



Standing Committee
for Economic and Commercial Cooperation
of the Organization of Islamic Cooperation (COMCEC)

Overview of the Post-harvest Losses in the World and the OIC Member Countries

Professor Keith Tomlins (co-authors Professor Ben Bennett, Dr Tanya Stathers, John Linton, Dr Gideon E Onumah, Claire Coote, Uli Kleih, Jan Priebe and Dr Aurélie Bechoff)

Natural Resources Institute, University of Greenwich, UK

Structure of Presentation

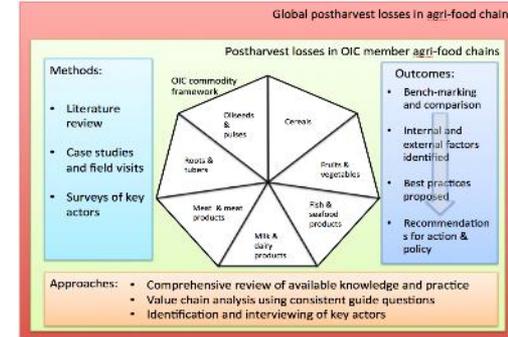
- Definition of postharvest losses (1 min)
- Conceptual framework (2 mins)
- Methods (2 mins)
 - Literature review, online survey, case studies
- Summary of findings (15 mins)
 - Global
 - Postharvest research specific
 - Commodity specific
 - Common challenges
 - Common solutions
 - Best practices

Definition of postharvest losses

- Defined by COMCEC as **food damage or degradation of food during different stages of the food supply chain**. We interpret this as those losses that are incurred between the farm-gate and prior to retail and consumption.
- Definition can vary according to what is referred to as **quantitative losses** (weight loss) and **qualitative loss** (insect damage) etc.



Conceptual Framework



- Takes into account a number of issues
- Quantitative and qualitative losses where known
- **Location of losses in the value chain** (further complexity)
- **Cumulative losses** (10% loss early in value chain can increase as the product progresses towards the consumer)
- **Estimating losses** as opposed to direct measurements which are few
- Difference between **physical, economic and quality/nutrition losses**. Food safety and environmental impacts
- **Gender impacts**

Methods



- **Brief Literature review** – 7 commodity groups x 57 countries
 - Based on available literature
- **Online survey** – 7 commodity groups x 57 countries
 - Used survey monkey to contact 400 experts globally who may have expertise in OIC Member Countries
- **Case study** – 7 specific commodities and one country for each (three involved field visits and 4 were desk based studies)



Products and countries for Literature Review and Online Survey

- **Products** - Cereals, Roots & tubers, Oilseeds & Pulses, Fruit & Vegetables, Meat & Meat products, Milk & Dairy, Fish & Seafood

| Arab Group | Asian Group | African Group |
|----------------------|-----------------|---------------|
| Algeria | Afghanistan | Benin |
| Bahrain | Albania | Burkina Faso |
| Comoros | Azerbaijan | Cameroon |
| Djibouti | Bangladesh | Chad |
| | Brunei | |
| Egypt | Darussalam | Cote d'Ivoire |
| Iraq | Indonesia | Gabon |
| Jordan | Iran | Gambia |
| Kuwait | Kazakhstan | Guinea |
| Lebanon | Kyrgyz Republic | Guinea-Bissau |
| Libya | Malaysia | Mali |
| Mauritania | Maldives | Mozambique |
| Morocco | Pakistan | Niger |
| Oman | Tajikistan | Nigeria |
| Palestine | Turkey | Senegal |
| Qatar | Turkmenistan | Sierra Leone |
| Saudi Arabia | Uzbekistan | Togo |
| Somalia | Guyana* | Uganda |
| Sudan | Suriname * | |
| Syria | | |
| Tunisia | | |
| United Arab Emirates | | |
| Yemen | | |

Case studies – field and desk based

| Commodity group | Commodity focus | Country and Regional Grouping | | |
|----------------------|---------------------------|-------------------------------|-------|---------|
| | | Asian | Arab | African |
| Cereals | Maize | | Egypt | |
| Roots & tubers | Cassava | | | Nigeria |
| Oilseeds & Pulses | Groundnuts | | | Senegal |
| Fruit & Vegetables | Tomato | Bangladesh* | | |
| Meat & Meat products | Sheep and goats | | Oman* | |
| Milk & Dairy | Milk | | | Uganda |
| Fish & Seafood | Artisanal coastal fishery | Indonesia* | | |

