



PROCEEDINGS

Asia-Pacific Community of Practice (CoP) on Food Loss and Waste SESSION 5

"Critical Point for Food Value Chain and Situation of Food Loss and Waste in Fruits and Vegetables Wholesale Markets in Asia"

Date	30 April 2026
Time	1:00–2:15 PM (Bangkok Time)
Platform	Online (APAARI Virtual Session)
Host	Ms Dipika Trivedi, Senior Technical and Administrative Associate, APAARI
Moderator	Dr Ravi Khetarpal, Executive Director, APAARI
Organizer	APAARI & Asia-Pacific Community of Practice on Food Loss and Waste
Participants	100+ participants from across the Asia-Pacific region and beyond
Join Zoom Meeting	https://us06web.zoom.us/j/84112968050?pwd=ja0mLKqhf6AXB3vdYUXbgI0w7K3tay.1 Meeting ID: 841 1296 8050 Passcode: 631312
FLAW-CoP Website	

Executive Summary

The fifth session of the Asia-Pacific Community of Practice (CoP) on Food Loss and Waste, organized by the Asia-Pacific Association of Agricultural Research Institutions (APAARI), focused on a critical yet often overlooked point in the food value chain: food loss and waste (FLW) in fruits and vegetables wholesale markets in Asia. Held virtually on 30 April 2026, the session brought together more than 70 participants, including researchers, policymakers, technical experts, development practitioners, and students from across the Asia-Pacific region and beyond.



APAARI | Asia-Pacific Community of Practice on Food Loss and Waste

Session 5 Proceedings | 30 April 2026

The session aimed to deepen understanding of food loss and waste occurring in wholesale markets, identify practical interventions for reduction and valorization, and explore technological, institutional, and policy approaches to improve sustainability within food systems. The discussion emphasized that wholesale markets serve a dual role: they are essential distribution nodes for fresh produce while simultaneously functioning as major hotspots of food loss and waste generation.

In his opening remarks, Dr Ravi Khetarpal, Executive Director of APAARI, emphasized the strategic importance of reducing food losses as an alternative to increasing food production. Drawing on global evidence, he highlighted that even modest reductions in food losses can significantly improve food availability and food security. He stressed the need for behavioral change, likening food conservation to everyday habits of resource-saving and underscoring the importance of transforming waste into opportunity.

The keynote presentation by Ms Meeta Punjabi, Food Systems Expert at the FAO Regional Office in Bangkok, provided an in-depth overview of findings from a comparative assessment of food waste management practices in selected Indian fruit and vegetable wholesale markets. The study examined major wholesale markets in India, including Delhi, Mumbai, Surat, Pune, Coimbatore, Indore, and Bhubaneswar, to assess the scale and composition of food waste, existing waste management practices, sanitation and food safety conditions, and opportunities for mitigation and valorization.

The presentation highlighted that approximately one-third of food produced globally is either lost or wasted, representing an economic loss of nearly USD 1 trillion annually and contributing 8–10% of global greenhouse gas emissions, primarily through methane release. Wholesale markets in India were identified as significant contributors to organic waste generation, with many operating as “bulk waste generators” where poor segregation and disposal practices result in large volumes of food waste being sent directly to landfills.

A major message emerging from the keynote was the need to transition from a linear food system based on production, consumption, and disposal to a circular food system that prioritizes prevention, reuse, recycling, and valorization of waste streams. Ms Punjabi emphasized FAO’s food use hierarchy, where edible food should first remain available for human consumption, followed by reuse for animal feed and other productive purposes, while disposal should remain the last option.



APAARI | Asia-Pacific Community of Practice on Food Loss and Waste

Session 5 Proceedings | 30 April 2026

The session also highlighted promising economic opportunities associated with food waste valorization. One key example was the Surat wholesale market, which has successfully operated a 50-ton/day biomethanation plant through a public–private partnership model for over a decade. This initiative converts organic market waste into bio-CNG and bio-fertilizer, while also supporting food processing activities such as tomato pulping. The Surat model demonstrated the financial feasibility of converting food waste into revenue-generating assets while simultaneously reducing greenhouse gas emissions and landfill dependency.

At the same time, serious concerns were raised regarding food safety, sanitation, and hygiene conditions in wholesale markets. Observations from the study indicated unsanitary handling conditions, including unsegregated waste, animal presence among fresh produce, poor waste management systems, and inadequate compliance with food safety and solid waste management regulations. These findings underscored the urgent need for investment in infrastructure modernization and enforcement of hygiene standards.

