



FEED THE FUTURE
BUSINESS DRIVERS FOR FOOD SAFETY

Cooperative Agreement No. 720BFS19CA00001

**MEASURING FOOD LOSS AMONG
SENEGALESE GROWING FOOD BUSINESSES**

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ABBREVIATIONS AND ACRONYMS

BBD	Baseline Benchmark Diagnosis
BD4FS	Feed the Future Business Drivers for Food Safety
FLW	Food Loss & Waste
GFB	Growing Food Business
HACCP	Hazard Analysis and Critical Control Points
OECD	Organization for Economic Co-operation and Development
PHL	Postharvest Loss
PRP	Prerequisite Program
SDG	Sustainable Development Goal
SSA	Sub-Saharan Africa
TLN	Technical Learning Note
USAID	United States Agency for International Development
USD	United States Dollar

OVERVIEW

Food Loss in Senegal

Food loss and waste represent a major threat to global food security over the next ten years.¹ In Africa, with the world's highest rates of hunger and malnutrition, about a third of all food produced goes missing before it ever reaches consumers. The FAO (2011) Global Food Loss and Food Waste study estimated food losses across Sub-Saharan Africa (SSA) to be about 20% of all cereals, 44% of roots and tubers, and 52% of fruits and vegetables between harvest and consumption.² Though estimates of postharvest food loss (pre-consumer) and waste (consumer household) have been questioned in terms of methodology and accuracy³, the issue of food loss post-farmgate remains financially important for growing food businesses (GFBs)⁴ already operating on thin margins.

This is particularly true in moments of economic, environmental, or health crises. For example, the consequences of the recent COVID-19 pandemic on food production and distribution systems throughout SSA add to the threat of food spoilage and loss due to disruptions in transport and storage.⁵ Farmers have had difficulty selling their products and this is particularly true in Senegal. In an interview on April 28, 2020, the FAO representative in Senegal noted that during the COVID-19 crisis, almost one million chickens and nearly 18,000 tons of vegetable crops - including 13,000 tons of onions, 550 tons of cabbages and 566 tons of carrots - had piled up due to difficulties transporting them to market.⁶ For both small-scale producers and small-medium food enterprises seeking to grow their business, this level of loss can be catastrophic for survival. Assisting these actors to mitigate excessive food loss is an important way to reduce business risk.

Food loss and waste (FLW) reduction has proven to be an effective mechanism for food-based businesses to decrease their exposure to a variety of financial, supply chain, and regulatory risks (Berkenkamp and Pearce, 2017).⁷ Equally important, targeted investments in FLW reduction at the production end of the chain have the potential to improve smallholder producers' incomes and livelihoods and improve food security, whilst simultaneously shrinking the environmental footprint of local and global food systems. Some scholars argue that in terms of food security it is more effective to invest in reducing losses and waste than to invest in increasing agricultural productivity. For example, in Senegal eliminating on-farm postharvest losses could increase the total value of vegetable supply by 45% (US \$72 million) per year and reduce vegetable imports by 22% (127,000 tons) per year.⁸

However, the value of investments in the middle part of the food supply chain among small-medium food enterprises is less clear. According to Herman Snel, Yeray Saavedra and Irene Koomen (2018), *Currently there is little practical guidance for food-based businesses who source from smallholder suppliers to make informed choices with regard to possible interventions and investments to reduce FLW aimed at generating lasting impact and positive returns on investments.*⁹ It has been estimated that roughly 25% of food loss in fresh fruits and vegetables occurs during processing and distribution – a rate that would incur significant financial constraints for many GFBs – however, documentation of loss rates is limited.¹⁰

To address this specific knowledge gap, the Feed the Future Business Drivers for Food Safety (BD4FS) project, funded by USAID and implemented by Food Enterprise Solutions (FES), developed food loss protocols to help food businesses identify and track food loss to better understand how it affects their bottom line. This Technical Learning Note describes our experience in applying these protocols to real businesses in Senegal to assist them to reduce food loss through the adoption of better food handling practices. BD4FS works with private sector GFBs to understand the challenges and opportunities that will drive these businesses, especially financial costs and benefits, to reduce their postharvest losses (PHL). One of the challenges in this private-

¹ OECD-FAO. 2014. Agricultural Outlook 2021-2030. <https://www.agri-outlook.org/>

² FAO. 2011. *Global food losses and food waste – Extent, causes and prevention*. Rome

³ Bellemare, M. et al. 2017. On the Measurement of Food Waste. *American Journal of Agricultural Economics*. **Volume 99, Issue 5**. October 2017.