- Field visits to Bangladesh, Oman and Indonesia

Summary of findings (Globally)

Postharvest Physical losses

| Postharvest loss (physical) | Global | Literature review | Online survey | Case/Field study |
|-----------------------------|--------|-------------------|---------------|------------------|
| Cereals | 12-15% | 9-31% | 10-25% | 16-48% |
| Root and Tuber crops | 22-34% | 7-50% | 12-40% | 7-25% |
| Oilseeds and Pulses | 10-18% | no data | no data | 14% |
| Fruit and Vegetables | 15-38% | 10-60% | 5-65% | 3-40% |
| Meat and Meat products | 11-12% | 6% | no data | 25-40% |
| Milk and Dairy products | 2-19% | 2-27% | 30% | 6-21% |
| Fish and Seafood products | 16-25% | no data | 50% | 3-50% |

Global losses are Authors own calculations taken from Gustavsson et al., 2011

Summary of postharvest economic losses

| Postharvest loss | Global | Literature review | Case/Field study |
|---------------------------|--|--|--|
| Cereals | NA | US\$4 billion per year (sub-Saharan Africa). | USD\$ 1.16 billion / annum (Egypt) |
| Root and Tuber crops | NA | USD20 million (South-West Nigeria) to Euro686 million (whole of Nigeria) | NA |
| Oilseeds and Pulses | NA | | US\$80 million per year (Senegal) |
| Fruit and Vegetables | NA | 25% loss in value of plantain (Uganda) | US\$7.7 to US\$20.6 million per annum (Bangladesh) |
| Meat and Meat products | NA | 6% (Turkey) | US\$31 million per annum or 49% (Oman) |
| Milk and Dairy products | US\$ 2.54 billion (Sub-Saharan Africa) | US\$56 million (Kenya + Uganda + Tanzania), US\$ 23 (Uganda) US\$1.7 billion (Pakistan) | US\$25 to US\$44 billion per annum (Uganda) |
| Fish and Seafood Products | NA | NA | US\$4.8 billion per year (Indonesia) |

Quality and nutrition losses

- The least is reported or known
- For cereals, the 'Missing Food' study estimated that 13.5% of the grain produced across sub-Saharan Africa is lost postharvest. Equivalent to US\$4 billion per year or the annual **caloric requirement of 48 million people** (World Bank, NRI, FAO, 2011).
- Biofortified sweet potato – **70% of vitamin A lost after two months storage** (Bechoff et al., 2010)



Lessons



- Already some useful information from OIC Member Countries and some excellent examples of best practice (more later).
- The **bulk of the information** obtained from the literature review, online survey and case/desk studies concerned the **physical losses**. Probably because physical losses are easier to estimate either by direct measurement or by visual inspection.
- **Wide variation** is reported losses
- **Much less was reported concerning the economic losses** and the amounts will differ markedly from one value chain for another, even for the same product and commodity. Not always known how the costs were estimated. An area of research.
- The **least known was regarding the quality/nutrition losses**. Critical for countries suffering from nutrition deficiency, particularly calories and vitamins.

Postharvest research specific

- Research on postharvest losses is **sparse and geographically scattered**. Some commodities have a greater coverage than others (e.g. artisanal fisheries and maize are far more researched than cattle or bananas). **Some OIC Member Countries and regions have seen much more postharvest loss research and practice than others** (e.g., Africa Group has seen a good amount of activities in some commodities, Asian and Arab Groups, with some notable exceptions, has seen very little research and analysis).
- **More research is available in lower income countries** than in higher income countries. This may indicate that donors have been driving postharvest loss research in these countries.
- The range of losses experienced across the literature varies substantially. Irshad and Baloch (1985) for example, found storage losses of weight for wheat in Pakistan varied from 3.5% to 25%. If all postharvest stages have the same degree of variability, this explains the high level of uncertainty and scepticism about total postharvest loss statistics.

Commodity specific

Grains:

- Particular challenges with **drying and storage**, especially related to pests in store.
- Small grains (e.g., sorghum and millet) often have **higher postharvest losses than larger grains** (e.g., wheat and maize).
- **Innovations**: improved dryers, mechanised threshing and shelling, training, improved on-farm stores and use of hermetic storage bags and sell as collective marketing by farmers.