The panel discussion broadened the conversation by introducing perspectives from post-harvest management, digital traceability systems, and business model innovation. Dr Manju Bala highlighted India’s post-harvest loss scenario, noting that despite some reductions in losses due to improvements in cold chains, packaging, and supply systems, monetary losses remain substantial because of increasing produce value. She emphasized low-cost technologies, food processing, bioactive extraction, and waste-to-wealth approaches as practical pathways for reducing losses.

Dr Anupama Panghal identified information asymmetry as a major root cause of food loss and waste. She argued that inadequate information sharing across supply chains results in “blind handovers” between farmers, traders, and wholesalers. Drawing on her research on blockchain-based traceability systems, she emphasized the potential of blockchain, IoT, and digital platforms such as e-NAM to improve transparency, real-time decision-making, and reduce avoidable losses, particularly in wholesale markets.

Dr Vijay Yadav Tokala emphasized the importance of holistic post-harvest management and capacity building. He highlighted that technologies alone cannot solve food loss and waste problems without effective knowledge transfer and convincing cost–benefit evidence for stakeholders. He introduced



APAARI | Asia-Pacific Community of Practice on Food Loss and Waste

Session 5 Proceedings | 30 April 2026

the Commodity Systems Assessment Methodology (CSAM) and the Postharvest Training and Services Center (PTSC) model as practical approaches for identifying context-specific loss points and improving access to technologies for smallholder producers.

The question-and-answer session generated strong engagement from participants, with discussions ranging from methane emission calculations and long-term trends in post-harvest losses to tomato waste valorization, drying technologies, and opportunities for converting agricultural waste into value-added products. Participants also raised broader institutional questions concerning the transition toward circular food systems and the readiness of governance structures to support such transformations.

Several key messages emerged from the session. First, reducing food loss and waste must be recognized as a central strategy for strengthening food security, climate mitigation, and resource efficiency. Second, wholesale markets represent strategic intervention points where investments in waste segregation, sanitation, food rescue, processing, and bimethanation can generate significant economic, environmental, and social returns. Third, low-cost technologies and management improvements may offer more scalable and context-appropriate solutions than highly capital-intensive infrastructure in many settings. Fourth, successful adoption of innovations requires strong capacity building, stakeholder engagement, and clear demonstration of economic viability.

The session concluded with a collective recognition that food loss and waste is not merely a technical issue but a shared societal responsibility requiring coordinated action from governments, researchers, private sector actors, market authorities, and consumers. APAARI reaffirmed its commitment to using the Community of Practice as a platform for knowledge exchange, collaborative partnerships, and practical interventions aimed at advancing sustainable, circular, and resilient food systems across the Asia-Pacific region.

APAARI, through the Asia-Pacific Community of Practice (CoP) on Food Loss and Waste, seeks to strengthen future collaborative actions and joint project development with key technical and knowledge partners to address emerging challenges in food loss and waste across the region. Building upon existing engagement, APAARI aims to expand collaboration with the Food and Agriculture Organization (FAO) for technical cooperation and evidence-based policy support on food loss and waste; ICAR-Central Institute of Post-Harvest Engineering and Technology for advancing technical expertise and scalable solutions on post-harvest loss reduction and value



APAARI | Asia-Pacific Community of Practice on Food Loss and Waste

Session 5 Proceedings | 30 April 2026

addition; Indian Institute of Technology Bombay as a CoP collaboration partner for research, technological innovation, and systems approaches to food waste management; and the International Water Management Institute as a strategic partner to explore integrated approaches linking food systems, water management, climate resilience, and circular economy practices. These collaborations are expected to support future regional projects, technical exchanges, policy dialogue, capacity strengthening, and evidence-driven interventions aimed at reducing agri-food loss and waste across the Asia-Pacific region.

1. Welcome and Opening Remarks

Ms Dipika Trivedi, Senior Technical and Administrative Associate, APAARI, warmly welcomed speakers, panelists, and participants from across the Asia-Pacific region on behalf of APAARI and the Asia-Pacific Community of Practice (CoP) on Food Loss and Waste. She underscored that participants' presence reflects not only professional commitment but also a shared responsibility towards more sustainable and equitable food systems across the region and beyond.

