Okra

Okra is mostly consumed in cooked form in Indian cuisine. The vegetable is sold in raw form to the But there is scope for the FPOs in carrying out value addition activities in okra, such as preparation of okra chips (dehydrated okra), IQF okra pieces, and okra juice extraction. 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 Okra – Direct to Market	Fresh okra with basic value additions such as washing, sorting, and packaging
2	Fresh Okra – Store and sell	Okra can be stored for short-term to medium-term to sell at better prices
3	IQF okra	Okra can be frozen and exported or sold to consumers
4	Okra chips (Dehydrated okra)	Okra can be dehydrated and mixed with salt, spices, and vegetable oil to increase the shelf life of okra and sell to consumers

Other business opportunities include okra juice extraction, okra gum extraction and gum powder preparation etc. 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 pomegranate required around the year for business viability, difficulties in marketing due to competition, unsuitability of varieties grown in Maharashtra, etc.

1 Fresh Okra – Direct to market

Okra can be sold directly to market post harvesting with basic post-harvest value addition such as washing, sorting, and packing in corrugated fibre boxes

Technology	Type	Eligible for Matching Grant
Plastic Crates	Implement	Yes
Pre-cooling chamber	Equipment	Yes
Packhouse	Civil construction	Yes
Conveyor Lines	Equipment	Yes
Bubble washer	Equipment	Yes
Reefer Truck	Vehicle + Equipment	Yes

Technology	Type	Eligible for Matching Grant
400 gauge polyethylene bags with 2% vents	Consumable	No

Process:

- Harvested okra should be collected in crates at the field and can be pre-cooled using a precooler before being sent to the packhouse
- At the packhouse, the harvested okra is washed using a bubble washer to remove field dirt. Washed okra are then sorted and graded manually
- Conveyor lines can be used for manual sorting and to move produce from one machine to another
- To prevent damage of produce during transportation, okras can be packed in 400 guage polyethylene bags with 2% vents to retain organoleptic qualities and minimum total microbial counts

Advantages:

- Sorting of okras helps FPOs to sell them through appropriate channels and realize higher prices (A and B grades to retailers and exporters, C grade can be processed by the FPOs)

Disadvantages / Challenges:

- Okras can face price crashes. Having no storage facilities will force FPO to sell the produce at low / unviable prices

2 Fresh Okra – Store and sell

Okra can be stored in cold rooms upto 2 weeks. Pre-fabricated cold storage rooms can be used to store okra for later sales when the market scenario improves, although okra has lower shelf life, even when stored in cold storage rooms.

Technology	Type	Eligible for Matching Grant
Plastic Crates	Implement	Yes
Pre-cooling chamber	Equipment	Yes
Packhouse	Civil construction	Yes
Conveyor Lines	Equipment	Yes
Bubble washer	Equipment	Yes
Container Cold Rooms	Equipment	Yes
Reefer Truck	Equipment + Vehicle	Yes
400 gauge polyethylene bags with 2% vents	Consumable	No

Process:

- Harvested okra should be collected in crates at the field and can be pre-cooled using a precooler before being sent to the packhouse
- At the packhouse, the harvested okra is washed using a bubble washer to remove field dirt. Washed okra are then sorted and graded manually
- Conveyor lines can be used for manual sorting and to move produce from one machine to another
- The washed and graded okra are packed in polyethylene bags and stored in the cold rooms. The shelf life recorded for okra in cold rooms is around two weeks. The okra can be either sold off in the market during the two weeks or processed into okra chips/ sold to processors
- To prevent damage of produce during transportation, okras can be packed in 400 gauge polyethylene bags with 2% vents to retain organoleptic qualities and minimum total microbial counts

Advantages:

- Sorting of okras helps FPOs to sell them through appropriate channels and realize higher prices (A and B grades to retailers and exporters, C grade can be processed by the FPOs)

Disadvantages / Challenges:

- Cold rooms require significant initial investment and grid-powered cold rooms have high operational cost. FPO should ensure high utilization throughout the year for the cold room facilities
- The increase in market prices may not be able to compensate for the storage cost incurred if the price increase is not significant

3 IQF Okra

Since okra has a low shelf life, processing of the okra into frozen okra slices can increase the shelf life and can be sold directly to the end consumers (after proper branding) or to retailers. The relevant technologies and the process for manufacturing IQF okra is as mentioned below:

Technology	Type	Eligible for Matching Grant
Shed for unit	Civil construction	Yes
Cutting Machine – Multipurpose Cutter	Equipment	Yes
Blancher	Equipment	Yes
Nozzle-spray brush washer	Equipment	Yes
Vibrating shaker	Equipment	Yes
IQF Freezer	Equipment	Yes
Continuous band sealer	Equipment	Yes

Okra IQF unit should be combined with the equipment suggested for fresh okra business opportunities suggested above.