Roots and tubers:

- Cassava, which is **highly perishable**, has very high losses, particularly in countries where infrastructure to get product from field to factory is inadequate (e.g., Nigeria). Losses seem to be high for other root crops such as sweet potato and yams, but research is very limited.
- **Peeling** (cassava), **storage** (yams) and **marketing** (sweet potato) were the highest postharvest loss elements reported by experts. Starch degradation known to be high for cassava, but was not reported in the survey.
- **Innovations** - Improved infrastructure, more efficient delivery of roots and tubers to processing points, simpler small scale drying.



Oilseeds and pulses

- Limited information..
- For most pulses and grain legumes, recommendations that apply to grains are common to this commodity group. **Quality and contamination issues are particularly important.**
- The highest reported losses were in storage (30-60%), largely due to the impact of **storage pests**. Project to improve stores and storage for this commodity group are clearly needed.
- Innovations – as for cereals



Fruit and vegetables.

- High perishability and ease of damage means that **postharvest losses can be high**. Emergence of new types of markets (e.g., supermarkets) and relatively high value mitigates these losses to some extent. Formal markets with high quality standards reduces losses (e.g. Turkey for green beans, Albania for watermelons).
- Some groups of fruit and vegetables have received much more research than others. E.g., tomatoes and mangoes well researched, dates little.
- **Innovations** - Improved **handling and packaging**; investment in **cold chain infrastructure**. **Price incentives** to improve quality and reduce losses and targeting medium to large sized processing firms as drivers of improved practice (Tomatoes and Bangladesh).



Meat and meat products

- Focus of research has been on the external or environmental impacts. **Very little research exists in any livestock sub-sector, especially in the small-holder sectors.**
- Strategies to address **meat by-products such as offal, skins and blood**, are commonly absent. High transport losses for live animals are often a factor of distance to market or slaughter. Post-slaughter, the absence of infrastructure including adequate cold chains a crucial factor.
- Lack of **standard sale terms in the sector** (whole animals are sold), common sale of under-weight animals, high transaction costs of animal sale and the under-utilisation of slaughter by-products. For home slaughter, high postharvest losses and public hygiene can be concerns.



Milk and dairy

- **Reported losses high** - milk and dairy products are perishable. Exacerbated by the relatively high incidence of small holder milk production (e.g., farms with 8-10 dairy animals).
- **Mixture of public and private infrastructure needed** to upgrade the milk and dairy value chains, particularly setting standards (e.g., Uganda) organising farmers (e.g., Kenya) and supporting the emergence of cool-chains.
- The milk and dairy case study in Uganda highlighted the challenges of **adulteration in this sector**, a loss largely born by the consumer.



Fish and Seafood Products

- Postharvest losses in capture fisheries have, to a large extent, been addressed in recent years. This reflects the scarcity and value of this resource. **A more important emerging issue is postharvest losses in aquaculture.**
- Since much fish is processed by small scale producers, many of the preservation methods and recommendations that apply to durable crops also apply to processed fish products.
- For fresh fish and seafood - **investments in cold chains and improved postharvest handling** could substantially reduce postharvest losses and food safety concerns.



Common challenges/problems identified by the research

- **Rodent losses** in the postharvest chain is probably under-estimated
- **For all value chains, actions taken on farm (and therefore outside the purview of this study) strongly impact on postharvest loss.** I.e., cleaning (maize), handling (cassava), drying (rice), sorting (fish), packing (vegetables) and preserving (meat) before product leave the farm profoundly impact up on postharvest losses down-stream. Focus on improving upstream practices and investments is essential to reduce later losses.
- **Food Safety - Aflatoxin** is a growing threat to the viability of small holder value chains, The knock-on impact on public health of this phenomena should be a concern for policy makers in OIC Member Countries.
- **Investment** - Many of the chains reviewed would benefit from development of cold-chain infrastructure (meat, fish, dairy, vegetables and fruit).
- **Policies** – is there a lack of policy related to postharvest management? A high subsidy for wheat in Egypt is leading to market distortions (fraudulent activity, price inflation and inefficiencies). Some good examples also.
- **Gender** - With only very limited exception, research and practice in the postharvest field in OIC Member Countries had not been gendered.



Common solutions identified during the research

On-farm.

- Breeding for postharvest qualities (e.g., storability)
- Early quality differentiation (e.g., sorting for different uses/markets)
- Improved harvesting (e.g., use of standard in-field practices and clean containers)
- Collective drying/processing prior to sale

In chain.