Recap of Previous CoP Sessions

Ms Dipika Trivedi provided a brief overview of the four preceding sessions:

- Session 1: Led by Dr Ravi Khetarpal (Executive Director, APAARI). Focus: Overall food loss and waste, and its implications for food safety, food security, nutrition, livelihoods, and the Sustainable Development Goals (SDGs).
- Session 2: Keynote by Prof. Pramod Pandey. Topic: New strategies on handling waste in animal agriculture systems for controlling greenhouse gas (GHG) emissions. Emphasis on climate dimensions, policy approaches, and science-based, policy-relevant waste management.
- Session 3: Led by Prof. A.K. Dikshit (IIT Bombay). Focus: Management of food waste technological options. Highlighted innovative and scalable technologies to reduce and manage food waste.
- Session 4: Led by Prof. Vinisha Piyate (Executive Director, International Institute of Waste Management, India). Topic: Circular economy approaches to tackle food loss and waste strategy, systems, and solutions. Strong emphasis on cross-country collaboration and connecting policy, innovation, and practice.



APAARI | Asia-Pacific Community of Practice on Food Loss and Waste

Session 5 Proceedings | 30 April 2026

Positioning Session 5 as focusing on a 'critical point in the food value chain', Ms Trivedi highlighted the importance of fruits and vegetables wholesale markets as major hotspots of food loss and waste in Asia. She shared a personal reflection from Thailand: witnessing immense volumes at Asia's largest fruit and vegetable wholesale market, situated near her residence in Bangkok, prompted her to reflect on how food could be better saved and redirected to those in need.

2. Introductory Remarks

Speaker: Dr Ravi Khetarpal, Executive Director, APAARI

Dr Khetarpal provided context on APAARI's three active Communities of Practice:

- The Asia-Pacific Biopesticides and Bio-solutions CoP running for over a year, attracting significant global partners and attention.
- A CoP on Public-Private Partnership (PPP), linked to STDF/WTO project outputs, focusing on PPP principles, gaps in real-world implementation, and promotion of agricultural trade.
- The Food Loss and Waste CoP inspired by influential FAO publications and initiated with the conviction that reducing losses, rather than simply increasing production, can address hunger at scale.

Dr Khetarpal cited research published in Nature indicating that saving just 1% of global crop loss in the field can feed approximately 25 million people. He likened the philosophy of loss reduction to 'grandmother's advice' conserving resources through everyday mindful behaviors. He introduced the keynote speaker, Ms Meeta Punjabi, Food Systems Expert at FAO Regional Office, Bangkok, emphasizing her extensive experience in sustainable agrifood systems transformation, food loss and waste management, and her academic background (PhD in Agricultural Economics, Michigan State University) and work with the World Bank, FAO, IFAD, the Bill & Melinda Gates Foundation, CGIAR, and others.

3. Keynote Presentation

Speaker: Ms Meeta Punjabi, Food Systems Expert, FAO Regional Office, Bangkok



Title: Comparative Assessment of Food Waste Management Practices in Selected Indian Fruit and Vegetable Wholesale Markets

3.1 Study Focus and Rationale

Ms Punjabi presented the findings of a study conducted in India in collaboration with COSAMB/KOSAMB (the National Coordinating Agency of the State Agricultural Marketing Boards). The study focused on fruit and vegetable wholesale markets key distribution nodes that are also epicenters of food waste. The central questions guiding the research were:

- What is the volume and type of food waste generated in these markets?
- How is waste currently managed?
- Are there best practices, and what are their economic and environmental impacts?

The study covered major wholesale markets including Delhi (Azadpur), Mumbai (Vashi), Pune, Bhubaneswar/Hyderabad, Surat, Indore, and Coimbatore[1].

3.2 Global Background on Food Loss and Waste

To orient participants, Ms Punjabi highlighted key global facts:

- Approximately one-third of all food produced globally is lost or wasted.
- The estimated economic value of this loss is around USD 1 trillion annually[2].
- Food loss and waste contributes 8–10% of global GHG emissions, predominantly methane — a gas far more potent than CO₂ in terms of climate impact[2].
- 673 million people remain undernourished globally, even as one-third of food production is wasted[2].

FAO definitions as framing tools:

- Food Loss: Post-harvest losses up to, but not including, the retail stage.
- Food Waste: Losses at the retail and consumer/household level.

Global policy anchors include SDG Target 12.3 (halve per-capita food waste and reduce supply chain losses), the Global Methane Pledge, the COP29 Declaration on reducing methane from organic waste, and the Food Waste Breakthrough initiative. Revised Nationally Determined Contributions (NDCs) now explicitly incorporate food loss and waste as a climate change component[2,3].



