Orange

Orange is widely consumed both as fresh table fruit and as processed food such as orange juice, orange squash, orange jams, etc. There are multiple business opportunities that are available to FPOs growing Oranges. Some of the business opportunities that are suitable for FPOs are mentioned below and the technologies related to those businesses are detailed in this document.

S. No.	Business Opportunity	Brief description
1	Fresh orange – Direct to market	Fresh oranges with basic value, add such as washing, sorting, and packaging.
2	Waxed orange – Direct to market	Fresh oranges that are washed, waxed, sorted, and packed.
3	Fresh / Waxed orange – Store and sell	Oranges stored for short-term to medium-term to sell at better prices during off-season or low market arrivals
4	Orange juice – Bulk B2B sales	Low grade oranges processed to juice and sold to B2B segment such as processors, hotels
5	Orange peel powder	Peel of oranges used for juice making dried and converted to peel powder

Other business opportunities include ready to serve orange juice, orange squash, orange jams, orange concentrate. These business opportunities are not detailed in this document as they may not be suitable for FPOs due to high investment costs, significant volume of orange required around the year for business viability, difficulties in marketing due to competition, unsuitability of varieties grown in Maharashtra, etc.

1 Fresh Orange – Direct to market

Oranges can be sold directly to market with basic post-harvest value addition such as washing, sorting, and packing in corrugated fibre boxes. Oranges have good shelf life, nearly 10 days, at ambient temperature.

Technology	Type	Eligible for Matching Grant
Packhouse	Civil construction	Yes
Dry storage	Civil construction	Yes
Washing: - Nozzle-spray brush washer (or) - Bubble washer	Equipment	Yes

Technology	Type	Eligible for Matching Grant
Sorting and Grading: - Mechanical sorter (or) - Optical sorter	Equipment	Yes
Packaging - Automatic vertical packer in netlon mesh bags (or) - Manual packaging in vented corrugate fibre board boxes	Equipment (or) Manual process and Consumable	Equipment – Yes
Conveyor lines	Equipment	Yes
Plastic crates	Tool	Yes

Process:

- Harvested oranges should be arranged in crates at the field to minimize damage to the fruit
- At the packhouse, oranges can be washed either through a bubble washer or through a nozzle-spray brush washer to remove field dirt
- Washed oranges are then sorted either manually or through sorting machines. Low-cost mechanical sorters and high-cost optical sorters are available for sorting process
- Conveyor lines can be used for manual sorting and to move produce from one machine to another
- To prevent damage of produce during transportation, oranges can be packed in corrugated fibre boards boxes lined with polyethylene sheets
- Oranges can also be packed in netlon mesh bags through automatic vertical packers that bags the fruits as per required weights of packs
- Oranges can be stored in dry storages, while maintaining the relative humidity through a humidifier if required

Advantages:

- Sorting of oranges helps FPOs to sell the oranges through appropriate channels and realize higher prices (A and B grades to retailers and exporters, C and D grades to processors)

Disadvantages / Challenges:

- Unwaxed oranges have lesser appeal, and hence fetch lower prices in comparison to waxed oranges. They also might not be suitable for exports, as it will require elongated shelf life which waxing provides
- In case FPO has processing set up for oranges, it is necessary to store orange over long periods for continuous supply to the processing unit

Additional process:

- Oranges can also be de-greened to enhance its physical appeal. De-greening can be done by passing ethylene gas. De-greening should be done only when absolutely necessary as it reduces shelf-life of the fruit

2 Waxed Orange – Direct to Market

Waxing is the process of applying food-grade wax on the outer skin of orange. It helps in increasing the shelf-life and enhances the physical appeal of the fruit.

Technology	Type	Eligible for Matching Grant
Packhouse	Civil construction	Yes
Dry storage	Civil construction	Yes
Washing: - Nozzle-spray brush washer (or) - Bubble washer	Equipment	Yes
Nozzle spray with rotating brush waxer	Equipment	Yes
Continuous hot air tunnel dryer	Equipment	Yes
Sorting and Grading: - Mechanical sorter (or) - Optical sorter	Equipment	Yes
Packaging - Automatic vertical packer in netlon mesh bags (or) - Manual packaging in vented corrugate fibre board boxes	Equipment (or) Manual process and Consumable	Equipment – Yes
Conveyor lines	Equipment	Yes
Plastic crates for harvesting	Tool	Yes

Process:

- Harvested oranges should be arranged in crates at the field to minimize damage to the fruit
- At the packhouse, oranges can be washed either through a bubble washer or through a nozzle-spray brush washer to remove field dirt. Surface water of orange is removed by blowing air on the washed fruits.
- Washed oranges are then fed to nozzle spray rotating brush waxer to apply food-grade edible wax on the fruit
- Post applying of wax, oranges are passed through hot air tunnel dryers for drying of wax coating
- Waxed oranges are then sorted either manually or through sorting machines. Low-cost mechanical sorters and high-cost optical sorters are available for sorting process
- Conveyor lines can be used for manual sorting and to move produce from one machine to another
- To prevent damage of produce during transportation, oranges can be packed in vented corrugated fibre board boxes lined with polyethylene sheets
- Oranges can also be packed in netlon mesh bags through automatic vertical packers that bags the fruits as per required weights of packs
- Oranges can be stored in dry storages, while maintaining the relative humidity through a humidifier, if required

Advantages:

- Sorting of oranges helps FPOs to sell the oranges through appropriate channels and realize higher prices (A and B grades to retailers and exporters, C and D grades to processors)
- Waxed oranges increases shelf life of fruit and thus can be transported over long distances (exports)
- Waxed oranges fetch higher price in market compared to unwaxed as it enhances appeal

Disadvantages / Challenges:

- In case of prolonged subdued market prices, cold storage facilities are important. They can be stored in regular dry storages (ambient conditions and required relative humidity) only for less than 10 days
- In case FPO has processing set up for oranges, it is necessary to store orange over long periods for continuous supply to the processing unit

3 Fresh / Waxed Orange – Store and sell

Oranges can be stored in cold storage for short-term to medium-term. Oranges can either be stored without waxing or with waxing. Waxed oranges can be stored for relatively longer duration than unwaxed oranges. Cold storages can be either be a combination of civil construction with refrigeration units or pre-fabricated container cold rooms.

Short-term cold storage: Up to 8 week of storage at 5-7°C and relative humidity of 90-95%

Medium-term cold storage: Up to 4 months of storage at 0-3°C and relative humidity of 90-95%

Technology	Type	Eligible for Matching Grant
Packhouse	Civil construction	Yes
Washing - Nozzle-spray brush washer (or) - Bubble washer	Equipment	Yes
Nozzle spray with rotating brush waxer	Equipment	Yes
Continuous hot air tunnel dryer	Equipment	Yes
Sorting and Grading - Mechanical sorter (or) - Optical sorter	Equipment	Yes
Conveyor lines	Equipment	Yes
Vented corrugated fibre boards for packaging	Consumable	No
Plastic crates for harvesting	Tool	Yes
Pre-cooling chambers	Equipment	Yes
Cold storage - Container cool rooms (or) - Cold storages	- Civil construction (or) - Equipment	Yes
Reefer trucks	Equipment + vehicle	Yes

Process:

- Harvested oranges should be arranged in crates at the field to minimize damage to the fruit
- At the packhouse, oranges can be washed either through a bubble washer or through a nozzle-spray brush washer to remove field dirt
- Washed oranges are then fed to nozzle spray rotating brush waxer to apply food-grade edible wax on the fruit
- Post applying of wax, oranges are passed through hot air tunnel dryers for drying of wax coating
- Waxed oranges are then sorted either manually or through sorting machines. Low-cost mechanical sorters and high-cost optical sorters are available for sorting process
- Conveyor lines can be used for manual sorting and to move produce from one machine to another
- Oranges can be packed in CFB boxes for further cold storage
- Oranges should be pre-cooled by forced air cooling before cold storage. Pre-cooling chambers should be set-up in cold storage facility

- Cold storage can either be pre-fabricated container cold room or regular cold storages (civil construction fitted with refrigeration system)
- Pre-cooled oranges are stored at required temperature in cold storages while maintaining humidity. In case the cold storages are not equipped to control humidity, humidifiers can be installed
- Many container cold rooms come with pre-cooling facility. In such cases, separate setting up of separate pre-cooling chambers are not required
- Post cold storage, oranges are suggested to be transported through reefer trucks to maintain the table shelf-life of the fruit

Advantages:

- Cold storage enables FPOs to storage produce and sell them during off-season / market prices are favorable
- In case of exports to long distance, such as middle eastern countries, pre-cooling and reefer trucks are required till the produce is loaded to containers in port

Disadvantages / Challenges:

- Cold storages require significant initial investment and grid-powered cold storages have high operational cost. The increase in market prices may not be able to compensate for the storage cost incurred if the price increase is not significant

4 Orange juice – Bulk B2B sales

Orange is consumed widely in the form of juice. In India, orange juice is either consumed at juice shops where they are freshly prepared or from ready-to-serve packets. Manufacturing orange juice and selling it in bulk requires minimal investment as it does not need to be processed to suit end consumer consumption. The juice can be sold to ready-to-serve orange juice/concentrate/squash manufacturers or to hotels / restaurants.