⁴ A Growing Food Business (GFB) is considered a small-medium food enterprises that recognizes and embraces the importance of food safety as an integral part of its business model.

⁵ FAO 2020. Addressing the impacts of COVID-19 in food crises.

⁶ https://www.francetvinfo.fr/monde/afrique/senegal/coronavirus-au-senegal-le-panier-de-la-menagere-offre-aux-plus-demunis-les-stocks-generes-par-la-crise_3938773.html

⁷ Trillium Asset Management and National Resource Defense Council. 2017. *Assessing Corporate Performance on Food Waste Reduction: A Strategic Guide for Investors*.

⁸ Assane Beye and Adam M. Komarek. 2020. Quantification and benefits of reducing post-harvest losses: Evidence for vegetables in Senegal. Center for Development Research, ZEF-Discussion Papers on Development Policy No. 300.

⁹ Snel, H. et al. 2018. Hotspot Analysis on Food Loss and Waste in African Agriculture; Literature review. Wageningen Centre for Development Innovation, Wageningen University & Research.

¹⁰ The Rockefeller Foundation. 2013. "Waste and Spoilage in the Food Chain." *Decision Intelligence Document*, (May).

sector approach is that GFBs often perceive that the adoption of postharvest food handling practices is too costly, that the return on investment is too far in the future, and the benefits are not immediate. Therefore, unless buyers are willing to pay more for products resulting from improved practices—sorting, cool storage, increased sanitation—GFBs have reported to BD4FS that they feel it is not worth the effort or investment. Moving from perceptions of what the cost/benefit of changing post-harvest food handling practices may be to the measurement and analysis of what they actually are is a key focus of this study. Our central thesis is: by helping GFBs to accurately document their degree of food loss, they will be able to calculate the benefit/cost relationship between changing practices and adopting technologies to significantly reduce FLW. BD4FS believes that “seeing the numbers” will convince GFBs that strategic and targeted investments will result in reduced FLW, increased revenue, and better quality, and safer food for customers.

Food Loss and Food Safety

Food contamination and spoilage are both the result of inadequate hygiene, temperature control, and storage. For GFBs, adopting the appropriate set of food handling practices will improve food safety and also contribute to a reduction in food loss. Businesses around the world are realizing the benefits of reducing food loss from receiving to final product. This is especially important for smaller to medium-sized companies, like the GFBs in Senegal, who are often under-resourced and lack consistent market access. Food loss for them can spell financial disaster. Even in larger firms, food loss is often not front and center in business plans and operations and is simply accepted as the cost of doing business. With the evidence mounting for the need to reduce food loss, both large and small firms are recognizing an opportunity to improve their bottom lines by reducing resource leakage while also directing more nutritious - and safe - food into the food system. As with improving food safety, the upfront costs of quantifying and measuring food loss can outweigh the cost of not addressing it (Provision Coalition 2020 FLA Toolkit¹¹). It has been demonstrated that some businesses can achieve a positive return on investment within just one year. In fact, according to Hanson and Mitchell (2017)¹², businesses tend to experience a median savings of \$14 for every \$1 invested in food loss measurement, prevention, and reduction. While the focus of the BD4FS program is to improve food safety in GFBs business models and operations, reducing postharvest and post-slaughter loss is also an opportunity for businesses to improve retention of nutritious foods, access to new markets, and revenue.

