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Innovating to save on wastages in agri-value chains: global and Indian experience

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ABSTRACT: Globally, about one-third of food produced for human consumption every year (approximately 1.3 billion tonnes) is either lost or wasted while moving from farm to fork. In developing countries, like India, losses occur more from poor supply chains because of poor infrastructure, while in developed countries it is wasted at the retail and consumer end because of higher standards or sheer neglect. Apart from leading to less food available for all, food loss and wastage entail loss of precious scarce resources – water, land, energy, labour, capital – and adversely affect the environment with greater greenhouse gas emissions, leading to global warming and climate change. Both sets of countries need to do a lot to transform this situation, and save precious natural resources. It is much more cost-effective and sustainable to save the food already produced rather than to keep producing more and more to rot. This can be done by building strong, efficient, compressed and reliable value chains in developing countries through investment in infrastructure, institutional changes and innovation in technology, products, practices and policies. Particularly, the role of packaging at the farm level before moving the produce to processing units/wholesalers/retailers needs to be recognised in a country like India where packaging is minimal and the absence thereof causes qualitative and quantitative food losses. The situation in industrialised countries requires better production management, de-emphasising appearance standards, more explanatory date marking systems, and raising awareness among consumers about better buying, cooking and recycling methods. This can save food wastages at the retail and consumer levels.

Keywords: innovation, services, policy, handling and storage solutions

I am going to give a brief overview of the global situation, and then focus more on South and South East Asia. As the Food and Agriculture Organization of the United Nations (FAO) has been telling us, almost one-third of the food we produce (1.3 billion tonnes) is being either lost or wasted. The value of that is US$680 billion in industrialised countries, and roughly US$310 billion in the developing world. If only one-fourth of that were to be saved we could feed roughly 870 million people who are underfed and going hungry.

Also, if we can save food a little better, that should give some people a little higher income, with better prices to farmers and lower prices to consumers, especially in the part of the world where I come from, South Asia. On the whole, that will be true for Africa, too.

This is an edited transcript of the presentation, with some of the powerpoint slides shown.

	Agricultural production	Postharvest handling and storage	Processing and packaging	Distribution	Consumption
Cereals	6%	7%	3.50%	2%	3%
roots & tubers	6%	19%	10%	11%	3%
oilseeds and pulses	7%	12%	8%	2%	1%
fruits and vegetables	15%	9%	25%	10%	7%
Meat	5.1%	0.3%	5%	7%	4%
fish and seafood	8.2%	6%	9%	15%	2%
milk	3.5%	6%	2%	10%	1%

	Agricultural production	Postharvest handling and storage	Processing and packaging	Distribution: Supermarket Retail	Consumption
cereals	2%	2%	0.5%, 10%	2%	27%
roots and tubers	20%	10%	15%	7%	30%
oilseeds and pulses	12%	0%	5%	1%	4%
fruits and vegetables	20%	4%	2%	12%	28%
meat	3.50%	1.00%	5%	4%	11%
fish and seafood	12%	0.50%	6%	9%	33%
milk	3.50%	0.50%	1.20%	0.50%	15%

Figure 1. Estimated or assumed waste percentages for each commodity group in each step of the food supply chain, in South and South East Asia (top), and in North America and Oceania (below). *Source:* FAO (2011).

We all know food loss is mainly accidental. No-one wants spillage or spoilage to happen, but it takes place in developing countries because people do not have the resources to prevent it. On the other hand, food *waste* (left to spoil, or discarded) is more or less intentional. That is what is happening in supermarkets and even in our fridges when food is left too long, for whatever reasons. In industrialised countries, over 40% of food is wasted.

In South and South East Asia where there is still considerable poverty – in fact the largest concentration of poverty globally – food losses are highest post-harvest (Figure 1) in handling and storage, and minimal at the consumption end of the supply chain because people are so poor they do not want to waste anything. That is an important observation when considering innovations where interventions need to be made.

