries, including textile, paper, adhesive, pharmaceuticals, food and beverages, chemicals and animal nutrition industry.
- 2) Sukhjit Starch and Chemicals Limited is an India-based agro-processing company that manufactures maize based specialty products and ingredients solutions in India. The Company manufactures modified starches, Dextrines, liquid glucose, HMS among others.
- 3) Varalakshmi Starch Industries Private Limited (VSIPL), formerly known as Varalakshmi Starch Industries Limited roughly produces about 150 tonnes of modified starch.

7. Competitive Landscape of Maize based Speciality Products and Ingredient Industry in India

7.1. Overview of players in Indian Maize Starch Industry

The Indian Maize Starch market is anticipated to grow at a of 3.6% from 2023 to 2029, when it is predicted to reach a volume of 9.5 million tons. This sector is booming as maize is easily accessible in India and has multi-fold uses in the food and beverage, pharmaceutical, animal nutrition, textile, and paper industries. Indian Maize starch application segment is dominated by the food and beverage industry. Sustainability, circular economy, having multiple suppliers, diversified customers, and continuous pursuit of innovation.

The Maize Starch industry has a positive outlook for the upcoming years. The majority of end use industries have shown strong growth aspirations, which is encouraging for the industry's expansion. Companies are prioritizing advancement in technology and creative- innovative solutions to broaden their business frontiers in domestic as well as global markets. The main growth drivers for this sector are the robust demand across end-user sectors driven by increased import substitutions, strong export growth, and expanding domestic consumption. Growing robust local demand combined with higher exports will boost the market in coming years.

Companies sign volume & rate contracts with durations ranging from three months to a year. In rate contracts, prices of end products are fixed for a predetermined period of time. If raw material prices rise during this time, it puts pressure on the manufacture company's margins. Due to the commodity nature of the starch and the extensive government control over sales and procurement for agriculture, players in this business have very little influence over pricing and very little leverage when negotiating with customers.

Exhibit 107(a): Major Indian Players in Maize based speciality products & ingredient solutions

Indian Maize Starch producing companies	Gulshan Polyols Limited	Gujarat Ambuja Export Limited	Sayaji Maize Products	Roquette India Private Limited	Sukhjit Starch and Chemicals Limited	Tirupathi Starch & Chemical Ltd	Universal Starch Chem - Allied Products Ltd	Sanstar Ltd
Year of Establishment	1981	1991	1941	2010	1943	1985	1973	2005
Plant location	UP (1), Gujarat(1)	Gujarat (1), Maharashtra(1), Karnataka (1), Uttarakhand (1), WB(1)	Gujarat (1)	Karnataka (1), Gujarat (1), Uttarakhand (1)	Punjab (1), Telangana (1), WB (1), Himachal Pradesh (1)	Madhya Pradesh (1)	Maharashtra (1)	Gujarat (1), Maharashtra (1)
Maize milling Capacities (MTD)	600	3,050	710	1,500	1,000	300	500	1,100
Expansion plans	-	Expansion planned for 1000 MTD in Gujarat	-	-	-	Expansion planned for up to 600 MTD and with inclusion of liquid glucose product portfolio.	Planned expansion for derivatives.	Planned expansion of Dhule facility by 1,000 MT/day; which will catapult Sanstar into 2 nd largest player in India after GAEL

Source: Company website, Primary interactions, Frost & Sullivan research

Exhibit 107 (b): Capacities of Indian Maize based Speciality Products and Ingredient Players



Indian Maize Starch producing companies	Maize milling Capacities, MTD	Market Share based on Maize milling Capacities, %
Gujarat Ambuja Starch Products Ltd	3,050	21.7%
Roquette Riddhi Siddhi Pvt. Ltd	1,500	10.7%
Sanstar Ltd	1,100	7.8%
Sukhjit Starch Products Ltd	1,000	7.1%
BlueCraft Agro	850	6.1%
Cargill	800	5.7%
Sayaji Maize Products Ltd	710	5.1%
Gulshan Polyols	600	4.3%
ShreeGluco Biotech	600	4.3%
Universal Starch Chem - Allied Products Ltd	500	3.6%
Kasyap Sweetener	420	3.0%
Sahyadri Starch & Industries Ltd	400	2.9%
Rajaram Maize Products Ltd	300	2.1%
Paramesu Biotech	300	2.1%
Everest Starch	300	2.1%
Santhosh Maize & Industries Ltd	100	0.7%
Others	1,500	10.7%