STUDY RATIONALE AND OBJECTIVES

Postharvest food losses - occurring at the production, harvest, postharvest, and processing phases - are the most important source of FLW in developing countries. These occur due to poor infrastructure, poor temperature management, low levels of technology, lack of access to affordable financial services, and low investment in the food production systems, especially the cold chain.

Key factors affecting food losses and the gaps in knowledge and skills identified in the literature and through BD4FS engagement with GFBs in Senegal include:

- Lack of understanding of harvest indices of plant foods and how maturity is related to quality and shelf life.
- Poor sorting and grading practices during preparation for market, allowing damaged and decaying foods to enter the supply chain and to spread decay to other foods.
- Inadequate temperature management and lack of control of relative humidity, leading to shriveling, wilting, and deterioration of perishable foods.
- Low quality packaging which provides little or no protection during handling, transport, and storage.
- Delays in transport to market without proper storage (cool storage for perishables and drying of staple grains, beans, and legumes before storage).
- General lack of education on appropriate postharvest handling practices and technologies, leading to rough handling, mechanical damage, improperly handled mixed loads, and food safety concerns.
- Under-utilization of sustainable and cost-effective postharvest practices, leading to high levels of food loss on the farm, and in wholesale and retail markets.

¹¹ <https://provisioncoalition.com/toolsandresources/foodlosswastetoolkit>

¹² Hanson, Craig & Mitchell, Peter. (2017). The Business Case for Reducing Food Loss and Waste. A report on behalf of SDG Champions 12.3.

The BD4FS food loss protocols provide businesses with a baseline assessment of their current food loss so that after participating in the program’s trainings and technical assistance services, they can compare the resulting reduction in FLW and assign a financial value to it.

Objectives

1. Develop and adapt food loss protocols for GFBs in Senegal.
2. Calculate the extent to which food loss is an issue for Senegalese GFBs using the BD4FS food loss protocols.
3. Assess the effectiveness of measuring food loss and ease of use by GFBs.

METHODOLOGY

To address the study objectives, BD4FS developed, adapted, and tested the protocols to measure food loss among businesses operating in the post-farmgate to pre-consumer spectrum of perishable food supply chains. This TLN documents (1) the development and adaptation of BD4FS food loss protocols for 50 Senegalese GFBs, (2) findings regarding food loss and food safety among a core study group of 50 participating GFBs, and (3) lessons learned about the protocols through data collection and interpretation.

Protocol Development

The protocols were developed in collaboration with postharvest expert Dr. Lisa Kitinoja¹³; the BD4FS technical staff and Senegal team streamlined and adapted them to GFB conditions in Senegal (see below for details). The protocols were developed to better understand food loss among GFBs operating in the perishable food sectors in Senegal. Specifically, they were designed to answer the following research questions:

- Do GFBs currently track or calculate food loss on their own?
- What is the actual level of food loss by type of business and food handled?
- Do they track or calculate deterioration of food quality?
- How do they manage food that is unfit for human consumption?

Adaptation of Protocols

Initially, BD4FS developed subsector protocols for each: fruit, vegetables, meat and poultry, and fish and seafood. Upon evaluation, the team merged the fruit protocol with the vegetable protocol and added a milk and dairy protocol by adapting the meat and poultry protocol. Following are the resulting four subsector protocols:

- Fruits and Vegetables
- Meat and Poultry
- Fish and Seafood
- Milk and Dairy

Since BD4FS planned to administer a food safety diagnostic at the same time as the food loss protocols, questions that were determined to be related to food safety - e.g., hazard and risk analysis, risk assessment, management commitment, product labeling, temperature control, and personal hygiene - were removed from the food loss protocols.

Each protocol was translated into French and into Wolof, the language spoken by many interviewees. The protocols were then tested in the field and the wording was further revised to ensure clarity and accuracy of translations.

