PROJECT ON MAIZE PROCESSING

Future Zen Consultants
Concept to Market Services
India

www.futurezen.in

ABOUT US

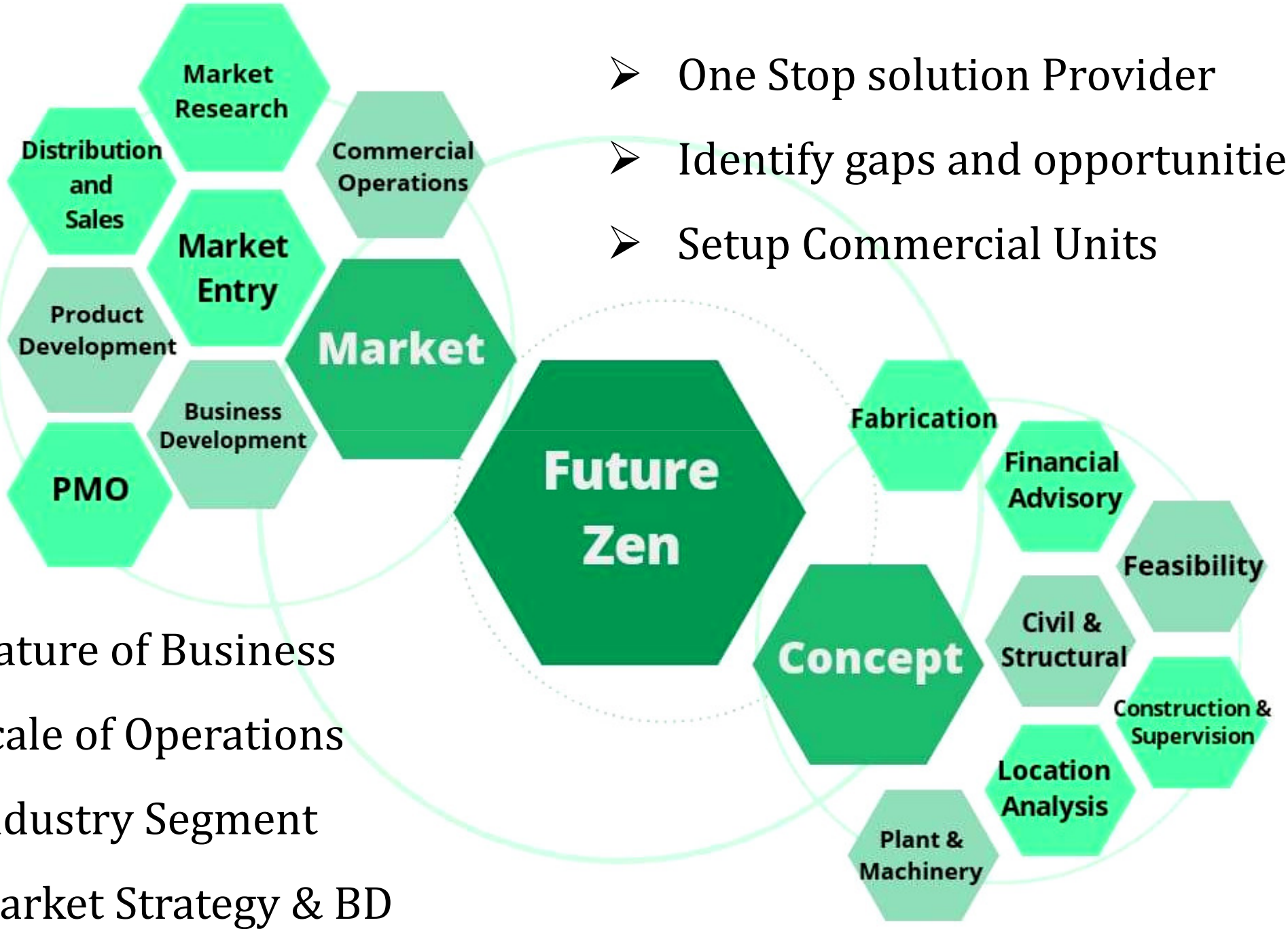
(FUTURE ZEN CONSULTANTS)

Future Zen Consultants - About Us

- **Future Zen Consultants (FZC) LLP** is an Business Advisory and Project Management Consulting (PMC) firm providing Concept to Market (C2M) solutions for the diversified industries across locations.
- FZC adds value to the business of the organizations by providing Project related Engineering and Management services.
- FZC expertise revolves around all the facets of Business Operations namely Engineering, Management, Finance & Accounting, Legal & Liaison, Sales & Marketing and Secretarial & Compliances.
- Our Vision is to take up innovation and new development projects under Greenfield category, through which we want to develop alternate products for the market to cater to all the sections of the society.