Source: Primary interactions, Frost & Sullivan research

7.2. Overview of Key Financial Performance Indicators

Exhibit 108 (a): Key Financial Indicators of Indian Maize based Speciality Products and Ingredient Solutions Players

Parameters	Revenue, INR Mn			Growth CAGR, %
	2021	2022	2023	2018-2023
Company name/ Year				
Gujarat Ambuja Starch Products Ltd (Maize Processing revenue)	19,580	26,440	32,030	19%
Sukhjit Starch Products Ltd- Revenue from Starch & Derivative	5,090	8,230	10,565	27.6%
Sanstar Ltd	3,101.30	5,047.67	11,780.82*	62.8%** (Y-O-Y- 2021-22)
Universal Starch Chem - Allied Products Ltd	2,970	4,580	5,187	21%
Tirupathi Starch Products Ltd	2,000	3,200	3,647	11%
Gulshan Polyols (Starch revenues)	890	1,680	2,020	13%
Roquette Riddhi Siddhi Pvt. Ltd	3,020	1,500	1,930	-15%

Note: Revenue for Sanstar for FY 2023 is consolidated whereas revenue for FY 2021 and FY2022 is standalone value.

Source: Annual Reports, Money control, Frost & Sullivan research

Exhibit 108 (b): Key Financial Indicators of Indian Maize Based Speciality Products and Ingredient Solutions Players

Parameters	ROCE (%)			ROA (%)			EBITDA (INR Mn)			EBITDA Margins (%)		
	2021	2022	2023	2021	2022	2023	2021	2022	2023	2021	2022	2023
Company name/ Year												
Gulshan Polyols	24.9%	19.9%	9.2%	12.5%	10.6%	4.6%	133.0	152.2	95.1	17%	14%	9%
Gujarat Ambuja Starch Products Ltd	28.0%	31.0%	16.5%	15.0%	17.3%	11.1%	561.5	741.2	549.1	12%	16%	12%
Roquette Riddhi Siddhi Pvt. Ltd	4.7%	6.2%	3.6%	20.8%	9.8%	2.1%	77.3	102.9	63.5	26%	68%	42%
Sukhjot Starch Products Ltd	8.3%	20.0%		6.9%	7.4%	-	68.6	153.0	143.0	10%	13%	10%
Tirupathi Starch Products Ltd	5.0%	14.0%	14.0%	0.8%	5.2%	3.8%	9.3	21.2	-	5%	7%	-
Universal Starch Chem - Allied Products Ltd	15.2%	22.6%	14.7%	3.6%	6.1%	2.9%	18.5	27.9	-	6%	6%	-
Sanstar Ltd	21.0%	23.2%	23.7%	7.1%	7.7%	11.4%	370.5	397.2	726.6	11.9%	7.9%	6.1%

Source: Annual Reports, Money control, Frost & Sullivan Research

Exhibit 108 (c): Key Financial Indicators of Indian Maize based speciality products and ingredient solutions players

Parameters	Equity ratio			Debt Ratio			Debt- Equity Ratio		
	2021	2022	2023	2021	2022	2023	2021	2022	2023
Company name/ Year									
Gulshan Polyols	0.7	0.7	0.58	6.8	7.7	2.40	0.0	0.2	0.33
Gujarat Ambuja Starch Products Ltd	0.8	0.8	0.8	14.2	10.3	5.72	0.1	0.1	0.09
Roquette Riddhi Siddhi Pvt. Ltd	1.1	1.0	0.88	9.2	11.9	8.4	0.1	0.04	0.05
Sukhjit Starch Products Ltd	0.47	0.53	0.54	2.9	3.5	2.2	0.4	0.7	0.24
Tirupathi Starch Products Ltd	0.2	0.2	0.27	1.0	1.0	1.39	0.2	4.4	3.67
Universal Starch Chem - Allied Products Ltd	0.2	0.3	0.29	1.7	2.2	1.4	1.37	0.87	1.11
Sanstar Ltd.	0.35	0.41	0.51	0.52	0.41	0.30	1.47	1.00	0.60

Source: Annual Reports, Money control, Frost & Sullivan research

7.3. Key Success Factors for Maize based Speciality Products and Ingredient Solutions Industry



Experienced Promoters

Maize starch being the commoditised product which is used across different industries requires a sound technical team with know-how of manufacturing as well as understanding of customers need. Manufacturing of maize based speciality products and ingredient solutions requires an experienced and sound team with expertise in efficient and cost-effective procurement of maize, technical understanding of manufacturing process, understanding of customers’ requirements, and building long term relationships with them, among others. Management having significant experience



with highs and lows of this sector have advantage over the competition.