3.3 FAO's Regional Strategy

FAO's regional approach to food loss and waste encompasses: awareness raising; supporting countries to develop national policies and strategies; custodianship of the Food Loss Index; identification of hotspots and appropriate interventions; and support for multi-stakeholder approaches[3].

3.4 Food Use Hierarchy

Ms Punjabi emphasized FAO's food use philosophy, which prioritizes actions in the following order:

- Prevention and Reduction the primary goal, so food remains available for human consumption.
- Reuse, Recycling, and Valorization food that cannot be saved for humans should first go to animal feed, then to other useful products.
- Disposal/Landfill only as a last resort.

She underscored that food which can still serve nutritional or productive purposes should not be prematurely channeled into energy conversion or landfill streams[4].

3.5 Wholesale Markets as Food Waste Hotspots

In India, fruit and vegetable wholesale markets have been formally designated as 'bulk waste generators'. The study found that up to one-third of organic waste in landfills originates solely from wholesale markets[1,5].

Study objectives included:

- Estimating volumes and composition of food arrivals and waste.
- Mapping existing food waste management practices.
- Assessing compliance with India's Solid Waste Management Rules.
- Identifying and evaluating technologies and best practices.
- Estimating methane mitigation potential[1].

The prevailing current practice in most markets studied:

- No segregation of organic from dry waste.
- Mixed waste piled and transported by contracted firms to landfills.
- Markets pay contractors for waste removal incurring costs where they could generate revenue[1,5].



3.6 Economic Opportunity

Ms Punjabi highlighted the significant untapped economic potential. As an illustrative example, 100 tons of food waste per day can generate gross revenue of approximately USD 3,500/day (approx. INR 3 lakhs/day) through bio-CNG or bimethanation technologies. In contrast, markets currently spend substantial sums (in crores of INR annually) to dispose of the same waste[1].

3.7 Best Practice: Surat Wholesale Market

The Surat wholesale market was presented as a model case study:

- A 50-ton/day bimethanation (bio-CNG) plant has been operational within the market premises for approximately 10 years under a public-private partnership (PPP) model.
- Under the PPP: the market provides land on lease; the private party invests in and operates the plant.
- Inputs: primarily vegetable market waste, supplemented by organic waste from nearby hotels.
- Output: approximately 2 tons/day of bio-CNG, plus bio-fertilizer.
- Financial viability fully demonstrated, with documented investment and operational costs available.

The market has also established a food processing unit, converting surplus or unsold produce (e.g., tomatoes to pulp) into value-added products. Cumulative impacts include:

- Economic: Revenue from the processing unit and plant; potential income from carbon credits.
- Food and nutrition security: Extended shelf life and reduced losses through processing.
- Environmental: Reduced landfill burden and GHG mitigation.
- Resource use: Bio-fertilizer production supports soil health and the bio-economy[1,5].

3.8 Food Safety, Sanitation, and Hygiene Concerns

Alongside the waste management issues, the study documented alarming sanitation and hygiene conditions in many markets, including:

- Animals (cattle, dogs) freely roaming among fresh produce.
- Cow dung and filth in close proximity to food.



- Strong foul odours and severely unsanitary conditions.
- Reports of harmful synthetic dyes and chemicals being used[1,6].

Ms Punjabi noted that FSSAI has issued a guidance document for fruit and vegetable markets which urgently needs systematic adoption and enforcement. Compliance with Solid Waste Management Rules was found to be very weak, and new 2026 regulations make continuation of existing practices untenable[6,7].

3.9 National-Level Estimates

Based on extrapolations from the case study markets (using conservative estimates), the study estimates:

- Approximately 3.5 million tons of food waste generated annually from wholesale markets across India.
- Significant avoidable methane and CO₂-equivalent emissions.
- Large potential for clean energy generation and carbon credit revenues.
- Substantial bio-fertilizer/compost potential, critical for improving soil organic matter.

Ms Punjabi concluded with a call for investment in upgrading wholesale markets many of which are over 50 years old and improving their layout, logistics, handling infrastructure, sanitation, food safety systems, and circular economy integration[1,5].

4. Panel Discussion

Three panelists provided responses to the keynote, offering complementary perspectives from their respective areas of specialization.

