



Post Harvest losses in Africa - Analytical review and synthesis

icipe FINAL TECHNICAL REPORT

SUBMITTED TO IDRC



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1. Basic Project Information

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2. Abstract

Postharvest losses (PHLs) are regarded as one of the most critical constraints affecting the food security across Africa. Consequently reducing such losses offers an important way of increasing availability of food and alleviating poverty without requiring additional production and at the same time decreasing the burden on the environment. PHLs estimates vary widely and there is no consensus on the proportion of food produced that is currently lost. Figures between 10 and 40 per cent and as high as 50 per cent are quoted for cereals alone, but these estimates link back to the limited primary datasets, whereas much of the published figures are based on data collected three decades ago. Recently, PHLs mitigation has re-emerged as the most promising intervention to address food insecurity in Africa. Many organizations are positioning themselves to tackle PHLs. A systematic review of literature on PHLs and interventions indicates, however, a lack of reliability in methodologies for assessment and interpretation of losses. Moreover, technologies to mitigate the losses depict limitations in addressing overall dynamics along supply chains. Interventions in PHL research should therefore focus more on rigorous loss assessment using systematic methodologies, and designing holistic approaches for loss mitigation from value chain perspective.

Keywords: Review, postharvest, losses, innovations, mitigation, sub-Saharan Africa

3. The research problem

The global and national food situation over the past decade has become a big issue for food-deficit countries in Sub-Saharan Africa (SSA). With the surge in food prices that began in 2006 and peaked in mid-2008, and resumed the rising trend in 2011, a major effort to overcome PHLs is gaining momentum as this has connection with food security and the fight against poverty in most of the developing countries in SSA. However, without systematic evidence on current losses, the arguments over the potential for reducing global food losses as a contribution to feeding nine billion people by 2050 will remain largely rhetorical in the context of developing countries. Farmers throughout SSA have long suffered serious losses of their produce along the supply chain from harvesting up to consumption. For many families, such losses threaten household food security, while for others, early produce disposals at low prices for fear of loss causes tremendous loss of revenue. Postharvest losses (PHLs) are a measurable reduction in foodstuffs and may affect either quantity or quality. There is a dearth of data on PHLs and estimates vary widely. Hence, there is lack of consensus on the actual proportion of food produce that is currently lost. Without systematic evidence on current losses, it will be difficult and unrealistic to measure progress against any PHLs reduction target. Therefore, the present project funded by the International Development Research Centre (IDRC), aims at conducting an analytical review of PHLs in SSA.

4. Objectives

4.1. Overall objective

The overall objective of the present project is to provide evidence on PHLs of various commodities in Sub-Saharan Africa and to help decision-makers in governments to optimize their post-production policies and strategies in order to prevent food losses at different levels of the supply chain.

4.2. Specific objectives

1. To provide an analytical review of PHLs and postharvest (PH) innovations related to food and income security.
2. To produce a guideline for rigorous and systematic assessment of PHLs along targeted commodity value chains.
3. To generate action plans for PHL research and PH interventions.

The objective of the project throughout implementation remains the same. However, target commodities for the review were modified in the project inception workshop so that the review can reflect more specifically on those commodities that have a higher food, nutrition, and economic importance at the national level in the respective countries. Table 1 shows the countries and commodity categories: grains and cereals, root and tuber crops, fruits and vegetables and livestock products as originally proposed.

Table 1: Originally proposed country – commodity combinations for the review

Countries	Group of commodities
Benin and Ghana	Root and tuber crops
Ghana, Kenya and Mozambique	Livestock products
Malawi and Mozambique	Grains and cereals
Tanzania and Kenya	Fruits and vegetables

The project inception workshop allotted new commodities combinations to each country. Seven commodity categories: cereals, pulses, fruits, vegetables, root and tuber crops, fish/meat/milk, and oil crops were generally assigned. These are shown in Table 2 together with the specific commodities in each category for the six (6) review countries: Benin and Ghana in West Africa, Kenya and Tanzania in East Africa and Malawi and Mozambique in southern Africa.