Dr. CK Jain, the promoter of Gulshan Polyols, has nearly forty years of experience in the maize milling sector. Since 1986, the Kasyap Family of Kashyap Sweetener's has been in the maize milling business, providing the company with experience. Gupta Family has been a promoter of Rajaram maize products since 1966. The Sardana family, promoters of Sukhjit Starch and Chemicals Ltd.'s with their strong experience have helped the company to flourish.

One of the major players in the starch market, Sanstar Ltd first gained experience in tapioca starch trade before venturing into the production of maize based specialty products and ingredients solutions . Mr. Gautam Chowdhary (MD), the promoter of Sanstar Group, has over 50 years of industry expertise. The management has been long involved in manufacturing of starches and sweeteners. In 1989, company completed acquisition of Salem Glucose Pvt. Ltd and eventually turned it into 100 MT/day maize crushing unit under the name of Santosh Starch. Management also has a lot of expertise in maize procurement as well as finished goods sales.



Strategic location

Access to raw material, maize as well as potential customers is crucial to be successful in this industry. When procuring maize, price as well as quality are both important. Despite being one of the top producers of maize, India faces challenges in maintaining supply of the maize crop due to its several uses, including the production of ethanol and animal nutrition. Hence stocking of maize is essential in maize based speciality products and ingredient solutions business, so that plant keeps on running smoothly.



Sanstar's plant in Shirpur, Maharashtra, is located in maize growing belt of Jalgaon, Jalna, Nandurbar, Malegaon, Nashik and Aurangabad. It is close to Mumbai Agra national highway which makes transportation efficient and easy. The plant in Bharuch, Gujarat is located in close proximity to Jamnagar- Amritsar national highway and is at 86 km distance from Mundra port and 51 km from Kandla port. The Shirpur, Maharashtra plant is located at a proximity to Nhava Sheva and Hazira ports. This ensures company's reach across different part of West and North India. Through direct interactions with farmers, Sanstar has establish fair pricing mechanisms, offer agricultural expertise, and provide support to farmers in terms of best practices. By directly sourcing maize from farmers, Sanstar not only ensure the freshest produce but also empower local agricultural communities, fostering sustainable farming practices. The company has more than 50,000 MT of maize storage silos at the Maharashtra plant which brings down the costs of handling losses; transportation as well as reduces outside 3rd party storage rents. Company is also working with Indian railways and has made an application for a railway siding unit at Nardana, which shall further bring down the logistic cost of transportation of maize. Being uniquely located in raw material belts; the company commands on one of the lowest procurement costs for maize in the maize based speciality products and ingredient solutions industry.

Sukhjit Starch and Chemical products' maize milling facilities are positioned strategically in India's North, East, and South, close to the maize growing belts. Additionally, the various weather patterns in the regions enable consistent year-round procurement of maize at cheap prices, giving the business an extra advantage.

GAEL has strong inhouse purchasing and procurement system along with multiple initiatives for cost optimisation, product localisation, supply chain efficiency improvement, and material yield improvement add to the GAEL's preparedness against the raw material price increase. Bluecraft Agro also has an established procurement and distribution network. Company follows practice of inventory built up in maize harvesting season of March to May and November to January to ensure good quality maize at competitive pricing. Company's Yamuna Nagar plant is the oldest in the industry with established operation of more than eight decades.



Diverse product portfolio with Diversified clientele base across diverse industries

The product mix determines revenue, and it changes based on the market prices and level of demand for completed goods. A significant amount of the starch output is used by the food & beverage, paper, and packaging industries. While co-products are utilized in poultry and cow feed, as well as partially in the food business as maize oil, derivatives like glucose and sorbitol are utilized in the food and beverage and pharmaceutical industries. Sukhjit Starch has diversified clientele with the top five customers contributing 15% to overall revenue through 2022. Dabur India Ltd, Heinz India Pvt Ltd, Nestle India Ltd and Marico Ltd were few of the reputed customers of the company. Bluecraft Agro has established relationships with many customers who have been associated with the company for more than 2-3 decades. During FY22, sales to top 10 customers were around 25% of net sales, reflecting its diversified customer base.