4.1 Panelist 1: Post-harvest Losses and Technology

Dr Manju Bala, Principal Scientist, ICAR–Central Institute of Post-Harvest Engineering and Technology (CIPHET), Ludhiana

4.1.1 India's Fruits and Vegetables Scenario

India is the world's second-largest producer of fruits and vegetables. Over the past decade, fruit production has increased by approximately 30% and vegetable production by 22%, driven by policy support. Major fruits include mango, banana, citrus, and guava; major vegetables include potato,



onion, and tomato. Geographic spread and logistical gaps in storage, transport, and handling contribute to significant post-harvest losses.

4.1.2 Quantifying Losses

A CIPHET study (approximately 2015) on post-harvest losses in banana, guava, mango, tomato, and green peas found that wholesale-level losses alone exceeded 1%, with total post-harvest losses (farm to retail) ranging from 7–16% [8]. A subsequent NABCONS study observed some reduction in percentage losses; however, monetary losses increased due to the higher value of produce, with losses valued at approximately USD 5 billion [9].

4.1.3 Key Factors Reducing Losses

- Strengthening of cold chain infrastructure.
- Improved supply chains, packaging, and handling practices.
- Adoption of post-harvest technologies.
- Supportive government policies.

4.1.4 Low Processing Rates and Future Outlook

Processing of fruits and vegetables in India remains below 5% significantly lower than other Asia-Pacific countries. With rising urbanization and export demands, processing and value addition are projected to grow at a CAGR of 5.1% by 2030.

4.1.5 CIPHET Technologies and Circular Economy Work

CIPHET's current work spans:

- Sensor-based monitoring, image-based sorting and grading, improved packaging, and freshness detection.
- Bioactive compound extraction (e.g., hesperidin from immature citrus drop-offs).
- Development of bio-thermal coal from paddy/wheat straw combined with mushroom mycelium.
- Zero-waste pea processing: converting pea hulls (30–50% of pea volume, often wasted or used as animal feed) into dietary fiber-rich and protein-rich fractions; used to create value-added products such as pasta.



- Capacity building: CSR-funded awareness programs in Ludhiana training farmers, students, and stakeholders on household composting, vermicomposting, and bio-energy production[10].

4.2 Panelist 2: Blockchain, IoT, and Data Gaps

Dr Anupama Panghal, Associate Professor, National Institute of Food Technology, Entrepreneurship and Management (NIFTEM), Sonipat, India

4.2.1 Information Asymmetry as a Root Cause

Dr Panghal presented information asymmetry the absence of timely, accurate data across the supply chain as a fundamental driver of food loss and waste. She described 'blind handovers' at each stage:

- Farmers often lack knowledge of market demand at harvest time.
- Traders have limited real-time information on product condition in transit.
- Wholesalers cannot reliably anticipate rejection rates.

Example: A tomato farmer in Nashik sends produce to Mumbai without awareness of a market glut, resulting in a price crash and avoidable waste. A review of over 187 academic publications confirmed information asymmetry as a widely cited root cause of food loss[11].

4.2.2 Research: Blockchain Traceability Proof of Concept

Dr Panghal described a two-year project funded by India's Ministry of Food Processing, which developed and tested a blockchain-based traceability system for honey and coriander powder in partnership with CropIn (technology provider)[12].

Key findings:

- Internet connectivity: Limited connectivity at farm level (Dehradun pilot) hampered real-time data entry.
- Industry reluctance: Companies were hesitant to disclose all traceability points or bear additional costs without visible benefits.
- Consumer demand as the decisive factor: Companies were more willing to adopt blockchain when consumers demonstrated willingness to pay a premium for traceable products more so than policy mandates alone.

4.2.3 Applying Blockchain/IoT in Wholesale Markets



Dr Panghal proposed that wholesale markets could serve as practical starting points for blockchain traceability implementation, building on India's existing e-NAM (Electronic National Agricultural Market) infrastructure. Specific suggestions:

- Replace manual data entry with IoT-based sensor recording at market entry points.
- Costs should be borne by APMC/market authorities, not individual farmers.
- Edge computing can address connectivity limitations local devices store data offline and sync it when brief internet windows are available[13].

4.3 Panelist 3: Holistic Management, Capacity Building, and Business Models

Dr Vijay Yadav Tokala, Horticulture and Post-harvest Specialist, Postharvest Education Foundation, and International Consultant

4.3.1 Critical Control Points Across the Chain

Dr Tokala emphasized that losses accumulate throughout the chain from harvest through to consumption and that poor practices at one stage are carried forward to the next. Wholesale markets are strategic intervention points because, even in smallholder-dominated systems, they aggregate sufficient volume to pilot and scale innovations.