Technology	Type	Eligible for Matching Grant
Shed for unit	Civil construction	Yes
Screw-type juice extractor	Equipment	Yes
Settling tank	Equipment	Yes
Filter press	Equipment	Yes
Storage tank	Equipment	Yes

Orange juice unit should be combined with the equipment suggested in any one of the above three business activities. This is because, only oranges that are of C and D grade should be utilized for processing to juice. Grade A and B oranges fetch higher prices as they are consumed as table fruit

Process:

- Oranges should be peeled manually. Nagpur Santra is suitable for manually peeling
- Peeled oranges are fed into a juice extractor, post which the juice is collected in a settling tank
- Slice + roller crusher can result in better juice extract than screw-type juice extractor. This is because slicing and then crushing in rollers avoids crushing of orange seeds, resulting in lesser bitter taste on the juice
- Suspended solids are removed through the settling tank
- Filter press can be used to further remove small, suspended solids and get fine juice
- Juice is collected in storage tank from which it is packed in suitable packs as required by buyer
- Feed pumps can be used to move juice from one machine to another

Advantages:

- C and D grades fetch very low prices in open-market. Processing them into juice provides better prices to the FPO
- Orange peel, a byproduct of the process, can also be monetized giving additional revenue to the FPO

Disadvantages / Challenges:

- Juice of Nagpur Santra, the variety grown in Maharashtra, gives a bitter taste[1]. This makes it unsuitable for direct consumption as juice. Debittering is an expensive process and would require high investments
- Since the juice is sold in bulk form in the B2B market, the margin realized by the FPO may not be high

Additional process:

- Debittering of orange juice can be done either by enzyme treatment or through membrane filtration. Debittering process can be expensive and might not be suitable at small scale or low price points.
- **Ready to serve Orange juice**: Orange juice from the above process can be further processed to packaged ready to serve juices. Additional processes include mixing of preservatives and sugar additives, homogenization, pasteurization, bottle filling and capping, and labelling. Marketing of ready to serve orange juices shall be challenge as established brands are available in the market. Producing the juice at small scale may not be viable in terms of pricing to compete with established brands.

5 Orange peel powder

Orange peel is a by-product in the manufacturing of orange juice. Orange peel powder is widely used in cosmetic industry for its high Vitamin C content. It can be marketed either directly to final consumers in surrounding areas or through online e-commerce websites. The FPO can also act as third-party manufacturers for bigger units or supply to cosmetics manufacturing companies.

[1] https://timesofindia.indiatimes.com/city/nagpur/the-bitter-story-of-nagpur-orange/articleshow/54271608.cms

Technology	Type	Eligible for Matching Grant
Shed for unit	Civil Construction	Yes
Fruit pulper	Equipment	Yes
Stainless Steel table for drying	Equipment	Yes
Pulverizer	Equipment	Yes
Sieving: - Manual sieve (or) - Vibratory sieve	- Implement (or) - Equipment	Yes
Packing: - Band sealing machine (or) - Form fill seal machine	- Equipment	Yes

Orange peel powder manufacturing unit should always be combined with orange juice manufacturing unit, as the peel is a by-product of the juice manufacturing process.

Process:

- Orange peel should be washed to remove dirt
- It is then crushed through rollers and is dried
- Drying can either be done on drying-yards (sun-drying) or through solar dryers
- The dried peel is converted into powder through the pulverizer
- To get fine powder, the pulverized powder can be sieved either manually through a sieve or mechanically through a vibratory sieve
- Orange peel powder is then packed either through a band dealer (manual) or through an FFS machine (semi-automatic)

Advantages:

- Since it is processing of a by-product, the input cost is negligible. Hence, the margin can be high

Disadvantages:

- Nagpur Santra's peel is not bright orange in color. This reduced the physical appeal of the powder
- Direct B2C sales through online channels is challenging, as it will require investments for marketing and competing with established brands

Alternate process:

- Orange peel powder can also be produced by crushing the orange peel in rollers, drying the crushed orange peel through solar dryers, and pulverizing the dried crushed orange peel pieces. But following this process might not deliver the same quality of peel powder produced through the above mentioned fruit peel pulping process. Fruit peel pulping is better at keeping the color and peel oil intact in the powder