Measurement of Food Loss: Data Collection and Analysis

BD4FS applied the protocols to a core study group of 50 GFBs in Senegal as part of the baseline benchmark diagnosis to better understand the degree of food loss among Senegalese food businesses. The BBD included additional inquiries designed to measure other aspects of food management, especially food handling and food safety practices. All data sets were collected and recorded by the BD4FS Senegal team into the Qualtrics software program.

¹³ Dr. Lisa Kitinoja is a postharvest extension specialist and serves as program manager and lead postharvest trainer for the Postharvest Education Foundation (PEF).

The data collection was carried out from August 12 to September 23, 2021, by the BD4FS Senegalese staff and three hired enumerators. The team trained the enumerators on the survey tool, accompanied them on their first visit to businesses for the administration of the survey, and provided guidance and support throughout the data collection process.

Upon collection of the data, the team promptly began data entry through a survey form designed in Qualtrics. Data entry was carried out by three data entry operators under the supervision and support of the project team. Data cleaning occurred simultaneously to data entry with the country team carefully reviewing and correcting discrepancies for data submitted to the server. Most of the issues were related to missing data as the survey was designed with automatic controls and validations to reduce errors, such as display logics and skip logics. The team proceeded with the analysis of the cleaned and verified data using Qualtrics and Microsoft Excel.

Application of BD4FS Food Loss Protocols

To assess the utility of the food loss protocols and to provide recommendations for future use, the BD4FS Senegal team posed the following questions:

- Did the protocols provide an accurate estimate of food loss?
- Did the team have suggested improvements for the food loss protocols?
- Are there recommended actions that could be taken to improve food loss capturing and monitoring among GFBs?

RESULTS

BD4FS Food Loss Protocols

The BD4FS food loss protocols contain four sections, each intended for postharvest GFBs in one of the following subsectors: Fruit and Vegetables, Meat and Poultry, Fish and Seafood, and Milk and Dairy Products (referred to as “subsector protocols”). Summaries of these protocols are included in Annex 1 and an earlier iteration is published in the [Business Drivers for Food Safety Tools and Practices](#).

There are two basic descriptions of quality losses that we consider here. Each subsector protocol was designed to collect information on physical losses and quality losses, defined as follows:

- **Physical losses** – Loss of water, nutrients, weight, etc. In fruits and vegetables (F&Vs) and other perishables like milk and meat, this occurs due to improper harvesting/slaughter, transportation, storage and distribution. The postharvest life of fruits and vegetables is governed by water content, respiratory rate, ethylene production, endogenous plant hormones, and exogenous factors such as microbial growth, temperature, relative humidity and atmospheric compositions. (Barrett, Beaulieu & Shewfelt 2010¹⁴).
- **Quality losses** – Additionally, there is “consumer preference” as it relates to quality. Consumer preferences are based on color and appearance, flavor (taste and aroma), texture, nutritional value and price points. Consumers sometimes erroneously deem F&Vs “low quality” if they do not adhere to a desired shape, color, size etc., or if beef is not bright red. These preferences are influenced in part by cultural preferences and commercial marketing (Barrett, Beaulieu & Shewfelt 2010).

The protocols have two main parts:

1. Collection of general information on the company -
 - a. Setting and Business Parameters
 - b. Organizational Structure, Responsibility, and Management
2. Food loss checklists related to postharvest operations -
 - a. Fresh Handling / Packing / Packinghouse Checklist
 - b. Cooling Fresh Fish Checklist
 - c. Transport / Dispatch Checklist
 - d. Processing Checklist
 - e. Storage / Warehouse Management Checklist

¹⁴ Barrett, D.M., Beaulieu, J.C. and Shewfelt, R. (2010) Color, Flavor, Texture, and Nutritional Quality of Fresh-Cut Fruits and Vegetables: Desirable Levels, Instrumental and Sensory Measurement, and the Effects of Processing. *Critical Reviews in Food Science and Nutrition*, 50, 369-389

The protocols also contain a form for the estimation of food losses that can be used in cases where food loss is not recorded by the companies.

BD4FS designed the protocols in this way – the four different subsector protocols with operation-specific checklists - so that the applicable questions can be asked of each GFB, considering its products, raw materials, and postharvest operations.