Sanstar Ltd has diversified product basket which includes maize starch and its various maize based specialty products and ingredients solutions such as dextrin, high maltose maize syrup, dextrose monohydrate, maltodextrin, sorbitol, and co-products. These products find applications in a wide array of industries including food, pharma, textiles, paper, industrial, oil and gas etc. Hence it is not dependent on exposure to a singular industry thereby hedging the risk for Sanstar. Sanstar Ltd is also one of the largest providers of certified organic starch within the industry. The company supplies to both domestic as well as exports markets. Reputed clientele like AB Mauri, ITC, Capital Foods, Hindustan Unilever Ltd and Godrej Agrovet and Zydus wellness, etc.



GAEL with multiple domestic clients is also one of the largest exporters for maize starch & maltodextrin followed by Sanstar Ltd which earned ~USD 16.06 million in exports of starch from April-

September 2023. Sanstar Ltd is also one of the only two exporters for Dried glucose syrup with ~25.3% share for same time period.

Robust financials with strong market position

In India, GAEL is largest maize processor. The company has ~3,050 tons crushed per day capacity with next plant announced in Gujarat to come up by 2025, making it the largest player in the maize based speciality products and ingredient solutions industry. The maize-based speciality products and ingredient solutions division has shown a cumulative aggregate growth rate (CAGR) of more than 12% for the fiscal years 2016–2021, and it is contributed to ~65% of GAEL's revenue in FY 2023. Sukhjit Starch Products limited maize milling unit's revenue from starch increased by CAGR 81% to reach INR 1,056 Crores in FY 2023 from INR 550 Crore in FY 2018. For the same period starch revenues of Gulshan Polyols increased by CAGR 13% from INR 111 Crores to INR 202 Crores in FY 2023.



Sanstar Ltd is the third largest producer of maize based speciality products and ingredient solutions used in food & beverage and animal nutrition industry. Revenue of Sanstar Ltd grew by around 134% during FY23 from FY 21 to reach INR 779 Cr in FY23. Growth is attributed to strong demand from the end user industries like textile, paper and food products leading to an increase in the capacity utilization across the product categories. Also, emerging sectors such as ethanol, biotechnology applications and biodegradable packaging are expected to contribute to the growth.

EBITDA margins for FY 2023 was 6.14%. Going forward, the margins are expected to improve further on the back of continued stable demand, benefit from newly commissioned Solar Plant in Maharashtra plant and pending receipt of SGST rebate.

Focus on Technology for enhancing efficiency of plant and increasing utilization.

Sukhjit Starch utilizes state-of-the art effluent treatment technology, which converts biomass into biogas, reducing carbon emissions. Company has spent about INR 62.15 lacs during FY2023 under reference in pursuit of improving the quality of products line, developing new products, and improving their applications.

By utilizing renewable energy resources, energy-saving technology, and increasing plantation, GAEL is striving to reduce its carbon footprints. It has installed Biogas Engines, Biomass-based Boilers, and other energy-saving equipment at different units/plants. Company has taken initiatives to generate energy through renewable sources like solar power, windmill, biogas and biomass (rice husk). The Company has spent INR 18 Crores as capital investment on energy conservation during the FY22.



Sanstar imports critical technology from Germany for many of the high-speed rotating machines from companies such as GEA Westfalia. During FY23, Sanstar Limited had undertaken the construction project of a Bio-Gas engine and Solar Power Plant to cut the electricity cost, which is next major cost after raw material. The solar plant of 3.5 MW at Maharashtra unit has already commenced its operations in Dec 2022. Biofuel of 1.6 MW is Has commenced operations in Feb 2023. These projects are expected to result in improving profitability margins. Company is also generating electricity by waste totaling to 5 MT at both the unit location; and the project has been hallmarked as waste to energy project under the MNRE schemes from the central government of India.

7.4. Ethanol Manufacturing in India

Seven or eight years ago, there was barely any discussion of ethanol in India. However, ethanol has now emerged as one of India's priorities for the 21st century. Considering recent developments and public support, the government has chosen to push up the 20% ethanol blend objective in petrol by five years, from 2030 to 2025. In addition to sugarcane, ethanol factories using contemporary technology are being established all over the nation to produce ethanol from agricultural waste. Domestic production of ethanol will also reduce reliance on oil imports by blending it with conventional fossil fuels for consumption.

As a byproduct of the sugar industry, ethanol is utilised in alcoholic beverages, medicines, plasticizers, polishes, and cosmetics. Consequently, India's leading sugar producers are also among the world's top producers of ethanol.