Future Zen Consultants - Services

- One Stop solution Provider
- Identify gaps and opportunities
- Setup Commercial Units



- Nature of Business
- Scale of Operations
- Industry Segment
- Market Strategy & BD

PROJECT REQUIREMENTS

(RAW MATERIAL)

Maize - Introduction

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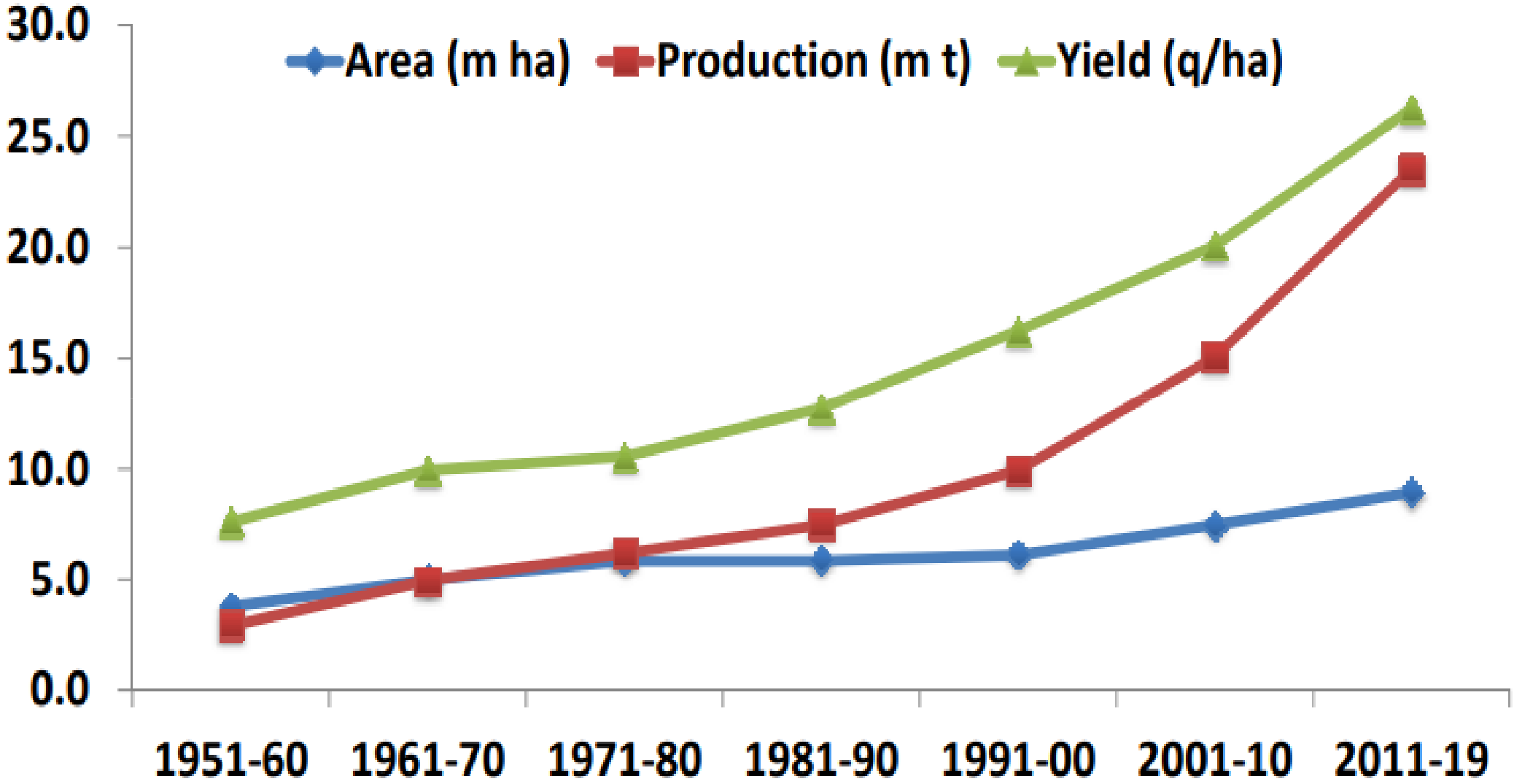
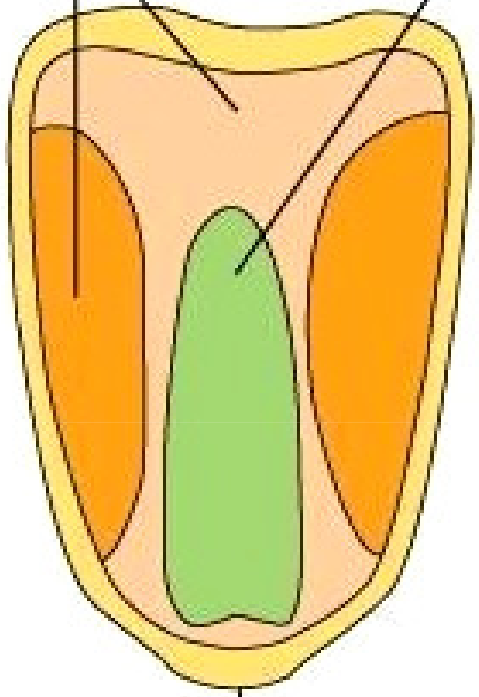
- Maize (Corn) is a cereal grain from the family of Poaceae (Gramineae). Every part (i.e. Grains, Leaves, Stalk and Cob, etc) of the maize plant has economic value to produce a variety of food and non-food products.
- Starch can be extracted mainly from Maize, Cassava and Potatoes. Also Rice, Barley, Sorghum and Sago are used but in lesser quantity.
- Maize currently represents the most popular feedstock for starch production accounting for approx 80% of the total output in the world.
- USA (38%) & China (23%) are Top producer of Maize. India share is only 3% .
- USA is the largest global starch producer in the world with approx 52% share followed by Europe (15%).
- USA is the largest producer of Maize Starch in the world with approx 60% share followed by China (27%) and Europe (8%)