PRP and HACCP Performances

In parallel with the food loss protocols, BD4FS used three diagnostic grids to assess the Prerequisite Program (PRP) and Hazard Analysis and Critical Control Point (HACCP) performances of each GFB. The first grid (*Assessment of the implementation of prerequisites*) contains 18 criteria and is dedicated to the PRPs. The two other grids (*Assessment of the phase of preliminary HACCP study* and *Evaluation of the implementation of HACCP plan*) contain a total of 19 criteria and are dedicated to HACCP systems.

Food Loss Among Senegalese GFBs

BD4FS used the protocols with a core group of 50 Senegalese GFBs that operate in the four targeted subsectors as follows: fruits and vegetables (51%), meat and poultry (23%), fish and seafood (19%), and milk and dairy (7%; figure 1). The primary activity of most of the GFBs is processing (73%), followed by marketing (19%), packaging (5%), transportation (2%), and storage (2%; figure 2).

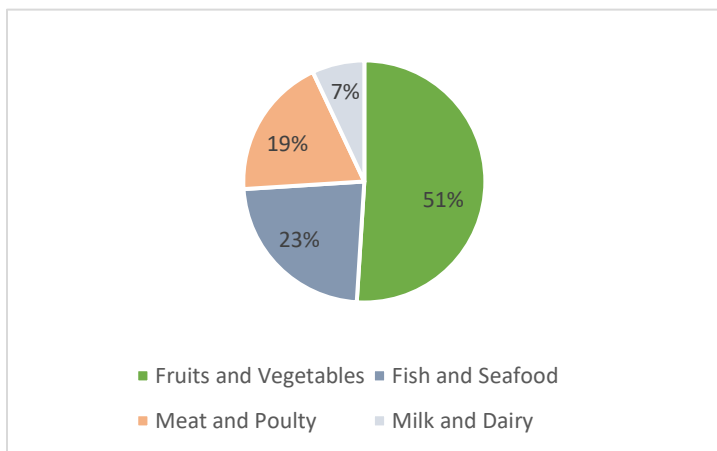


Figure 2. Distribution of GFBs by subsector.

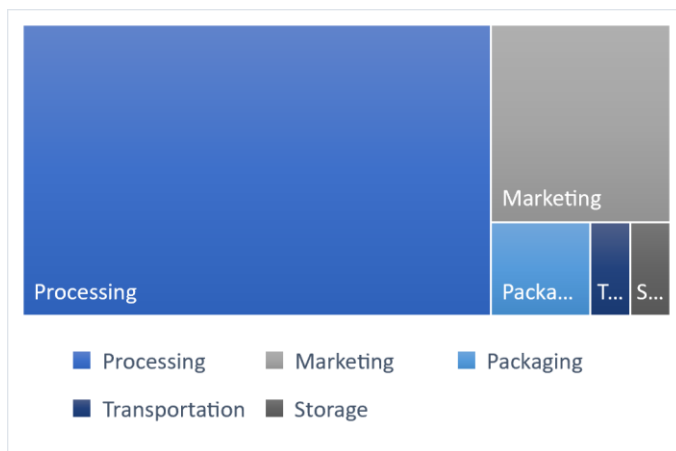


Figure 1. Distribution of GFB by activity.

Physical Food Loss

Reported physical food loss varied greatly among the 50 GFBs, due in part to differences in the size, sector, and activities of the companies. For example, the company that reported the largest quantity of losses is a company that stores onions and potatoes. Among the 50 GFBs, 35 reported having no physical food loss or having insignificant physical food loss and 4 GFBs reported that they have food loss but that it could not be estimated. Eleven (11) of the 50 GFBs reported having food loss that was recorded or could be estimated based on the average daily, weekly, or monthly loss reported by the company (Table 1). The reported and estimated physical losses were primarily related to business operations (sorting, grading, trimming). While some companies reported that they also have losses related to food safety issues (lack of access to processing, proper transportation, refrigeration and freezing, storage), these are more difficult to record as they tend to occur irregularly. Additionally, the BD4FS form used to estimate losses only allowed for estimating the recurring losses related to the company's activities and does not capture occasional or intermittent losses.