In North America and Oceania, much more of the loss takes place at the consumption end of the chain (Figure 1), in fridges or superstores, amounting to

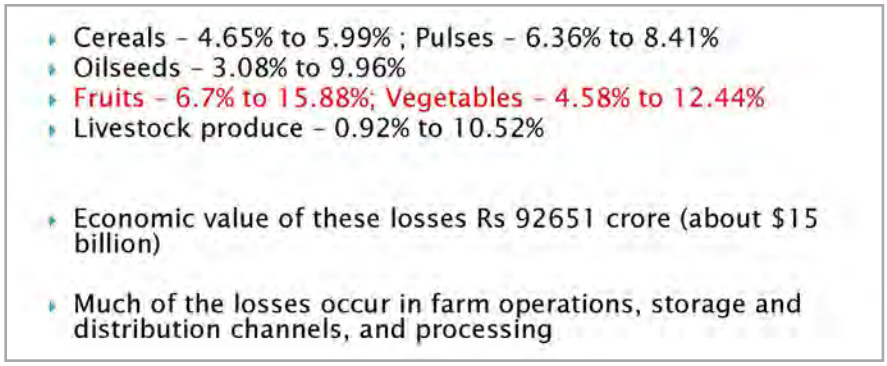

Figure 2. Food loss estimates for India in 2013–14. *Source:* ICAR-CIPHET (2015).

US$630 billion overall. To solve that is a tougher challenge. Interventions here need to be directed at supermarkets and consumers rather than post-harvest.

I come from India, which annually achieves about 800–900 million tonnes of agricultural produce overall, and still has the largest number of poor in the world despite the fact that our country is growing at 7–8% per annum. Our institute, ICRIER, estimates food losses for India, and while they differ from the global estimates they are still substantial in fruit and vegetables (Figure 2).

Causes and innovative solutions

Farm equipment

In developing (low-income) countries, food losses begin with the lack of proper farm equipment (harvesters, threshers, etc.), and that is where innovations would be needed. In a country like India, 85% of farmers are smallholders; they own less than two hectares each, and about 66% own less than one hectare. Even if we can mechanise farming at that scale, with the best machines in the world, how could they afford to use them? When governments offer farmers a subsidy on capital to buy equipment, they still cannot afford to use that machinery optimally, and that leads to over-capitalisation and high cultivation costs. In fact, buying a tractor becomes a problem because they still have to pay the interest.

Here is the innovation that I want to talk about for farm machinery. If we can have Uber taxis in urban areas, why not have Uber tractors, Uber harvest combines, Uber threshers? We have to think outside the box! That is the type of innovation we need. The farmer is willing to pay for a service. If the government wants to give out farm subsidies, let them not be on the price of the machinery, because the manufacturer normally will raise the price to capture all that subsidy. Instead, give the subsidy directly to the farmer's bank account and let him choose the service provider who gives best service at the lowest cost. This is where we need innovation – in policy and in practice. Offering access to these good machines that can save on wastage means the farmer saves on the wastage and that helps him afford the service. That is the type of innovation I am talking about.

Figure 3. Proper packaging can reduce losses in transportation, and wastage.

Packaging and transport

Another cause of food loss and waste is in packaging, which is another challenge for a smallholder. For example, the normal practice for onions on the farm is to leave them loose (Figure 3). The farmers cannot transport loose onions to the markets which may be 20–30 km away. One response in a smallholder economy is aggregation or clustering. This is an innovation in institutional engineering, and India has already demonstrated success in this kind of innovation in the milk supply chain.

Farmers have surplus milk – maybe two litres, three litres, half a litre – and now they have developed aggregation at farm level. Producers with small volumes of surplus milk take it to a central point where each lot is tested for fat content, using a special machine, and paid for on the basis of the fat content. This innovation has been revolutionary in country areas.

India in 1951 was producing only 17 million tonnes of milk per year, whereas the US was producing 53 million tonnes. Today, India produces more than 150 million tonnes annually, and is the world's largest producer (the US currently produces 92–93 million tonnes). Milk production in India is all done by smallholders. Revolution can happen – you need institutional engineering!

This is the type of innovation that is needed in fruit and vegetables, which are not one commodity but 20 commodities – and that is the challenge. We need to start somewhere. When I worked with IFPRI in Indonesia, we visited a

one-hectare farm. This smallholder was part of a cluster of 30 whose produce was collected at his farm, where it was graded, sorted, washed, packaged and barcoded for traceability so the buyer could know where it had come from. The big retailer would arrive in the evening and take that entire produce. The next day the retailer sent their next order for produce, so the farmers knew how much of what commodity they needed to supply the next day. We can come up with this kind of innovation in India.