4.3.2 Capacity Building Gap

Despite the availability of technologies and research, adoption remains low for two main reasons:

- Stakeholders are not sufficiently aware of available solutions.
- Stakeholders require clear cost-benefit evidence before committing to adoption.

Effective extension, training, and knowledge transfer remain critically underdeveloped components of the food loss and waste response.

4.3.3 Commodity Systems Assessment Methodology (CSAM)

Dr Tokala described the CSAM, a 24-step methodology that maps the entire post-harvest system from production to the end of the supply chain[14].

Key features:

- Identifies region- and commodity-specific loss points, avoiding generic, one-size-fits-all solutions.



- Classifies solutions into three categories: advocacy/policy, technology, and knowledge transfer.
- For each solution, recommends a simple cost-benefit analysis comparing 'with technology' and 'without technology' scenarios to generate evidence for farmer and private-sector uptake.

4.3.4 Postharvest Training and Services Center (PTSC) Model

Dr Tokala proposed the PTSC as a dual-purpose model combining a training center and a service center offering shared access to technologies on a pay-per-use basis (e.g., farmers pay per crate to use a solar-powered cold room). Evidence from pilot applications in Kenya and Rwanda indicates the model can have a long-term positive impact on small-scale producers[15].

A freely downloadable self-study e-learning manual produced by the Postharvest Education Foundation covers post-harvest loss assessment, practical technologies, and training methodologies, with a focus on small-scale producers[16].

5. Question and Answer Session

A number of questions were received via the chat box during the session. Others have been documented below for follow-up responses. Questions are presented in full, as submitted.

5.1 Methane Emission Calculations

Q: Was a methane emission calculation conducted in the India wholesale markets study? If yes, could you elaborate on how this was done?

— *Mr Abhishek Khadka*

A: Yes, methane emission calculations were conducted as part of the study, carried out by an environment expert on the team using standard, established tools. The specific tools and methodology can be discussed in more detail with interested participants offline, as this is a technical area that merits dedicated discussion beyond the scope of the session.

— *Dr Meeta Punjabi*

5.2 Has the One-Third Loss Figure Changed Since 1992?



Q: Ms Punjabi explained the current circumstances very well. When I began working in this field in 1992, post-harvest losses were cited at approximately one-third of production. Is this figure still the same?

— *Dr Abdul Rahim Khan*

A: The combined figure of roughly one-third still holds, but the composition has been refined. FAO now distinguishes: food loss at approximately 13% (across the supply chain from post-harvest to before retail), and food waste at approximately 19–20% (at retail, food service, and household/consumer levels). Together, these still represent approximately one-third of global food production. Notably, consumer-level waste – food that sits uneaten in refrigerators, is discarded at restaurants, buffets, and social events – constitutes a very substantial share. This has given rise to global movements linking surplus food to food banks and redistribution networks.

— *Dr Meeta Punjabi*

5.3 Funding for Waste-to-Wealth Technologies

Q: An entrepreneur in Ludhiana has developed a machine capable of processing all types of waste – segregated or not with a capacity of 1 ton/day and a cost of approximately INR 1 crore. Funding is a major challenge. Can FAO provide support to such entrepreneurs?

— *Dr Manju Bala (on behalf of an entrepreneur from Ludhiana)*

A: FAO is primarily a technical agency, and direct funding to individual entrepreneurs is not within its typical mandate, unless embedded in specific project frameworks. However, India has a growing ecosystem of green funds and startup support schemes that may be more appropriate avenues. FAO can offer technical guidance and help navigate options. A separate follow-up discussion would be beneficial.

— *Dr Meeta Punjabi*

5.4 Tomato Waste Valorization: Scale and Progress



Q: What is the current potential and progress of tomato waste valorization in India? Is it actually being implemented at scale, or is it still mostly at the research stage?

— *Ms Shilpa (PhD Researcher, IIT Bombay, working on tomato waste valorization)*

A: Tomato has among the highest post-harvest losses of any vegetable in India. Tomato pulping remains the primary valorization pathway and is practiced at some scale; however, a key constraint is that processors require varieties with specific lycopene content and physical traits, and many fresh-market varieties are not suitable for processing. Advanced valorization pathways such as extraction of seed oil and other bioactive compounds from tomato waste are largely still at the laboratory or pilot scale and have not yet been widely commercialized. Scale-up requires both technological advancement and market development.

— *Dr Manju Bala*

5.5 India's Dried Onion Sector and Drying Technologies

Q: India is a major producer and exporter of dried onion. What is being done in terms of drying technologies and innovation?