Practices reported by some GFBs may explain their absence or low quantities of food loss. In the fruit and vegetable sector, some companies explained that upon receipt, damaged or deteriorated products are returned to the supplier who takes them back. In the fish and seafood sector, damaged or deteriorating products can be processed into dried fish or fish meal for animal feed. In addition, most of the 50 companies are small-scale processors, so their production is not continuous and they purchase their supplies as needed. Some of them produce to order and therefore have very little loss of raw material or finished products.

Table 1: GFBs with estimated physical food loss

GFBs	Subsector	Activity	Physical loss (kg)	Records of Food Loss Kept
1	Meat and Poultry	Processing	38	Yes
2	Meat and Poultry	Processing	32,000	Yes
3	Fruits and Vegetables, Fish and Seafood	Processing, Marketing	1,300	No
4	Fruits and Vegetables	Packing, Packaging	5,550	Yes
5	Fruits and Vegetables, Meat and Poultry	Processing	140	No
6	Fruits and Vegetables	Transportation, Processing	1,313	No
7	Fruits and Vegetables	Storage, Marketing	90,000	Yes
8	Fruits and Vegetables	Processing	525	No
9	Milk and Dairy	Processing, Marketing	32,500	No
10	Milk and Dairy	Processing, Marketing	12,000	Yes
11	Milk and Dairy	Processing	5,400	Yes
	TOTAL		180,766	

Quality Loss

Quality losses were the most difficult for companies and for BD4FS to assess or estimate. Twenty-four (24) of the 50 GFBs (14 Fruits and vegetables, 2 Milk and Dairy, 4 Meat and Poultry, and 4 Fish and Seafood) reported quality food loss but only three (1 Meat and Poultry, 2 Milk and Dairy) could estimate the quantity of food that suffered from quality loss. In the Meat and Poultry sector, 1 GFB reported that 1% of their annual production suffered from quality loss due to lack of access to cooling. In the milk and dairy sector, 1 GFB reported that 12% of their annual production suffered from quality loss due to various food safety issues (lack of access to cooling, lack of access to processing, and lack of access to storage), and another GFB reported that 9% of their annual production suffered from quality loss due lack of access to processing.

Table 2: GFBs reporting loss of food quality by subsector.

Sector	Number of GFBs that reported loss of food quality	Number of GFBs with estimated loss of food quality
Fruits and vegetables	14	0
Meat and Poultry	4	1
Fish and seafood	4	0
Milk and dairy	2	2
Total	24	3

PRP and HACCP Performance

Based on the number of compliant criteria from the PRP and HACCP grids, each GFB was assigned a percentage of PRP performance and a percentage of HACCP performance. Most of the GFBs had low PRP and HACCP performance, with 34 (68%) having a PRP performance of less than 50% and 35 (70%) not implementing HACCP.

SUMMARY OF FINDINGS AND RECOMMENDATIONS

The BD4FS Food Loss Protocols, implemented and tested among 50 GFBs in Senegal, provided insight into the extent to which these businesses contend with food loss while also identifying challenges in accurately capturing quantities of food loss. Before the start of the study, most of the participating GFBs reported that they had little to no physical food loss. Among the 11 companies that reported food loss, half kept quantifiable records and half needed to estimate the quantity of food loss using the form included in the BD4FS protocols. The quantities of food loss varied substantially – from 38 kg to 90,000 kg annually, with physical losses related to business operations being easier to estimate than losses related to food safety issues. Roughly half of the GFBs reported that they experience loss of food quality; however, very few (4) were able to provide an estimate to quantify that loss.

