

Consultancy Report: B.Axtell

Consultancy relating to research project:

NRIL Contract Number: ZB0227

DFID Contract Number: R7551

Project Title: Sustainable retailing of post-harvest technology to the poor: alternative institutional mechanisms for developing and transferring technology

Dates of Consultancy: 12/3/01 to 26/3/01 inclusive of travel

Terms of Reference

The consultant shall undertake the following activities in line with the terms and conditions of the contract. The work will be conducted in New Delhi, India in conjunction with International Development Enterprises (IDE), C5/43, Safdarjung Development Area, New Delhi – 110016. Reports may be prepared upon return to the U.K.

1. The consultant shall provide technical knowledge and guidance to support the project staff at IDE in their undertaking of the following activities:
 - a packaging technology scan to identify existing packaging solutions appropriate for the marketing and transportation of high value tomatoes produced in India;
 - the selection and evaluation of a range of potentially appropriate technologies that will be further evaluated by stakeholders.
2. The consultant will undertake to disseminate knowledge on the low-cost paper pulp packaging technologies, on which he has developmental experience, to the project staff of IDE and to other relevant stakeholders. This may take the form of a brief workshop.
3. The consultant shall provide technical expertise in any discussions with the institutional stakeholders involved in the technology development and refinement process. These constitute the Indian Institute of Packaging, commission agents within the Mandi system of marketing, the wooden box industry, and existing packaging manufacturers.
4. The consultant shall provide IDE with scientific and technical know-how on issues to be addressed when selecting and refining packaging technologies for use with perishable commodities such as tomatoes. This knowledge may be further informed by undertaking a brief survey of the local Mandis to identify apparent causes and of post-harvest damage or losses in a) packaged tomatoes and b) the tomato marketing chain in general, and to estimate the levels involved.

5. The consultant shall provide Dr Clare Johnson of ITC, U.K and Mr Guru Naik of IDE, India with an end of visit report within 10 days of completing the consultancy.

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1 Background and Summary

International Development Enterprises (IDE) works in several countries, mainly in the field of irrigation. Its promotion and dissemination of over 1.5 million treadle pumps is well known. IDE's approach is strongly market lead. In Himachal Pradesh IDE is promoting the use of drip irrigation to produce horticultural products by smallholder farmers. Farmers have identified tomatoes as a crop of interest as they grow in the two month (June-July) off-season when prices tend to be high in major markets.

Tomatoes are traditionally packed and distributed in 15 or 20 kg wood slat boxes made, not from timer off-cuts, but from valuable trees specifically felled. Recently the Government of Himachal Pradesh has brought in a number of environmental laws including a ban on felling trees for box manufacture. There is a widely held view that other States will follow and IDE considers that there is an urgent need to identify alternative packaging systems to allow farmers to market their produce. It should be noted that in certain sub-sectors, such as apples and grapes, wood boxes are rapidly being replaced by corrugated cardboard cartons (CCC's) and trays.

Against this background a two-week consultancy visit was paid to IDE to research alternative packaging for tomatoes. IDE had investigated key Institutions and Companies involved in packaging and visits were made to these and also to major markets and smallholder growers.

Suitable CCC packaging has been identified, at prices that are competitive with wood boxes. Indicative quotes of Rs 15/16 have been obtained; wood boxes costing Rs16-20. IDE is now planning trials in which the condition of tomatoes (against those in wood boxes) will be checked after road transport to the central Delhi wholesale market.

2. Conclusions and Recommendations

1. It is widely considered that, for environmental reasons, wood boxes are unlikely to be in use in 10 years.

2. Plastic, stacking field crates provide the best technical, economic and risk solution to small farmers transportation problems **provided that** they are provided on site by the buying agent. The crates are strong, water-resistant and can make a large number of trips to pay back the initial high cost (Rs 250 in Himachal Pradesh). Their use, however, leaves farmers firmly under the control of buying agents

3. The ideal alternative is considered to be 15kg CCC trays made of coated board, to increase resistance to moisture, and constructed with triangular load bearing corners that allow stacking. Damage in shallow trays has been shown to be less than in deep boxes (Punjab Agric. Univ report). The use of such trays is not, however, recommended at this time as the “technology change” is considered too great for farmers to accept.