— *Mr Joseph (PhD Researcher, Stellenbosch University, Cape Town)*

A: Drying is indeed a key technology for the onion sector and more broadly. Multiple techniques are in use including sun drying, solar drying, and microwave drying and they have high potential across a wide range of fruits and vegetables. These are relatively low-cost and low-energy technologies. As Ms Punjabi highlighted, dehydration/drying is one of the most underrated post-harvest technologies in the Indian context, applicable from MSME scale up to large industrial operations, and offers significant potential for reducing losses and adding value.

— *Dr Manju Bala*

5.6 Pineapple Waste Valorization (Documented for Follow-Up)



Question (submitted via chat; to be answered offline): Is there scope to convert waste pineapple (peel, crown, stem) into value-added products, particularly through enzyme extraction?

This question was documented and will be directed to the appropriate speaker for a follow-up written response.

5.7 Cost of Production and Scale of Valorization Research

Question (submitted via chat; to be answered offline): Was the cost of production calculated in the valorization studies? Were these conducted at pilot scale or commercial scale? (Note: cost of production typically has an inverse relationship with scale.)

This question was documented and will be directed to the appropriate speaker for a follow-up written response.

5.8 Institutional Transformation Towards Circular Food Systems

Question (submitted via chat; to be answered offline): Framing the food system as circular clearly has positive implications for reducing food loss and waste. This has significant implications for institutions and management structures built around the linear food system model. What is your experience — are institutions actively transforming, or is it still early days?

This question was documented and will be directed to the appropriate speaker for a follow-up written response.

5.9 Additional Remarks by Ms Meeta Punjabi (Supplementary)

In the course of Q&A responses, Ms Punjabi provided several additional reflections of significance:

- Value Chain Connectivity: Even basic value chain activities — such as organizing visits for farmers to wholesale markets and facilitating direct introductions to wholesalers — can significantly improve information flow and reduce avoidable losses.
- Dehydration as an Underrated Technology: Drying and dehydration technologies have broad applicability, from MSME to industrial scale, with relatively low energy and capital requirements, and represent a major underexplored opportunity.
- Cold Chain 'White Elephants': Large cold storage investments can become underutilized assets if end markets are unwilling to bear the added costs. For most markets without export



APAARI | Asia-Pacific Community of Practice on Food Loss and Waste

Session 5 Proceedings | 30 April 2026

orientation, low-cost handling improvements, better packaging, and low-energy technologies offer better return on investment than high-capital cold chain infrastructure.

6. Synthesis and Closing Remarks

6.1 Synthesis by Dr Ravi Khetarpal

Dr Khetarpal commended Ms Punjabi for presenting a complex subject in an accessible and comprehensive manner, and praised the panelists for the complementary operational, technological, data-driven, and business model perspectives they contributed. He highlighted the following key threads emerging from the session:

- The essential shift from linear to circular food systems — from production to consumption to valorization of waste resources.
- The need for a fundamental mindset change: from 'waste is worthless' to 'waste is wealth'.
- The value of blockchain and digital tools for enhancing traceability and transparency across the food supply chain.
- The critical role of capacity building and knowledge transfer, including resources such as the Postharvest Education Foundation's self-study e-learning manual.

6.2 Vote of Thanks

Ms Dipika Trivedi expressed sincere appreciation to:

- Dr. Meeta Punjabi — Keynote Speaker
- Dr Manju Bala — Panelist 1
- Dr Anupama Panghal — Panelist 2
- Dr Vijay Yadav Tokala — Panelist 3
- Dr Ravi Khetarpal — for continuous leadership and motivation
- All 100+ participants — for active and sustained engagement

Ms Dipika Trivedi reiterated that food loss and waste is a shared responsibility not merely a technical challenge and that experts and citizens alike must act collectively to reduce losses and move towards a hunger-free world.

6.3 Way Forward

APAARI intends to use the CoP as:



APAARI | Asia-Pacific Community of Practice on Food Loss and Waste

Session 5 Proceedings | 30 April 2026

- A platform for developing joint projects and collaborative initiatives.
- A network for scoping and implementing practical, evidence-based solutions on food loss and waste across the Asia-Pacific region.

Questions that could not be addressed live during the session will be routed to the appropriate speakers, and written responses will be shared with all participants. Full proceedings of the session will be prepared and distributed.