While some practices and the characteristics of the GFBs may explain the absence or low quantities of food loss, it is anticipated that food loss was underreported by most of the participating GFBs. The lack of regularly recorded written information on the volume of raw materials processed, food produced, and food loss by GFBs proved challenging for utilizing the protocols to quantify food loss and feel confident in those results. This was particularly true for non-recurring losses, including loss of food quality, which was found to be difficult to estimate in cases where they weren't recorded.

These findings indicate that there are areas for improvement in the BD4FS Food Loss Protocols. For example, using quantities to measure and estimate losses may not have been the easiest way to do this; in some cases, capturing food loss in financial terms may have been easier and may have resonated more with the owner-operators. Other important take-homes from this study are (1) Senegalese GFBs need education on the business impacts of food loss, especially lost revenue; and, (2) they could benefit from BD4FS tools and training on how to accurately record physical and quality food losses. Some participating GFBs expressed interest in better measuring food losses, and it is likely that some do not seek to measure quality losses because they are simply not aware of such losses and how much revenue they are foregoing. With these insights, BD4FS recommends the following:

- Raise awareness among GFBs about potential revenue increases by taking practical and affordable steps to reduce food loss. This could include developing broad instruction on how revenue versus input costs can reflect food loss or a simple way of assessing the monetary value of all types of losses so that businesses can see for themselves the possible loss of revenue resulting from food loss. This will make the business case for food loss reduction – it is good business!
- Once GFBs are convinced that food loss reduction is good for business (positive attitude), then equipping them with actionable knowledge and feasible technologies is next to change practice. Training companies on how to reduce physical food loss as well as loss of quality – primarily accomplished through good hygiene and cooling practices that are economical and easy to implement – is critical.
- Develop and make available a very simple tracking tool (digital where makes sense) to enable GFBs to continually assess their actual food losses – including mechanisms for regularly recording loss (both physical and quality) and evaluating the financial cost of that loss. Continuing to monitor food loss will enable businesses to ensure that the practices adopted are doing their job and that businesses will be able to track in near real time the ongoing costs and benefits of implementing the food loss practices they have adopted and they can evaluate the need to upgrade or intensify actions.

These recommendations are in direct alignment with the BD4FS mission to work with GFBs towards improving food safety in Senegal and other Feed the Future countries since practices that reduce food loss also improve food safety. A focus on food loss is intended, in part, to serve as an incentive or motivator for GFBs to drive the adoption of practices that reduce food loss, improve food safety, and in doing so improves their bottom line.

Annex I: GFBs Basic information: Sector, Activity, Employees, PRP and HACCP Performance

CFBs	Activity	Type of raw materials	Total Number of employees	Number of female employees	Number of young employees (15-29)	Percentage of PRPs performance	Percentage of HACCP performance
1	Processing	Fruits and vegetables	4	2	2	28	0
2	Processing	Fruits and vegetables	1	1	0	22	11
3	Processing	Fruits and vegetables, Meat and Poultry	5	5	3	17	0
4	Processing	Fruits and vegetables	4	4	0	33	0
5	Processing	Meat and Poultry	46	35	10	61	0
6	Processing, Marketing	Milk and dairy	566	56	147	83	26
7	Processing	Fish and Seafood	40	30	0	17	0
8	Processing, Marketing	Meat and Poultry	10	9	9	28	26
9	Processing	Fruits and vegetables	20	15	8	60	60
10	Processing	Meat and Poultry	3	2	2	39	0
11	Packing/Packaging	Fruits and vegetables	12	3	5	50	0
12	Processing	Fruits and vegetables, Meat and Poultry	5	1	1	67	5
13	Processing	Meat and Poultry	10	5	8	33	21
14	Processing	Milk and dairy	1	1	0	11	11
15	Processing	Fruits and vegetables	7	5	5	28	0
16	Processing, Marketing	Fruits and vegetables	7	2	0	55	0