4. It is recommended that 15kg CCC, with double walls, corrugated with either AB or BC corrugations (see note below) and designed to have a load bearing capacity of at least 450 kg are used for the trials. Ventilation should be provided as described in the Indian Institute of Management report (see Appendix 6.2)

Note: Corrugated cardboard boxes are made of one or more laminae with corrugations between layers of paper. The strength of the board is governed by the number of plies of paper used and the number of corrugations per unit length. The corrugation or flute types are common:

- Type A 105-125 corrugations/metre - gives cushion and board thickness of 4.5-4.7 mm
- B 150-185 „ „ strength „ 2.1-2.9
- C 120-145 „ „ combines strength and cushion 3.5-3.7

Boxes are normally made with an inner cushion of A corrugation and a stronger outer B wall. Wall construction with BC corrugations adds strength.

5. The transport trials will require careful planning if meaningful and statistically reliable data is to be produced. It is recommended that an experienced person should be contracted to design the trials. Dr Girja Sharan of the Indian Institute of Management would be a good candidate given his experience in the area.

6 The time frame to carry out the trials during the next season is very short. The trials will research three principle aspects:

- Transport damage in both CCC's and wooden boxes
- Market acceptability of the new package
- Acceptability of the new packaging to growers

7. If growers confidence is to be retained it is important that the transport trials succeed. For this reason the recommended carton design has been “over-engineered” with a crush strength of at least 450 kg (three times actual load at base of a nine high stack of 15kg cartons). Advice from 2 specialists in CCC design suggested a crush strength of 250 to 300 kg would be adequate while a third specialist recommended a figure of 450 kg. If, as expected, the trials are positive research can be carried on reducing the specification, and hence cost, next year. Board strength is substantially reduced under conditions of high humidity. Information obtained from

the British Packaging Industries Research Association suggests a 50% loss of strength if the relative humidity rises from 40% to 90%.

8. At the present time coated board is not available. One manufacturer, however, expects to have coated board with improved water-resistant properties available in the near future. The additional cost is estimated at Rs 1.5 / carton. This will help overcome the genuine concern that any tomatoes that crush will wet the carton and that high ambient relativity will reduce board strength. IDE should closely follow the development of this product

9. The plant of the likely manufacturer produces 18,000 carton blanks per hour. The very small size of the order being placed will mean that the unit price will be inflated. It is suggested that IDE obtain a “theoretical quote” for say 100,000 cartons and applies this price to farmers rather than the actual carton cost. In addition the recommended carton will be more expensive than one with a 250-300kg strength. Again quotes for the lower specification carton should be applied to farmers. The additional costs should be covered by the project.

10. Those at most risk in this investigation are the farmers. There is published evidence that indicates typical damage to tomatoes is 5% in wood boxes. It is recommended that the project carries the risk for any damage above 5% in CCC’s

11 Given the appalling condition (essentially under construction) of the road from the Shargaon growing area to Solan it is suggested that a pre-trial be carried out by loading wood boxes, plastic crates and CCC’s above the rear axle of a truck (this is the worst position). The load should be evaluated in Solan.

12. The Indian Institute of Packaging should be contracted to carry out independent quality checks on the cartons used.

13. It is suggested that small-scale trails are carried out on producing retail packs (paper moulded tray over-wrapped in cling film). If a demand exists this could generate employment, particularly amongst women.

Visits

1. Central wholesale market Delhi. This visit provided a good overview of the tomato handling and distribution chain. One very large, 200 ft long, shed is dedicated to tomatoes. Trucks arrive before 6am and off- load to the shed. A number of commission agents are spaced along the shed and the trucks back in to the designated buyer. The trucks cover huge distances, one driver interviewed had spent three days and nights driving from Assam.

All produce seen was packed in 20kg wood boxes (about 65%) or 25 kg plastic field boxes. Wood boxes cost Rs 20 new and Rs 14/15 second hand. Plastic crates cost Rs 150.