Process:

- The washed and graded okra are cut into the appropriate shape or form using a semi-automatic cutting machine into appropriate form or shape (~ 12 – 15 mm slices)
- The sliced okra pieces are inspected manually, by passing them across a conveyor belt, for any infection and foreign matter and ensuring consistent quality of raw materials
- The sliced okra is washed again in a bubble washer with 25 – 50 ppm hypochloride (5 mins) to remove foreign materials like soil and debris during the cutting process
- The sliced okra pieces are then blanched using a blanching machine, where the okra is exposed to hot water for a short period of time. Blanching is vital for killing the enzymes and preserving the color & taste of the okra
- The blanched okra slices are then cooled down to 10–12 °C for further processing using nozzle and brush washer. The blanched and cooled okra are then inspected by workers to remove defective ones
- The blanched and cooled okra are then dewatered by passing the slices through a vibrating shaker to remove extra water from the blanched okra before freezing to ensure good quality of frozen okra
- The okra is then passed through an IQF freezer (temp ~ -18 °C) to deep freeze the okra
- The frozen okra slices are then filled into HDPE bags and weighed as per the requirement and sealed with thread sealer. These HDPE bags containing frozen okra can be sold to processors or in case the FPO has taken any job – work for other FPOs.
- The frozen okra slices can also be packed in smaller retail size packs using an automated packing line where the FPOs can control the weight to be packed in each pack. Integrated fully automatic weighing machine and bag packer may also be used for packing the IQF okra in bags
- The IQF okra slices need to be stored in deep freezers or cold rooms till sold

Advantages:

- Freezing okras into IQF can help the FPOs achieve better returns for their produce. IQF okra also has better shelf life than the fresh vegetable
- IQF okra has potential for exports

Disadvantages / Challenges:

- IQF freezer, and the storage (deep freezer/ cold rooms) require significant initial investment and grid-powered cold storages have high operational cost
- FPOs should have high utilization of the IQF unit for breakeven and profitability

4 Okra chips

Okra chips are a dehydrated version of Okra which can preserved by drying. It can easily be added into the diet or can be consumed as a low-calorie snack, anywhere, anytime. Many commercial brands today add ingredients such as salt, spices, and vegetable oils not only to boost its flavor but also to lengthen its shelf life. Okra's suitability for drying is fair to good. Drying or dehydration is one of the most effective means to extend the shelf life of perishable fruits and vegetables. The main purpose of dehydration in preserving

fruits and vegetables is to remove moisture so that water activity of the dehydrated products is low enough for preventing the spoilage and the growth of pathogenic microorganisms and subsequently to reduce the spoilage reactions.

Technology	Type	Eligible for Matching Grant
Shed for unit	Civil construction	Yes
Cutting Machine – Multipurpose cutter	Equipment	Yes
Blancher	Equipment	Yes
Tray dryer (or) Solar dryer	Equipment	Yes
Continuous band sealer	Equipment	Yes

Okra chips unit should be combined with the equipment suggested for fresh okra business opportunities suggested above. Lower grade okra can be processed into chips as higher grade can fetch better prices when sold as fresh vegetable.

Process:

- Harvested okra should be collected in crates at the field and can be pre-cooled using a precooler before being sent to the packhouse
- At the packhouse, the harvested okra is washed using a bubble washer to remove field dirt, dirt, insect matter, mold spores, plant parts, and other material that might contaminate or affect the colour, aroma, or flavor. Washed okra are then sorted and graded manually. The okra top stalk end and tail is chopped manually, since the same cannot be sorted out while using a cutting machine
- Conveyor lines can be used for manual sorting and to move produce from one machine to another
- The washed and graded okra are cut into the appropriate shape or form using a semi-automatic cutting machine into appropriate form or shape (~ 12 – 15 mm slices)
- The sliced okra pieces are inspected manually, by passing them across a conveyor belt, for any infection and foreign matter and ensuring consistent quality of raw materials
- The sliced okra is washed again in a bubble washer with 25 – 50 ppm hypochloride (5 mins) to remove foreign materials like soil and debris during the cutting process
- The sliced okra pieces are then blanched using a blanching machine, where the okra is exposed to hot water for a short period of time. Blanching is vital for killing the enzymes and preserving the color & taste of the okra
- The blanched okra is then dried using a tray dryer or solar dryer to obtain dehydrated okra chips, which are packed in pouches using continuous band sealer

Advantages:

- As a value added product, dehydrated chips fetch better margins to FPO
- Dehydration significantly reduces the cost of transportation and storage due reduced weight and volume of dehydrated vegetables. Unlike fresh vegetables, dehydrated vegetables do not require refrigerated storage

Disadvantages / Challenges:

- Okra chips has limited market as consumption is low

Alternate process:

- The dehydrated okra chips can also be added with salt, spices, and vegetable oil to get snack okra chips (ready-to-eat)