Maize – Production in India



- Maize ranks 1st in Productivity in India
- Maize ranks 3rd in Production of Grains in India.

Maize - Material Composition



endosperm

gluten
cattle feed

corn meal cereals

raw starch

corn syrup
mixed table syrups
candies
confections
ice cream
shoe polishes

corn sugar
infant formulas
dietetic foods
caramel coloring
vinegar
lactic acid
tanning mixtures
brewing
artificial silk

edible starch
corn starch
jellies
candies

dextrin
mucilage
glue
textile sizing
food sauces
fireworks

industrial starch
laundry starch
textile sizing
filler in paper
cosmetics
explosives

hull

bran
cattle feed

germ

oil cake (or meal)
cattle feed

crude corn oil

soap

glycerin

soluble corn oil
textile sizing
cloth coloring

plastic resin
rubber substitutes
erasers
elastic heels

refined corn oil
salad oils
cooking oils
medicinal oils

Maize – Why Processing?

- Increasing Demand in Local as well as International Market
- No Increase in Demand for other Crops
- Higher Production yield as compared to other Crops
- Diversified use of Crop
- Sustainable against Climate change
- Less water consuming Crop
- Easier Processing Technologies
- Demand for Value added products
- Demand for Starch and Derivatives
- Used for Ethanol Production (Future Energy Option)
- Carbon trading

Maize – Forward Integration Industry Segments

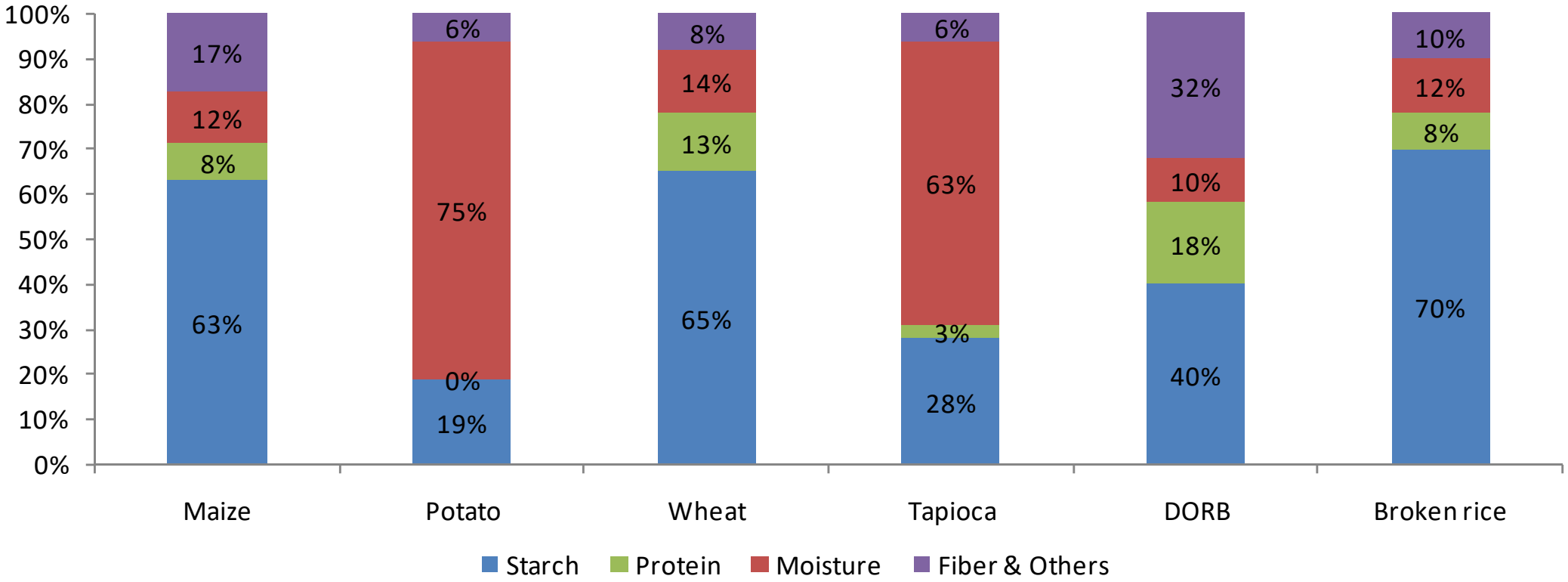
Major Products:

1. Starch Powder
2. Liquid Glucose
3. Malto Dextrin
4. Maltose Syrup
5. Dextrose MH

Starch – Introduction

- Starch can be extracted mainly from Maize, Cassava and Potatoes. Also Rice, Barley, Sorghum and Sago are used but in lesser quantity.
- Maize currently represents the most popular feedstock for starch production accounting for approx 80% of the total output in the world.
- **Starch** is a white, odorless and tasteless form of carbohydrate. It is a complex polysaccharide made from thousand of glucose molecules with numerous derivatives like Liquid Glucose, Malto Dextrin , Dextrose, Sorbitol and Maltose Syrup, etc.
- **Starch Derivatives** are value-added products derived from modification of starch. Based on modifications and derivative properties, derivatives can be used as a sweetener (sugar substitute), thickener, film former, adhesive/cohesive, water binder and water retainer etc.
- **Starch and starch derivatives** find use in multiple industries into Food Processing, Pharmaceutical, Paper, Textiles and Leather, etc
- **By Products** such as Gluten, Steeping Water, Husk Fibre are used in Feeds.

Starch – Comparison across Crops



- *Broken Rice and Maize have higher Starch contents as compared to other crops.*
- *Hence any plant based on Broken Rice and Maize shall offer much better project economics on account of low feedstock prices and lower operating costs.*
- *In the Indian markets, however maize (corn) is the main source of starch derivation due to its high starch content, easy availability, low moisture and by-products which have a readily available market.*