Four agents were interviewed and the following points emerged:

- Even if bans on wood were introduced wood boxes will still be available for at least five years.
- If there were problems with wood boxes, plastic crates were a good alternative as they made many trips
- Collapsible plastic crates had been tried but they broke
- The packaging is the farmer's problem, we make our living by buying and the auctioning the fruits.
- Two traders were very dubious about the use of CCC's for such low value products.
- Concern of squashed fruits weaken cartons

Two traders were open to examining CCC's provided it could be shown that:

- They were in the same price range; approx. Rs 1 /kg of fruit.
- They protected better than wood boxes
- They would not loose strength if wetted by squashed fruit

The buying system is complex but in general:

- In the field the tomatoes are collected by the agents or in many cases a farmer acting on behalf of a group.
- The product is delivered to an agreed commission agent in Delhi market.
- The CA auctions the produce, some going to the local market and parts being re-packed for transport to other cities.
- The boxes may then be graded and repacked
- The CA makes payment to the local agent, generally within 24 hours
- The truck drivers receive information regarding loads to be picked up via the transport system and load accordingly.

Indian Institute of Management, Ahmedabad.

An extremely productive meeting was held with Dr Girja Sharan who presented his work on tomato packaging. A report is included in the Appendix to this report. The following notes, taken from his presentation are additional to the report.

The Ahmedabad market receives some 1500 tonnes of produce per day of which, in season, 150 tonnes are tomato. The season for tomato moves as follows:

- | | |
|-----------------------------|-----------|
| • Gujarat | Nov- Mar |
| • Rajasthan | April-May |
| • Punjab & Himachal Pradesh | June-July |
| • Karnataka | Aug-Oct |

It was stated that growers are actively interested in alternatives to wood box packaging.

The traditional wood box has been evaluated as follows:

- It has an average, but variable, stacking strength of 350 kg
- It is not affected by moisture
- Low cost Rs 8 to 20

- It is rough and causes damage to the fruits
- It is heavy, typically 1.5 to 2 kg

Dr Sharan, working closely with a local major packaging company, CORE have developed and tested 3 types of CCC packaging:

- A 20 kg carton
- A 15 kg carton
- A 10 kg tray

In summary the tray was found to perform best (suitable for transport up to 2000km), the 15 kg carton second (up to 1000 km) and the 20kg carton least well (up to 500km). Dr Sharan considers that a crush strength of 250 kg is required to protect tomatoes in transit.

Dr Sharan's work provides important technical base line data for IDE and they are to be congratulated for identifying his research.

CORE Emballage Ltd. Contacts Mr Akshay Chandran and Mr V Srivastava

CORE is the second largest manufacturer of CCC in India and has a fully automated plant in Gujarat. It has its own design team and is capable of manufacturing cartons to any given specification. Discussions were held on the collaborative work with Dr Sharan. The main constraint appears to be price, some Rs 25 for a 15 kg box.

Farmers visits, Gujerat.

Two farmer groups were visited. In the first case tomatoes were being packed into second-hand 10 kg cardboard boxes (cost Rs 5.5) for transport to Delhi. The boxes were not ventilated and the farmers stated that this was deliberate, it had been found that fruits packed "on the turn" would ripen during transport to the Delhi market. First quality produce was sold at Rs 40/ box and second grade at Rs 20. In both cases a charge of Rs 4 was made for the carton.

The farmers stated that they were finding a greater demand for produce packed in CCC's

A totally different system was in place in the second group. Here a Delhi based agent had sent a truck of plastic field crates to purchase the crop at Rs2 /kg.

Small CCC manufacturer at Anand, Gujerat

A visit was paid to a small manufacturer of CCC's. The plant was very labour intensive and prices of Rs 10.5 were quoted for a 250 kg crush strength, 15 kg capacity box. This company clearly has low overheads and hence lower costs but it is considered that quality control would be a problem as no in house testing facilities are available.

Indian Institute of Packaging , Mr N C Saha, joint director

A short meeting was held with Mr Saha who made it very clear that the IIP acted on a paid consultancy basis. He had all facilities available to assist IDE but would require a contract prior to providing information. The IIP would be a useful body to provide independent quality checks. Beyond this the commercial manufacturers are capable of design and production of CCC's for the project.

Packaging and Food Industries Trade Fair.

IDE arranged an afternoon to visit this event. Little relevant information was found.

Federation of Corrugated Box Mfrs of India.

A useful meeting was held with Mr Harish Madan, Chairman. The problems faced by IDE were explained and Mr Madan confirmed that our thinking was correct. He did however strongly recommend the use of cartons with a crush strength of at least 450 kg given the road and vehicle conditions in rural India. We were told that CORE has financial problems and he was not surprised that its prices were high. The distinct impression was gained that other companies could produce the same quality cases at lower prices.