Table 2: Revised country-commodity combinations for the review

Country	Commodity category						
	Cereals	Pulses	Fruits	Vegetables	Root & tuber crops	Milk & meat/ fish	Oil crops
Benin	Maize, rice	Cowpea	Mango, orange	Tomato, Leafy vegetables	Cassava, yam	Fish	Groundnuts
Ghana	Maize, rice	Cowpea	Mango, oranges	Tomato, Okra	Cassava, yam	Fish	Groundnuts
Kenya	Maize, rice	Beans	Mango, banana	Cabbage, tomato	Cassava, Irish-potato	Milk & meat	Groundnuts
Malawi	Maize, rice	Beans	Banana, mango	Tomato, cabbage	Cassava, sweet potato	Fish	Groundnut
Mozambique	Maize, sorghum	Cowpea	Mango, banana	Tomato, cabbage	Cassava, sweet potato	Fish	Groundnuts
Tanzania	Maize, sorghum	Beans	Mango, oranges	Tomato, cabbage	Cassava, sweet potato	Fish	Sunflower

5. Methodology

The methodology of conducting the present review was designed to incorporate several steps as summarised in the framework shown in Figure 1, to be actualized in six (6) schedules.

5.1. Schedule I: Identification of relevant literature and studies

In this schedule, the effort was to gather all published and unpublished (grey) literatures that satisfy the following criteria:

1. Date: projects and studies conducted from 1980 - 2012
2. Language: English, French or Portuguese
3. Countries: studies or projects conducted in Benin, Ghana, Kenya, Malawi, Mozambique and Tanzania.
4. Content: literatures document qualitative or quantitative information on postharvest loss or postharvest innovations of the commodities specified in Table 2.