According to Ministry of Petroleum and Natural Gas, Govt. of India, ethanol market is predicted to expand by 500% domestically. At a 20% blending level, the demand for ethanol is expected to rise to 1016 billion litres by 2025. Consequently, the value of the ethanol sector will increase from about Rs. 9,000 crores to over Rs. 50,000 Crore, a growth of more than 500%. Government decided to expand interest subvention scheme for enhancement of ethanol distillation capacity. Ethanol production capacity doubled and number of distilleries increased by 40% in 4 years (2019-2023). Ethanol distillation capacity is expected to grow by more than three times to 1,500 Crore litre annually.

Exhibit 109: Ethanol market Opportunity in India

Ethanol Supply	Year Projected Petrol Sale (Million Metric Tons)	Projected Petrol Sale (Cr. litres) *	Blending (in %)	Requirement of ethanol for blending in Petrol (Cr. litres)**
	24.1 (Actual)	3413 (Actual)	5	173
	27.7	3,908	8.5	332
	31	4,374	10	437
	32	4,515	12	542
	33	4,656	15	698
	35	4,939	20	988
	36	5,080	20	1,016

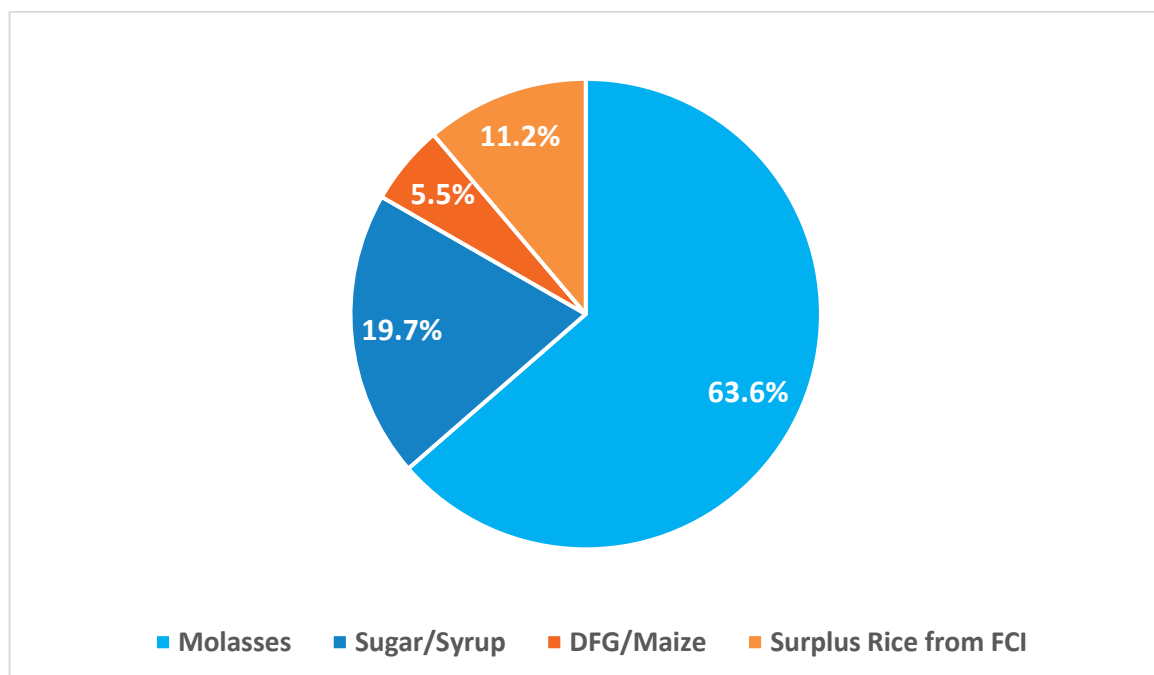
Source: Niti Aayog Report, 2022; Frost & Sullivan Analysis

*The petrol projections may undergo revision due various factors like penetration of EVs, etc.

** The figures are optimistic, as the E20 fuel will be consumed by new vehicles from 2023 only demand for ethanol will, however, increase due to penetration of E100 two wheelers, which are now being manufactured in the country.

In October - November 2020, National Biofuel Coordination Committee (NBCC) gave approval to utilise surplus stock of rice lying with Food Corporation of India (FCI) to be released to the distillers for ethanol production and gave go ahead to utilise maize for ethanol production. Separate price for maize based ethanol was established in October 2022 which will benefit the manufacturers of maize based ethanol. With increasing demand use of Damaged Food Grains(DFG) or Maize will increase so as to meet the target of 20% blending by 2025.