Farmer visits in Himachal Pradesh

IDE is working with 5 groups of farmers in the area, two of which were visited. The first is on a tarmac road a few kms from the town of Solan, the second 30 km (1.5 hrs) from Solan on a road now being re-constructed. Both groups showed keen interest in alternative packaging, including a logo and brand image. Concerns centered over:

- Transport damage less than wood boxes
- Cost, no more than wood boxes at Rs 20
- Loss of structural strength should tomatoes crush and wet carton
- Market acceptability in Delhi

The general impression was gained that the farmers have a positive interest in, and are willing to fully take part in the planned trials **provided that** they are not exposed to increased costs or risks.

Mohan Fibre Products Ltd

This large company in Chandigarh produces a range of moulded paper products. Very interesting discussions were held as the owner and I had common paper moulding contacts from some 15 years ago. A number of ideas, on low cost prototype mould manufacture, were discussed and will be followed up in the UK.

The owner stated that he was convinced that with time the distribution of retail packs of horticultural produce would become more common. It was agreed that IDE would carry out some research into the acceptability/price of retail packs based on a water-resistant paper moulded tray wrapped in cling film. Technical advice was offered by Mohan.

Agro Industrial Packaging India Ltd. Simla

This State owned cardboard box plant is the largest in India, fully automated and able to produce 18,000 blanks/ hr. The General manager agreed to provide samples of a carton with a minimum 450kg/ load capacity, double walled with either AB or BC flutes within two weeks for demonstration to farmer groups. He assured IDE that an order could be met for the June season. An estimated carton price of Rs 15/16 was given.

Samples of a new moisture resistant coating were shown, which appeared excellent. The company hopes to begin trials with this material in the near future.

It is suggested that IDE should collaborate with this company based in Himachal Pradesh.

Persons contacted

Mr Guru Naik, Associate Director, IDE. C5/43 Safdarjung Development Area. New Delhi 110 016

Dr V K Dixit Programme Co-ordinator Micro-Irrigation IDE

Mr Samir Vaidya. Area Marketing Manager. IDE , Simla

Mr Tom Hemphill, Director IDE, India

Mr Tapishwar Kumar. Managing Director, Mohan Fibre Products, 5861 Duplex Modern Complex, Manimajra, Chandigarh 160, 101.

Mr Amrit Chauhan. General Manager, Agro Industrial Packaging Ltd, Himrus Building, Circular Rd, Simla, Himachal Pradesh

Mr Harish Madan, Chairman. Federation of Corrugated Box Mfrs of India
118 Deepshikha, Rajendra Place, Delhi 110 008

Mr N C Saha. Joint Director. Indian Institute of Packaging. Plot 21, Functional Industrial Estate. Patparganj. Delhi 110 092

Mr Akshay and Mr Srivastava. CORE Emballage. Core House, Off CG Road Ellisbridge, Ahmedabad

Itinerary

Mon March 12/13		Travel to Delhi
Weds	14	Meeting IDE staff
Thurs	15	Delhi Azadpur Mandi, wholesale market
Fri	16	Travel Ahmedabad. Indian Institute of Management

Sat	17	Core Emballage Farmer visits Box plant at Anand
Sunday	18	Return Delhi
Mon	19	Indian Institute of Packaging
Tuesday	20	Chairman, Corrugated Box Federation Post Harvest Trade Fair
Weds	21	Travel to Chandigarth Mohan Fibre Producers
Thurs	22	Visit farmers in Solan area
Fri	23	Travel Simla Agro Industrial Packaging Ltd
Sat	24	Travel Simla to Delhi
Sun	25	Round up meeting with IDE Travel to UK

Appendix 1. Suggested Carton Design.

It is recommended that the carton design and specification is based on the tested designs of Dr Sharan except that:

- the stacking strength should be increased from 250kg to a minimum of 450kg
- if technically available the boxes should be coated on both sides of the board to reduce moisture absorption.

The following specification is a guide and the manufacturer should be requested to design the best possible carton within a cost limit of Rs 18/20.

Capacity	15kg
Construction	5 ply with vertical BC corrugations
Dimensions, mm	430 x 205 x 390
Paper plies	150 g/m. sq
Stacking strength	minimum 450 kg
Ventilation	8 holes 24.5mm in diameter on long wall

APENDIX not available electronically. Hard copy submitted to CPHP April 2001.