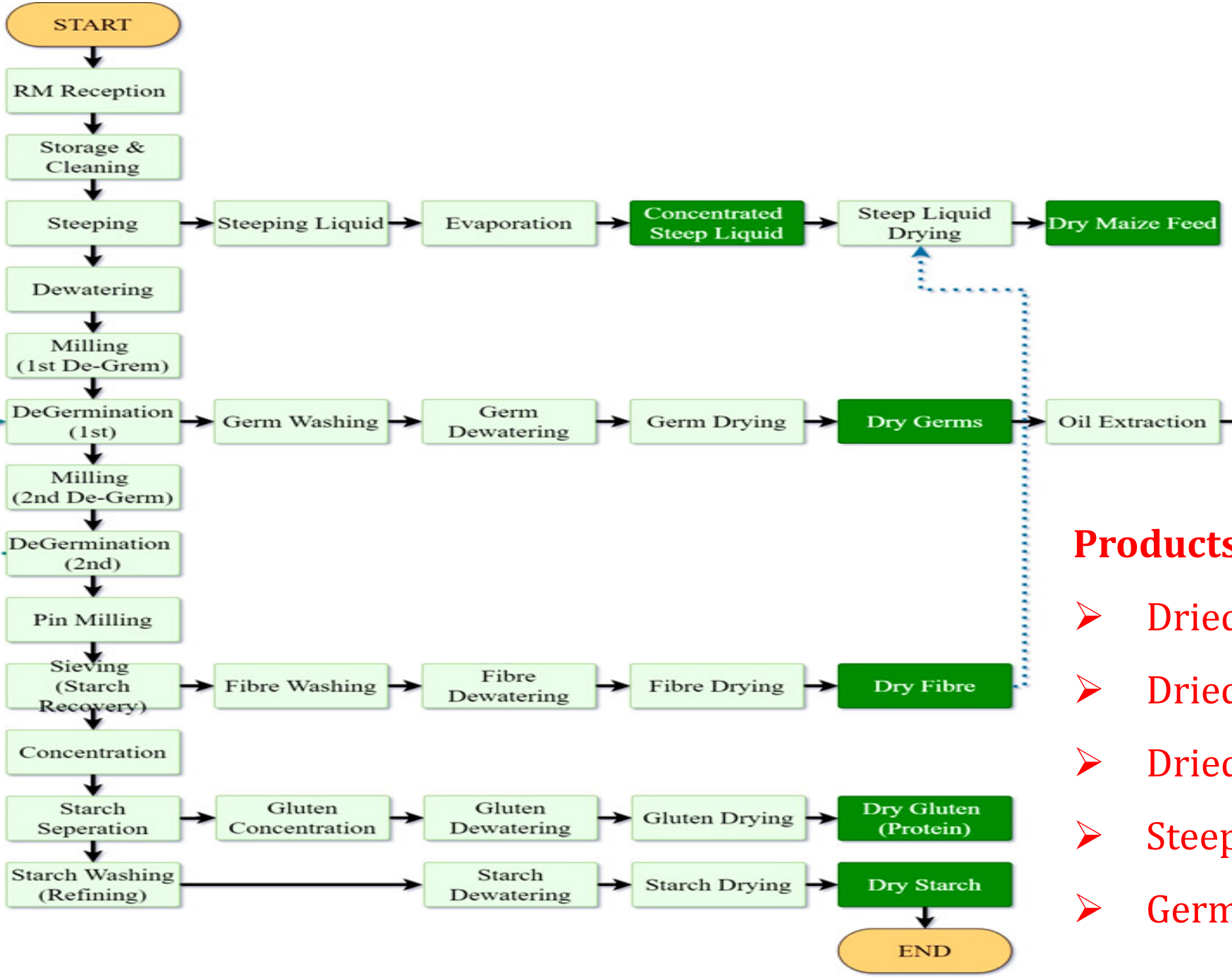
Starch – Growth Drivers

- **Alternate Market Development**: Starch is increasingly being used in production of Ethanol/ENA and biodegradable products enabling to transform the Starch industry's size and prospects.
- **High Price of Substitute**: Continuous rice in price of sugar has accelerated the need for development of alternate sweetener especially for the Food & Beverages Industry and hence the increase in demand for sweeteners from natural and artificial sources.
- **Mature Market**: Indian starch industry is at a nascent stage comprising only around 40 products from corn derivatives which have been commercialized so far, whereas the international market comprises more than 800 starch and derivative products.
- **Low Per Capita Starch Consumption**: Despite growth in the industry, India's per capita starch consumption is approx 2.0 kg and is still less than China (12 kg), USA (75 kg) as well as the world average (7 kg). Such low consumption trend in India as compared to World markets will accelerate the growth potential of the Industry.

PROJECT REQUIREMENTS

(PROCESS)