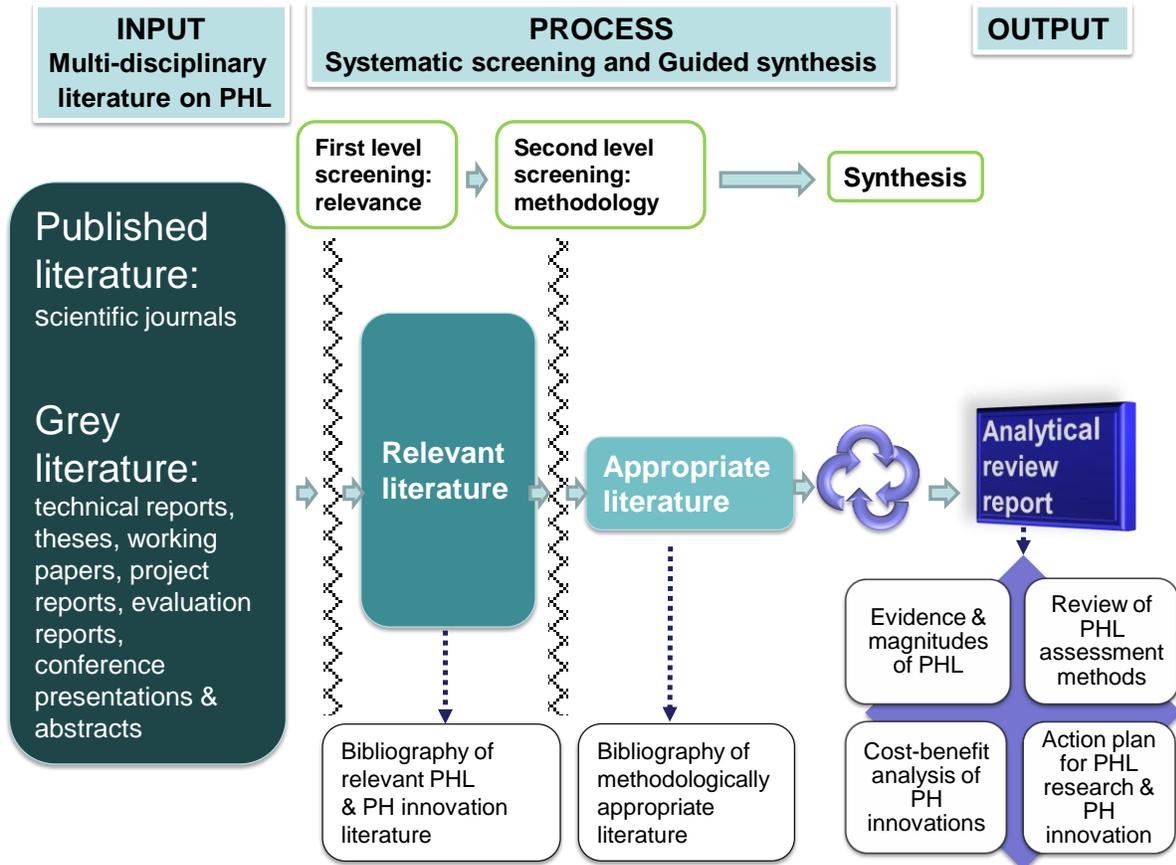


Figure 1: Methodological framework

Source (Own presentation)

5.2. Schedule II: Literature search and sources

1. Literature search - A broad-based and multi-disciplinary literature search strategy was applied. The search retrieved relevant literatures (according to **Schedule I**) belonging to the following thematic areas: agricultural economics; food security surveillance; food policy; marketing and distribution; engineering, agro-processing; storage; stored products protection, nutrition (studies evaluating nutritional value loss); socio-economic/cultural studies; food safety, agribusiness and value chain management, and studies that relate pre-harvest practices to postharvest losses among others.
2. Study types in retrieved literatures included but were not limited to: case studies conducted within a country or cultural settings in the country, surveys, regressions and prediction studies, extrapolation and modelling studies, focus group discussions with players in various levels of a commodity value chain – (farmers, processors, transporters, warehouses, traders, consumers), simulated laboratory experiments, commodity tracking studies and PHL innovations evaluation studies.
3. Databases included published literature and unpublished literature.

5.3. Schedule III: Literature screening

Part (1) First stage screening - titles and abstracts of any retrieved articles were screened as per criteria detailed in **Schedule I**.

Consistent with schedule I of the review methodology, the literatures are dated between 1980 and 2012, and report qualitative or quantitative postharvest losses, perceptions of the losses by local communities, and innovations that have over the time, been applied to address the losses.

Part (2) Second stage screening –This step involved critical evaluation of all relevant literatures for methodological appropriateness. An overall assessment of articles on the basis of authenticity of information and suitability for the review was undertaken. A rating scale of 1 to 5: (1) poor, (2) fair, (3) satisfactory, (4) good, (5) excellent was applied. An article was selected for full review and information synthesis based on its methodological rating, that is, if rated 3-5 (satisfactory, good, and excellent).

5.4. Schedule IV: Interpretation (information synthesis) of selected literature

Full-text papers that had passed second stage screening (schedule III part (2)) were reviewed and interpreted against the backdrop of moderating factors because the real magnitude of PHL and suitability of PH innovations differ depending on social, economic and environmental circumstances under which commodities are grown, harvested, stored, processed, marketed and utilized or consumed.

5.5. Schedule V: Development of detailed value chain diagrams complete with PHL annotations

PHL and PH innovations were summarized following a value chain perspective.

5.6. Schedule VI: Summary of results of review and action Plan

Review results and action plan proposals were summarized in tabular format.

6. Project activities

6.1. Building project team and identification of consultants

The project began in February 2012. In March 2012 a project assistant to the coordinator was recruited. The whole month of March was devoted to the identification of consultants in the 6 countries covered by the project. In April 2012, the 12 consultants were identified, two per country (one postharvest or food science expert and one agricultural economist).

6.2. Developing the review methodology

A review methodology was developed and discussed with participants in the project inception meeting held in April 2012. The methodology was validated and was applied by all consultants for information collection.

6.3. Conducting project inception workshop

A two-day inception workshop was held at *icipe* Nairobi, Kenya from 24 – 25 April 2012 to:

- ✓ Discuss project objectives and expected outputs.
- ✓ Deliberate on the postharvest loss situations in participating SSA countries.
- ✓ Discuss and validate the methodology to be adopted for the review work envisaged in the project objectives.
- ✓ Propose and agree on communication products that the project would deliver.
- ✓ Deliberate and agree on terms of reference for national consultants in the project.