- Incentives for better drying/sorting/cleaning
- Improved containers
- Improved collective and in-chain storage
- Awareness raising of loss causes
- Greater access to and use of mobile phone technologies
- Micro finance directed at promoting market efficiency (e.g., warehouse receipt systems)

Systemic

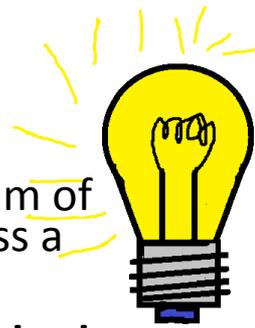
- Clear and understood rules and standards
- Easily available and locally adapted capacity building and training tools.
- Traditional focus on productivity has overlooked how to address postharvest aspects of food production.

Best Practices

- **Ownership of postharvest losses by key private sector actors** in value chains can drive loss reduction.
- **Integrated computer technology (ICTs)** can be used to reduce losses - warning about impending postharvest losses of stored vegetables through chemical changes in store, sharing information about postharvest solutions using mobile applications, using sensors to detect when household or village stores are full and need emptying and identifying storage pests etc.
- **Sectoral strategic investments or application of seed grants** can have a big impact on up-grading value chains and reducing postharvest losses. i.e., investment in cold-chain infrastructure.
- **New industries can emerge from postharvest losses** – i.e., utilisation cassava peel waste as animal feed, starch recovery and mushroom media.
- **Indonesian artisanal fisheries sector is a good example of multi-actor collaboration to reduce postharvest losses.** Here, a coordinated development of capacity (through government), improvement to the enabling environment through strategic investment (e.g., landings and ice machines), upgrading of key aspects of the value chain (e.g., better roads and more reliable electricity) and innovative approaches (a zero loss programme in fish processing factories) have contributed to a significant reduction in postharvest losses.
- **Few examples of national loss reporting systems identified** (e.g. APHLIS and the Indonesia fisheries sector). Where these systems exist and are used by policy makers, emerging evidence suggests they have become effective.



Recommendations



1. Establish **national PHL reduction coordination committees** with the specific aim of identifying, prioritising and sharing postharvest losses data and practices across a range of strategic commodities.
2. Promote a **consistency of approach**. An OIC wide **PHL reduction coordination body** should be initiated with the aim of using consistent methods, sharing best practice and promoting system wide efforts.
3. Promote **capacity building and sharing** - best practice' workshops
4. Encourage local, national and, potentially, regional **multi-stakeholder commodity platforms**.
5. Involve **financial service providers** to investigate the possibility of developing specific PHL reduction instruments.
6. Consider developing projects that specifically engage **private sector actors** in identifying and reducing PHL. A challenge fund may be cost effective.
7. Consider a consistent approach to postharvest loss analysis and subsequent actions with **gender differentiation** in mind and to consider vulnerable groups in society.
8. A **competition** to develop PHL reduction ICTs could have a high impact to cost ratio.
9. Policy makers to consider **by-products**, particularly where high volumes can be achieved, can result in strategic investment opportunities for by-product upgrading and reduced postharvest losses.
10. If postharvest losses are to be addressed, a **system of measuring them at a strategic level** should be considered and promoted to national agricultural statistics bodies.

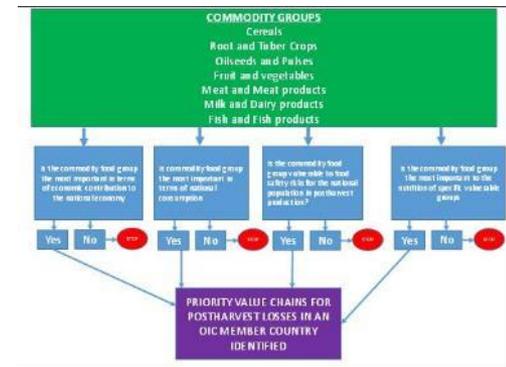
Towards a Policy framework

Good examples already. A challenge for policy makers is **postharvest losses are generally more complex** than pre-harvest losses - greater diversity of products and end uses and markets. Can be costly.

Policy makers may be able to **prioritise** which commodity groups and value chains to **focus resources on** using the following policy strategy:

Identify which **commodity** is most important in term of the following:

- Economic contribution to the national economy?**
- National consumption?**
- Nutrition of specific vulnerable groups?**
- Food safety risks for the national population?**



Having identified the commodity groups for a), b), c) and d) decisions can be taken regarding identifying the **value chains** that are most important according the criteria selected

Thank you