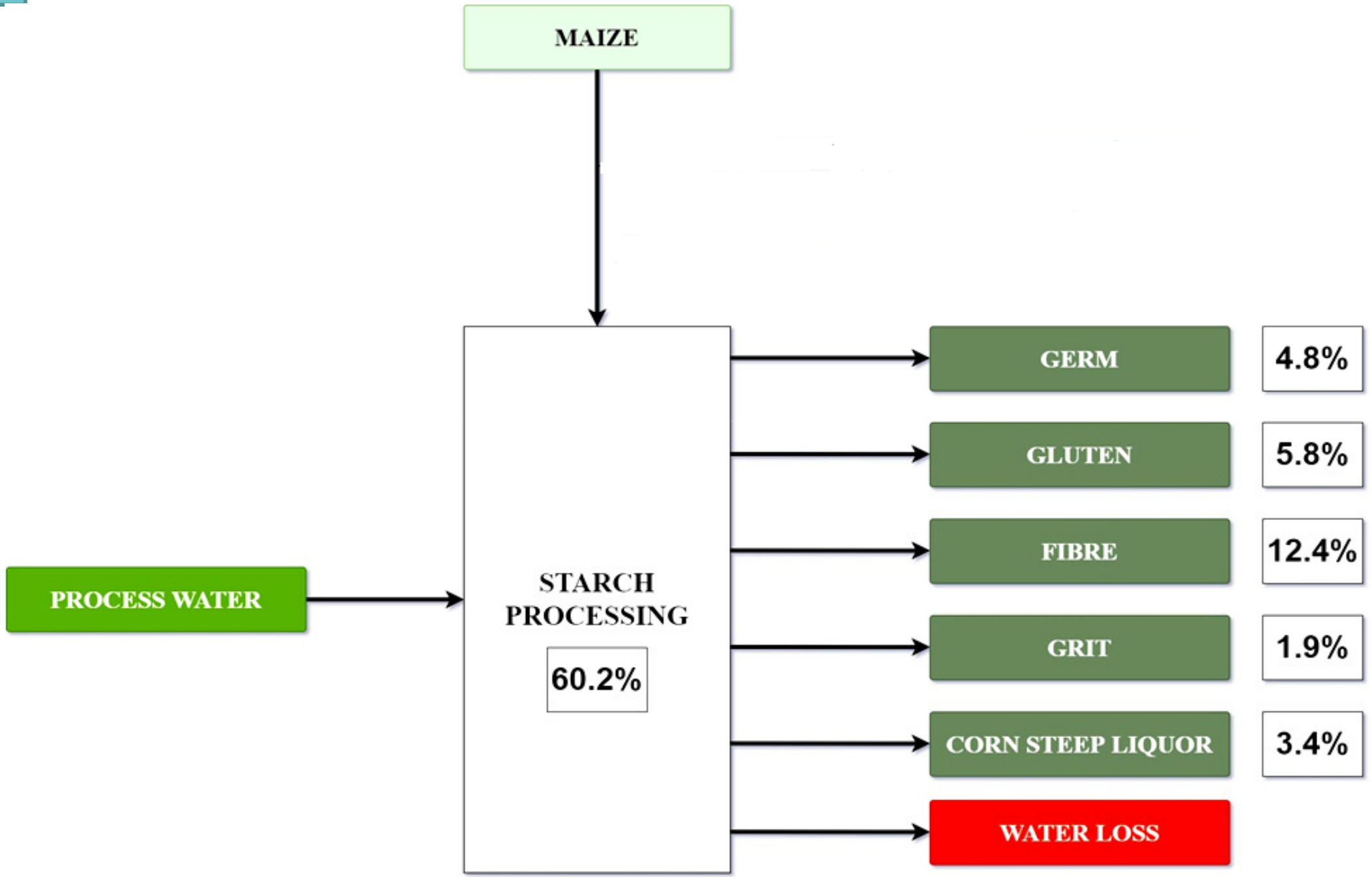
Maize Processing – Starch Process Flow Chart



Products

- Dried Starch
- Dried Gluten
- Dried Fibre (Feed)
- Steep Liquor (Feed)
- Germs (Oil & Cake)

Maize Processing – Value Addition (Level 1)



Process Description

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Maize Cleaning and Storage

- After the receipt of Raw Material, Maize is weighed and discharged to unloading hopper. Through the bucket elevator and rotary screen, maize is stored in the silos.

Maize Steeping

- The cleaned Maize from the silos is moved to the Steeping tank. The steeping of Maize is carried out in reverse flow in the sulfurous acid solution.
- The steeping liquid is transported to the first tank by pump while circulating in the tank, so as to keep the new Sulfurous Acid solution in contact with the Maize which require the longest steeping time, while the newly entered corn is in contact with the steeping liquid to be discharged, so as to maintain the best steeping effect.
- The steeped liquid will be concentrated in evaporation section to achieve dissolved solid content of more than 45%

Process Description…Continued

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Maize Milling

- The steeped maize is sent to the wet Maize storage hopper by pump through the stone removal, dewatering sieve, and then into the 1st De-Germ mill.
- In 1st De-Germ Mill, the Maize is broken into approx 4 to 6 pieces. The milled maize is then pumped to the 1st Germ cyclone. The top flow of the cyclone moves the germ to the germ washing system. The bottom flow material is filtered through the gravity screen to get the Maize Slurry and the material above the sieve goes into 2nd De-Germ mill.
- In 2nd De-Germ Mill, the corn is broken into approx 10 to 12 pieces. The broken Maize slurry goes through the pump to the 2nd Germ cyclone. The top flow material is return to the 1st De-Germ mill and mixed with the separated material by the gravity screen and then again returned to the 1st Germ cyclone. The bottom flow Maize slurry is sent to the fine grinding process.

Process Description…Continued

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Pin Milling

- When the thin Maize Slurry separated from the 2nd Germ cyclone is passed through the pressure arc screen, the resultant bottom flow of the sieve is coarse starch milk which is mixed with the recovered coarse starch slurry and then moved to the starch separation process together.
- The overflow from the pressure arc screen goes into the pin mill for fine grinding to maximize separation of starch from the fibre.
- The material after pin mill goes into the fibre washing system

Process Description…Continued

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Starch Recovery and Fibre Processing

- The finely ground slurry enters the fibre washing tank where it is sent to the 1st stage of the pressure warp sieve together with the washing water of the subsequent fibre.
- Undersize crude starch milk is isolated on the screen again after six grade pressure curved sieve counter current washing. The starch keep moving forward step by step, until the 1st screening in the sink is merged with fine grinding of the slurry into the 1st stage pressure curved sieve. The separated crude starch milk and the starch milk are screened out through fine grinding of coarse starch milk into starch refining process.
- Slurry is then discharged from the last stage of curved screen surface and then dehydrated by spiral extruder. The dewatered fibre is then dried by the first stage of bundle dryer and then the second stage of drying is carried out by mixing steeping liquid with fibre to produce the high protein fibre feed.
- The drying machine is equipped with automatic feeding system of return feed and maize slurry, so as to reduce the water in the feeding machine and ensure the uniformity of protein content in the fibre feed.