17	Processing, Marketing	Fish and Seafood	10	10	0	5	0
18	Processing, Marketing	Fish and Seafood	6	4	6	72	21
19	Processing	Fish and Seafood	7	3	4	22	0
20	Processing	Fruits and vegetables	10	7	2	50	0
21	Processing	Meat and Poultry	17	6	4	55	0
22	Processing, Marketing	Fruits and vegetables	3	2	3	44	0
23	Processing, Marketing	Fruits and vegetables, Fish and Seafood	2	1	2	33	11
24	Marketing, Packing/Packaging	Fruits and vegetables	47	37	25	16	0
25	Processing	Fruits and vegetables	14	6	4	61	0
26	Processing	Fruits and vegetables	12	8	4	61	47
27	Processing	Fruits and vegetables	79	75	76	44	0
28	Processing	Meat and Poultry	4	2	3	6	0
29	Processing	Fish and Seafood	38	35	15	0	0
30	Processing	Fish and Seafood	25	25	0	17	0
31	Processing, Marketing	Fruits and vegetables	3	3	2	38	0
32	Processing	Fruits and vegetables	4	2	4	33	11
33	Packing/Packaging	Fish and Seafood	3	3	3	44	11
34	Processing	Fruits and vegetables	6	5	4	44	11
35	Marketing	Meat and Poultry	1	0	0	33	0
36	Processing, Marketing	Milk and dairy	10	1	2	39	0
37	Processing	Milk and dairy	21	6	7	39	0
38	Processing	Fruits and vegetables	11	9	4	55	11

39	Transportation, Processing	Fruits and vegetables	9	8	7	44	0
40	Processing	Meat and Poultry	5	4	3	61	0
41	Processing	Fruits and vegetables	30	28	2	22	0
42	Storage, Marketing	Fruits and vegetables	68	5	2	22	0
43	Processing	Fish and Seafood	150	150	0	17	0
44	Processing	Meat and Poultry	300	75	180	89	89
45	Processing	Fruits and vegetables	4	3	2	11	0
46	Processing	Meat and Poultry	5	1	1	17	0
47	Processing	Fruits and vegetables	20	16	3	67	0
48	Processing	Fruits and vegetables	22	11	11	22	0
49	Processing	Fruits and vegetables	46	37	30	61	0
50	Processing	Fish and Seafood	150	150	4	6	0

Annex 2. EXAMPLE BD4FS Senegal-Adapted Food Loss Protocols

To capture food safety and food loss practices, BD4FS utilizes a prerequisites (PRP) diagnosis grid and food loss checklist. This baseline diagnosis document consists of three evaluation grids and three food loss checklists. The first grid is dedicated to the HACCP *prerequisites*, the two others to the “HACCP method” (*preliminary study*, HACCP method implemented in the company). It is important to remember this is not a HACCP certification audit, it is to help companies become HACCP ready.

The following provides an overview of the categories used in a BD4FS food safety and food loss diagnostic audit.

Assessment of the implementation of pre-requisites

Control of contamination sources

Considered Criteria:

- Building conformity
- Supplies
- Implementation of a traceability system
- Pest control
- Contamination originating from staff control
- Hands and premises cleaning

Assessment of the phase of preliminary HACCP study

Assessment conducted following the chronological continuation of the method tasks

Considered Criteria:

- Management and Staff activity engagement
- Description of the product
- Expected use of product
- Draft of the flow diagram
- Verify the flow diagram
- Hazards analysis
- Preventative measures drafting
- Determination of CCPs
- Determination of critical limits for each CCP

Evaluation of implemented Pre-HACCP plan

Assessment conducted following the chronological continuation of the method tasks

Considered Criteria:

- Monitoring systems and calibration for CCP
- Corrective actions
- Establish verification and analysis procedures
- Establish documentation and records keeping

Food Loss Protocol Checklists

Depending on the business and products, one or more sections may apply. Only use the appropriate section based on business activities.

Considered Criteria:

- Setting and Business Parameters
- Organizational Structure, Responsibility, and Management
- Fresh Handling, Packing, Packinghouse Checklist
- Cooling Product
- Transport/Dispatch
- Processing
- Storage/Warehouse Management
- Measurements of Daily Food Loss