23 participants including 11 consultants attended the meeting. With the exception of Mozambique where only one consultant (postharvest expert) was present, each of the project countries was represented by two consultants. The rest of the participants were postharvest specialists drawn from the University of Nairobi, Jomo Kenyatta University of Agriculture and Technology, and the Kenya Agricultural Research Institute.

6.4. Developing consultancy contracts

All the consultancy contracts between *icipe* and the 12 consultants were signed. The specific deliverable and times frame were as follow:

6.4.1. Specific deliverables:

- i. A full bibliographic compilation of all PHLs literature collected
- ii. A full bibliographic compilation of all the PH innovations identified
- iii. Detailed value chain diagrams or tables of specific commodities in the particular country complete with level-based PHL annotations.
- iv. An evidence-based review of the magnitude of PHL in the specific countries and possible mitigation strategies.

- v. Costs and benefits and others constraints of PH innovations identified
- vi. An action plan for PHL research and PH innovations

6.4.2. Time-frame

Consultancy covered 30 days. However, the deliverable period was extended to 90 days.

- i. A progress report was to be submitted within the first 30 days of the consultancy commencing on the date of signing of consultancy contract.
- ii. A first draft of consultancy report was to be submitted not later than 60 days commencing on the date of signing of consultancy contract.
- iii. The final report was to be submitted within 90 days commencing on the date of signing of the consultancy contract.

6.5. Results validation workshop

Results Validation Seminar was held at *icipe* headquarters in Nairobi from 18th to 23rd February 2013, the objectives of the workshop were:

- to discuss project findings
- to better understand the magnitude of postharvest losses for various commodities
- to identify research needs and innovation for PHLs mitigation
- to propose initiatives for the way forward

The workshop was attended by 28 participants including consultants from each country involved in the project, the international postharvest consultant from US, as well as representatives from IDRC. The rest of the participants were postharvest specialists drawn from relevant organizations in Nairobi.

7. Project outputs

As stipulated in the project document, the following outputs were achieved according to the different objectives of the project:

Objective 1: To provide an analytical review of losses and innovations related to food and income security

Output 1.1: Rigorous and systematic analytical review of PHLs and PH innovations conducted

Output 1.2: Paper on analytical review of PHLs and innovations submitted for publication in scientific journal.

Objective 2: To produce a guideline for rigorous and systematic assessment of PHLs along targeted commodity value chains

Output 2.1: Guideline for rigorous and systematic assessment of PHLs along commodity value chains produced

Objective 3: To generate an action plan for PHL research and PH interventions

Output 3.1: Action plan for PH research for losses reduction generated

Output 3.2: Action plan for PH interventions to reduce PHLs generated

7.1. Achievements

The content of the outputs are documented in the following publications:

7.1.1. Project inception workshop report

1. Affognon, H., and Mutungi, C. 2012. Postharvest losses in Africa- analytical review and synthesis: report of project inception workshop held at *icipe* Nairobi, Kenya, 24-25.04.2012, pp. 68. <http://hdl.handle.net/10625/49139>

7.1.2. Research reports:

2. Adegbola P. Y., Dannon E. A., Mutungi C. and Affognon H. 2012. Postharvest losses in Africa – Analytical review and synthesis: the case of Benin, 124 pp.

3. Vowotor K. A., Mensah-Bonsu A., Mutungi C. and Affognon H. 2012. Postharvest losses in Africa – Analytical review and synthesis: the case of Ghana, 123 pp.

4. Ndaka D., Macharia I., Mutungi C. and Affognon H. 2012. Postharvest losses in Africa – Analytical review and synthesis: the case of Kenya, 93 pp.

5. Chiwaula L., Mtethiwa J., C. Mutungi and Affognon H. 2012. Postharvest losses in Africa – Analytical review and synthesis: the case of Malawi, 71 pp.

6. Cugala D., Tostão E., C. Mutungi and Affognon H. 2012. Postharvest losses in Africa – Analytical review and synthesis: the case of Mozambique, 61 pp.

7. Mutungi C., Makindara J., Magoma R. and Affognon H. 2012. Postharvest losses in Africa – Analytical review and synthesis: the case of Tanzania, 115 pp.