Process Description…Continued

Starch Separation and Refining

- The starch slurry separated from the pressure screen before and after the pin mill, goes through the desanding cyclone, rotary filter and pre-concentration separator and then enters into the main separator of gluten and starch.
- The water separated from gluten by the top flow is sent to the concentration separator. The bottom flow starch milk is sent to the 12 stage washing cyclone with counter current washing. The washing water is the fresh water.
- The top flow of the first stage cyclone is concentrated by the clarifying separator. The bottom flow enters the main centrifuge and the top flow is process water.

Gluten Process (Concentration, Dewatering and Drying)

- The separated gluten from the top flow goes through the rotary filter and enters the gluten concentrator. The top flow is process water which goes into the process water tank for the germ and fibre washing. The bottom flow is the concentrated gluten that goes through the belt vacuum filter or filter press to get the wet gluten with less water content, then to the bundle dryer for drying.

Process Description…Continued

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Starch dewatering and drying

- After dewatering, the wet starch is sent to the air dryer to get the commercial starch with the required moisture content.

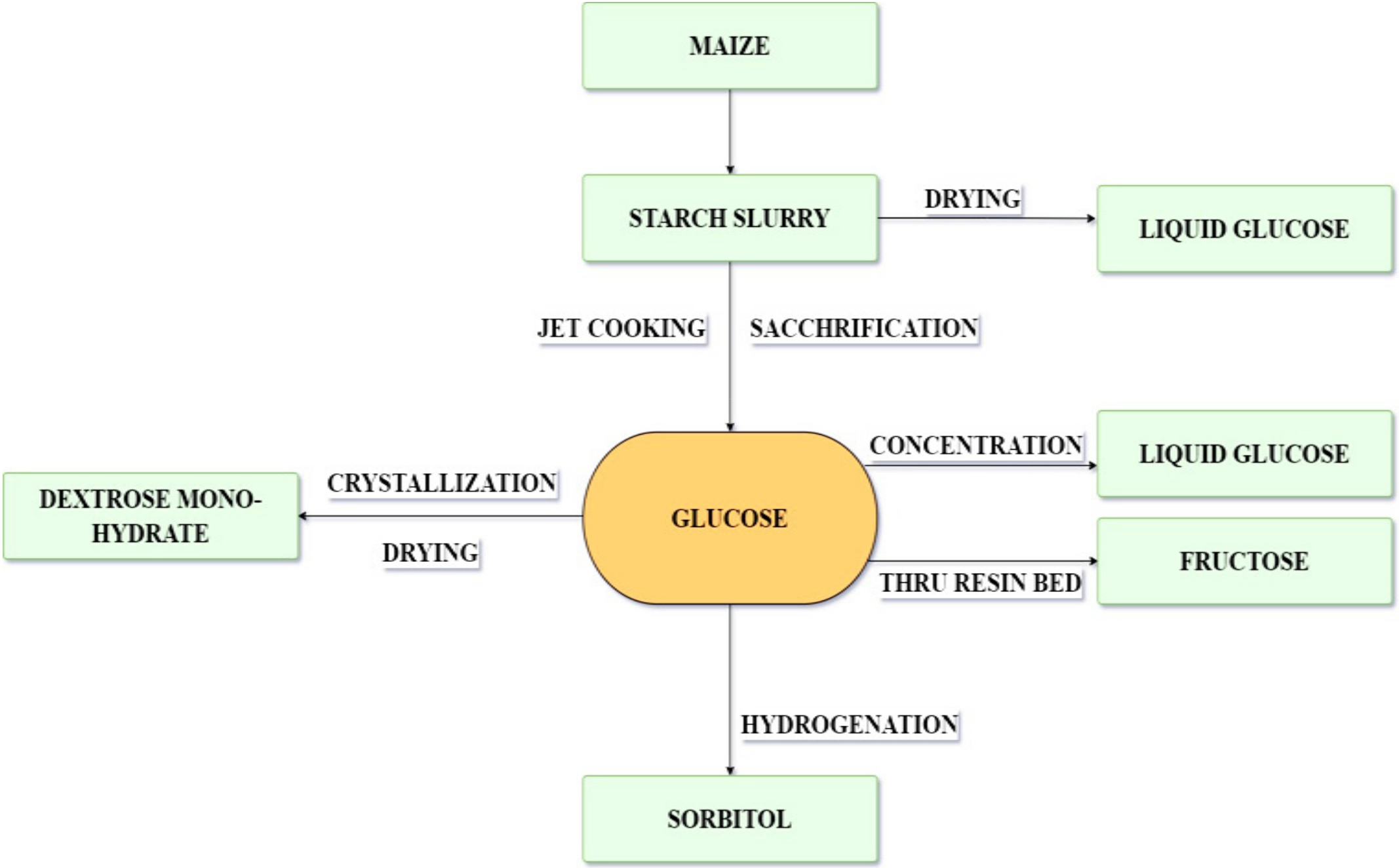
Germ washing, dewatering and drying

- The separated germ from 1st Germ cyclone is washed through the three stage gravity arc screen to move the germ to the germ squeezer for dewatering and then to the bundle dryer for drying to get the qualified germ.

Maize steeping liquid concentration

- The thin maize steeping liquid is concentrated through the MEE (Multi Effect Evaporator) for final product or can be mixed with fibre to make it into feed.

Maize Processing – Value Addition (Level 2)



PROJECT REQUIREMENTS

(MARKET)

About Products - Starch

Industry	Key Applications/Usage
Food & Beverage	In Confectionery Industry as Sweetner. In Pudding, Custards and Soups as Thickeners & stabilizers. In bakeries to make wheat flour soft and lend a good texture. In preparation of ice cream and ice cream cones.
Pharma & Nutraceutical	Intermediate for Nutritional health food supplements. Production of liquid formulations. Used as Dusting Powder, Vitamin Stabilizer & Tablet compression. In the manufacture of surgical gloves and Antibiotics.
Textile	Used in finishing and changing the appearance of fabric after bleaching, dyeing and printing. Used as a component in the finishing agent for glazing and polishing thread
Paper	Used as binders, surface-sizing and paper-coating agents
Leather	Imparts glossiness, fineness and optimum weightage
Others	Adhesives, paints, leather, brewery