Exhibit 110: Ethanol % contribution from different feedstocks, 2021-22



Source: Ministry of Petroleum and Natural Gas, Frost & Sullivan Research

With government support and stern targets, ethanol production sector has flourished in past 3-4 years and will continue to grow as demand for sustainability and clean fuel rises. Companies manufacturing Ethanol will definitely be at advantage with different feedstocks being used. Till 2017- 18 Molasses from sugar industry was the only major source of feedstock for ethanol manufacturing. The increasing demand for Ethanol cannot be sustained only by molasses and other feedstocks such as maize will contribute in greater terms. Sanstar Ltd will have advantage for ethanol manufacturing due to already established mechanism for procuring maize at competitive prices.

8. Profile for Sanstar Ltd.

Company Background: Sanstar Ltd is one of the major manufacturers of plant-based specialty products and ingredients solutions in India for food, animal nutrition and other industrial applications. Sanstar has world class manufacturing facilities in Western and Central Region of India with widespread domestic and international distribution network. The Group is promoted by Mr. Gautam Choudhary, who has an experience of over 50 years. Sanstar Group (SG) comprises of two entities, namely Sanstar Ltd and Sanstar Bio Polymers Ltd (SBPL). The group is engaged in manufacturing of **maize based specialty products and ingredients solutions and its co-products such as Gluten, Germ and Bran**. Sanstar Limited and Sanstar Biopolymers Limited, companies based in Gujarat have applied for the scheme of the merger before the NCLT Ahmedabad, to consolidate their management and operations. The merger application was approved by the NCLT Ahmedabad vide its order dated November 23, 2023. Pursuant to the merger order, all the assets and liabilities of the Sanstar Biopolymers Limited got transferred to Sanstar Limited. The shareholders of Sanstar Biopolymers Limited will get the shares of Sanstar Limited, in the ratio of 1 equity share of Sanstar Limited for 1 equity share held in Sanstar Biopolymers Limited. The Board of Sanstar Limited has approved the allotment of equity shares pursuant to the merger order on November 28, 2023.

Manufacturing and R&D Capabilities: Company has third largest milling capacity in the Indian maize-based specialty products and ingredient solutions industry as of November 2023 and is well headed for expansion at its Dhule (Maharashtra) facility. Post the expansion, Sanstar will have aggregate capacity of 2,100 MTD and be 2nd largest player in maize-based specialty products and ingredient solutions providers industry. Manufacturing facilities of Sanstar are located in Gujarat and Maharashtra which are the major states for producing maize in India. Plant in Shirpur (Dhule, Maharashtra) is spread across whopping 200 acres, which gives ample space for future expansion plans. Plant in Kutch (Gujarat) is spread across 90 acres of land. Plants are completely integrated with SCADA automation enabling increased efficiency, improved product quality, cost savings, enhanced safety and flexibility and adaptability to respond to change. Along with these plants, Sanstar also has a 50,000 MT of maize storing warehouse at Shirpur facility which enables to stock enough maize. Sanstar also has R&D facility located in Ahmedabad, Gujarat which enables the company to constantly develop specialty starches for various food and industrial applications. Sanstar manufacturers **maize starch, dextrin, modified starches, liquid glucose, high maltose maize syrup, maltodextrin, dextrose monohydrate, sorbitol, gluten, germ and steep liquor**. The products find application in **Textiles, Paper, Pharmaceutical, Food, Adhesives, Animal Nutrition & many other industries**. Novel application such as **bio polymers, bioethanol, biomaterials, mock meats** also boost the demand for starch.

Sourcing: Sanstar sources its maize through various channels, including mandi procurement, local stock houses, and direct farmer buying. This multifaceted approach allows Sanstar to ensure a consistent supply of high-quality maize while supporting local farmers and communities.

Key Clientele: Sanstar has a reputed clientele of companies such as AB Mauri, ITC, Capital Foods, Hindustan Unilever Ltd and Godrej Agrovet and Zydus wellness in domestic market. Sanstar has a strong presence in states of Maharashtra, Gujarat, and Andhra Pradesh. Sanstar is making strides in

markets of Telangana, Tamil Nadu, Madhya Pradesh, and Bihar. In exports markets, Sanstar supplies starch and other products to ~48 countries with Malaysia, Kenya and Vietnam being the top importers.