Market information

The whole system of production and food supply needs to be turned upside down, I believe. Instead of farm to fork it should be plate to plough. Food supply systems should be demand-driven. Farmers should know what the consumer is looking for, what quality, what quantity, so that he can avoid the gluts.

Normally, farmers look at last year's price when deciding what to produce this year. Here is an example. Onions in India are in daily use and there is no substitute for their pungency. Onions have destabilised and unseated the government because the onion prices last year went right up, very high. As a result, this year every farmer was growing onions. Last year he was receiving 30 rupees/kg; this year he can only sell onions at 5 kg/rupee. Onions are being thrown away on the road, in the field, all wasted, all because the farmer could not see what the price would be this year because there is no futures market in onions. A solution – another innovation – would be to bring in a futures market so the farmer can make his planting decisions by looking at the futures prices, not at the past prices. That would be one way to bring some symmetry between a demand-driven system and what the supply can be.

Storage infrastructure

Lack of proper storage infrastructure is another cause of food loss in developing countries – and again the classic example comes from onions. Onions are harvested and then have to be kept for five months to feed us before the next crop comes in. For storage locally, they are put onto a bamboo and cement platform, and tied together. If the weather is hot – and in India the temperature goes to 40–45°C – the onions lose 30% of their weight. If it rains, the onions sprout. Losses like these in traditional storage can be 25–30%, but modernised cold storages at 4°C are available, at a cost of 1 rupee/kg/month, for five months. Onions can be bought from the farmer at 10 rupees, and sold at 15 or 20 rupees, making a profit and stabilising prices. The technology is there, but government policy is interfering with its use. They say: 'You are hoarding, and we will not allow the private sector to hoard. This is an essential commodity.' So what do you do? We need another innovation, first to change the policy and then to bring in the new technology and reduce the losses from 30% to 3% only.

Levels of processing

In considering processing, look again at fresh onions – a classic case which I am using time and time again because it is relevant for India, Bangladesh, Pakistan, Afghanistan, all that belt. If you dehydrate onions you lift their shelf life to two years; 85% of an onion is water. That technology is readily available, so levels of processing that would increase the shelf life and reduce the loss, would be perfectly possible.

Figure 4. Better pushcarts for retail can reduce losses.

Retailing

Finally, the retailing near the end of the supply chain for fruit and vegetables (Figure 4). In India, some small retailers use pushcarts. You could design a pushcart with a solar panel on top, and a little storage container. The retailers cannot sell by night, but they still have to keep the produce fresh. Where can they keep it? They do not have big enough refrigerators at home to keep all this food, and at daytime temperatures of 40–45°C the loss in quality is tremendous from day to day. A simple innovation like a powered storage pushcart could save a lot of loss at the retail level. For cold storage, by the way, the cost of solar panel-produced power has come down below the cost of power from burning coal and the cost of electricity from the grid. Solar power generation on farmers' fields could enable cold storages in rural areas, drastically reducing the losses. This a great product that is already available, and needs to be even more so.

Industrialised countries

Professor Louise Fresco, in the Sir John Crawford address, has told us that Coles supermarkets will have electronic chips to tell them what they need to order at what time. I wish our fridges also had chips to tell us: 'Now this food is one week old and needs to be eaten, otherwise it will go stale.'

Here is a brief outline of some causes of food loss and waste in high-income countries, and some interventions that could help reduce it.

Causes and possible innovative solutions

- **Cause**: Production greater than demand; surplus sold cheap, e.g. for animal feed.
  Solution: Communication and cooperation among farmers to prevent the risk of excess production.
- **Cause**: High 'appearance quality standards' for fresh produce in shape, weight, size.

Solution: De-emphasise 'appearance quality standards'; conduct consumer surveys to better understand consumer preferences on food appearance; shorten supply chains so there are fewer quality and standards checks.

- **Cause**: Failure to comply with food safety standards.
  Solution: Adhere to food safety standards to avoid risk of rejection.
- **Cause**: Rigid/misunderstood date marking with Best before/Use by dates.
  Solution: Improve the accuracy of date marking rules, such as labelling it "safe to consume during this (longer) period", and improving consumer understanding of the labels' meanings.

So many innovations are possible, and you in the industrialised countries will know about them better than I can.

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