About Products – Liquid Glucose (LG)

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Sr	Application	Properties
1.	Confectionery	Used in Confectionery because LG contains maltose and hence resistant to crystallization. LG improves shelf life of the finished product due to its hygroscope qualities with non-crystallization nature. Approx 90% of the LG produced is consumed by confectionary industry. Its proportion to sugar is confectionary being about 33%.
2.	Tobacco industry	Used in the preparation of chewing tobacco to impart flavour and to promote desirable texture and keeping qualities. Also used for flavourings and dressing tobacco for cigarette.
3.	Tanning industry	Used to give pliability and weight to the leather. Adding 5% to 10% LG to shoe polish will prevent caving and also results in a shine.
4.	Bakery and Food Products	LG is a glucose of high DEXTROSE equivalent which moderates osmotic pressure and inhibits microbial spoilage.
5.	Pharmaceuticals	Production of liquid formulations.

About Products – Malto Dextrin (MD)

Sr	Application	Properties
1.	Beverages	Malto Dextrin is popular as a flavourings, bodying and drying agent in chocolate drinks, flavour powders, special diets, citrus powders and coffee powders. Malto Dextrin is also used to replace a portion of protein whipping agent in aerated beverages.
2.	Infant Foods	Used in Malto-dextrin is the simplest from of sugar, has soft mouth feel and is easily digested. This property makes its use extensive in baby foods, feed supplement, digestive foods. It also used as a carrying and dispersing agent for flavors .
3.	Instant Foods	Used as a bodying and bulking agent in pudding, soups and frozen desserts.
4.	Bakery and Food Products	Used in Fruit Products, Granola Bars, Cream filled Icing and Cakes due to presence of higher saccharide. Used as a moist holding agent in breads, pastries and meats.
5.	Pharmaceuticals	Used in isotonic drinks as a nutritional supplement for binding and density control of dissolving rate.
6.	Dairy	It is used in dairy as dairy whitener in milk industry.

About Products – High Maltose Syrup (HMS)

Sr	Application	Properties
1.	Pharma	Used for all liquid foods for patients suffering from Liver issues and low digestibility.
2.	Food Supplements	Used in Food Supplements Industry due to its sweetness and resistance to Crystallization.
3.	Bakery & Food Products	Used in Food and Bakery Products due to presence of variable mono-saccharide.

Product Applications - Gluten

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Industry	Key Applications/Usage
Animal Nutrition (Feed)	It is used in the poultry industry as a feed, since it is a rich source of proteins, amino acids, fat and minerals. It is also used as a protein supplement in cattle Feed.

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Thank You