7. Action Items

#	Action	Responsible
1	Prepare written proceedings of the session (including all Q&A, questions received but not answered live, and full documentation of discussions) and share with all participants.	<i>Ms Dipika Trivedi</i>
2	Share Ms Meeta Punjabi's CV and list of projects with all session participants.	<i>Dr Ravi Khetarpal</i>
3	Ensure all participants who submitted questions receive responses by directing their questions to the appropriate speakers.	<i>Dr Ravi Khetarpal</i>
4	Conduct follow-up offline discussion on tools and methodologies used for methane emission calculations from food waste in the India wholesale markets study, with interested participants.	<i>Ms Meeta Punjabi</i>

8. Speaker and Panelist Profiles

Keynote Speaker

- **Dr. Meeta Punjabi** — Food Systems Expert, FAO Regional Office, Bangkok. Specializes in sustainable agrifood systems transformation, food loss and waste management. PhD in Agricultural Economics, Michigan State University. Extensive experience with the World Bank, FAO, IFAD, BMGF, and CGIAR.

Panelists



APAARI | Asia-Pacific Community of Practice on Food Loss and Waste

Session 5 Proceedings | 30 April 2026

- **Dr Manju Bala** — Principal Scientist, ICAR–Central Institute of Post-Harvest Engineering and Technology (CIPHET), Ludhiana, India. Expert in biochemistry and post-harvest engineering, food quality, storage systems, and value addition.
- **Dr Anupama Panghal** — Associate Professor, National Institute of Food Technology, Entrepreneurship and Management (NIFTEM), Sonipat, India. Specializes in food supply chain and agribusiness management, circular economy, blockchain traceability, IoT, and green logistics.
- **Dr Vijay Yadav Tokala** — Horticulture and Post-harvest Specialist, Postharvest Education Foundation, and International Consultant. Over a decade of experience in cold chain management, post-harvest loss reduction, and capacity building across 30+ countries.

Session Host

- **Ms Dipika Trivedi (Ph.D)** — Senior Technical and Administrative Associate, APAARI; Host and Coordinator of the CoP on Food Loss and Waste.

APAARI Leadership

- **Dr Ravi Khetarpal** — Executive Director, APAARI. Provided opening remarks and session synthesis.



References

- [1] Punjabi, M., & COSAMB/KOSAMB. (2026). *Comparative Assessment of Food Waste Management Practices in Selected Indian Fruit and Vegetable Wholesale Markets*. FAO Regional Office for Asia and the Pacific, Bangkok.
- [2] Food and Agriculture Organization. (2024). *The State of Food and Agriculture (SOFA): Food Loss and Waste*.
- [3] Food and Agriculture Organization. *Regional Strategy on Food Loss and Waste Reduction*.
- [4] Food and Agriculture Organization. *Food Recovery and Food Waste Hierarchy Framework*.
- [5] Government of India & Market-Level Food Waste Assessments in Indian Wholesale Markets (as presented during CoP Session 5).
- [6] Food Safety and Standards Authority of India. *Guidance Document for Fruit and Vegetable Markets*.
- [7] Government of India. *Solid Waste Management Rules and Organic Waste Management Regulations*.
- [8] ICAR-Central Institute of Post-Harvest Engineering and Technology. (2015). *Assessment of Quantitative Harvest and Post-Harvest Losses of Major Crops and Commodities in India*. Ludhiana, India.
- [9] NABARD Consultancy Services. (Year if available). *Study on Post-Harvest Losses and Supply Chain Improvements in Fruits and Vegetables in India*.
- [10] ICAR-Central Institute of Post-Harvest Engineering and Technology. CSR outreach and awareness initiatives on composting, vermicomposting and bio-energy generation, Ludhiana.
- [11] Panghal, A., et al. Literature review on information asymmetry and food loss in agri-food supply chains (referenced during panel presentation).
- [12] Ministry of Food Processing Industries (MoFPI), Government of India. Blockchain traceability proof-of-concept project for honey and coriander powder in partnership with [CropIn](#).
- [13] Edge computing applications in agricultural IoT and digital traceability systems (technical concept referenced during panel discussion).



APAARI | Asia-Pacific Community of Practice on Food Loss and Waste

Session 5 Proceedings | 30 April 2026

- [14] Postharvest Education Foundation. *Commodity Systems Assessment Methodology (CSAM) Training Framework.*
- [15] Postharvest Education Foundation. PTSC pilot implementation experiences in Kenya and Rwanda.
- [16] Postharvest Education Foundation. *Self-Study E-learning Manual on Postharvest Loss Assessment and Management.*