7.1.3. Working paper

8. Njoroge A., Affognon H. and C. Mutungi 2013. Review of Postharvest Loss Assessment Methodologies, 32 pp

7.1.4. Project results validation workshop report

9. Affognon, H., and Mutungi, C. 2012. Postharvest losses in Africa- analytical review and synthesis: Gaps and outlook for future postharvest research and innovation in sub-Saharan Africa report of project results validation workshop held at *icipe* Nairobi, Kenya, 18th - 20th February 2013, pp. 87.

7.1.5. Policy briefs

10. Mutungi C. and Affognon H. 2013. Tackling Food Losses - Outlook for Postharvest Research and Innovation in Mozambique. ICIPE Policy Brief No. 1/13, 8pp.

11. Mutungi C. and Affognon H. 2013. Mitigation Food Losses in Benin - Status and Way Forward for Postharvest Research and Innovations. ICIPE Policy Brief No. 2/13, 8pp.

12. Mutungi C. and Affognon H. 2013. Fighting Food Losses in Tanzania - The Way Forward for Postharvest Research and Innovations. ICIPE Policy Brief No. 3/13, 8pp.

13. Mutungi C. and Affognon H. 2013. Gaps and Outlook for Postharvest Research and Innovations in Ghana. ICIPE Policy Brief No. 4/13, 8pp.

14. Mutungi C. and Affognon H. 2013. Addressing Food Losses - Status and Way Forward for Postharvest Research and Innovations in Kenya. ICIPE Policy Brief No. 5/13, 8pp.

15. Mutungi C. and Affognon H. 2013. Mitigation Food Losses - Status and Way Forward for Postharvest Research and Innovations in Malawi. ICIPE Policy Brief No. 6/13, 8pp.

7.1.6. Synthesis scientific journal article for submission

16. Affognon H., Mutungi C., Sanginga P. and Borgemeister C. 2013. Unpacking postharvest losses myths in sub-Saharan Africa: A systematic review. Article to be submitted to World Development

7.1.7. Database

17. The database is a collection of published as well as unpublished reports of works and studies conducted between 1980 and 2012 and selected for the present review. The collection represents only those articles that passed certain criteria for assessing appropriateness of the methodologies used to derive the reported findings. Concise summaries of each of the articles are provided. Available also are the links to the full articles. The collection reveals evidence and magnitudes of postharvest losses, the various methodologies used to assess the losses, and the innovations that were introduced, proposed or evaluated for reducing the losses

8. Project outcomes

It is early to have some outcomes of the present project. One important outcome expected is the citation of reports and scientific journal article emanating from the present review. However, many organizations were already interested in the outputs of the project. Following the request by DFID, soft copies of the six policy briefs were sent to them. During the last Forum for Agricultural Research in Africa (FARA) the 6th Africa Agriculture Science Week held in Accra, Ghana from 15th – 20th July 2013, 300 copies of the policy briefs were collected in less than 2 days by participants in the meeting. Also, the project results validation report was already cited in a

working paper on sustainable food systems by the World Resources Institute (WRI) in Lipinski, B. et al. 2013. “Reducing Food Loss and Waste.” Working Paper, Installment 2 of *Creating a Sustainable Food Future*. Washington, DC: World Resources Institute. Available online at: <http://www.worldresourcesreport.org>.

9. Overall Assessment and Recommendations

This project of analytical review of PHLs in Sub-Saharan Africa is a successful project given the number of outputs produced in a short period (18 months). We believe that the project made a great contribution by shedding light on the magnitude of PHLs figures that are often exaggerated and that are generally economic losses than physical losses.

Considering that PHLs are regarded as one of the most critical constraints affecting the food security across Africa, the main recommendation is for IDRC to consider a further grant for ICIPE covering the next three years in order to implement ideas emanating from the present review for the mitigation of food losses in Sub-Saharan Africa.

For an effective and successful project completion and delivery of project outputs, we have requested from IDRC to make commitment of project funds to support the activities outline in the table below and the request was approved.

Items	Milestones
1- Policy brief translation French and Portuguese	To completed by end of August 2013
2- Policy brief multiplication	To completed by end of September 2013
3- Country papers development	To completed by end of October 2013
4- Country report reviewing for final printing	To completed by end of October 2013