Commercial Grain Handling, Storage and Warehousing

Chemonics International Inc.
Module Four:
Commercial Grain Handling Storage and Warehousing

Introduction to the Module

The main objective this Module is to explain basic concepts of Commercial Grain Handling, Storage and Warehousing. It identifies the main types of benefits associated with the use of commercial storage facilities, and related costs.

Commercial storage is an important part of structured trade. Unlike on-farm, village or cooperative stores where farmers store grains for themselves, commercial storage providers have no direct interest in the grain other than the handling and storage charges. This puts them in a position where they can act as collateral managers (see Module 6). In this position, they can guarantee the quality and quantity of the grain in the store and can hold grain on behalf of a financier or buyer. Plus, they offer professional services.

Keeping grain in a commercial warehouse minimizes the risk for commodity financiers and buyers, and puts warehouse operators in a unique position in structured trade systems. Such warehouses make it possible for farmers, traders and buyers to transfer ownership of the grain without having to move it. This makes warehouse receipt systems (Module 6) and commodity exchanges (Module 7) possible.

In part, the aim of this Module is to correct some of the widely held misconceptions over warehousing systems and associated costs.

This Module should be particularly useful to grain traders and extension service providers’ working with smallholder farmers on bulking, aggregating and marketing of cereals and pulses. The Module should be used together with other materials in the Structured Trading Systems (STS) training.

The Module is estimated to take 3 hours and 25 Minutes.
## Module 4 - COMMERCIAL GRAIN HANDLING, STORAGE AND WAREHOUSING

### Module Summary

<table>
<thead>
<tr>
<th>Sessions</th>
<th>Training Methods</th>
<th>Training Materials</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <strong>Introduction to the Module</strong></td>
<td>Presentation</td>
<td>• Participants Handout 1: <em>Module Objectives</em></td>
<td>15 mins.</td>
</tr>
<tr>
<td>2. <strong>Commercial Grain Handling and Storage</strong></td>
<td>Discussion of participants’ experiences</td>
<td>• Participants Handout 2, 3 &amp; 4: <em>Lesiolo Grain Handlers Ltd.</em></td>
<td>20 mins.</td>
</tr>
<tr>
<td>3. <strong>Why Use Commercial Storage Services?</strong></td>
<td>Presentation and Discussion</td>
<td>• Participants Handout 5: <em>Why Use Commercial Storage Services?</em></td>
<td>10 mins.</td>
</tr>
<tr>
<td>4. <strong>Warehousing Contracts</strong></td>
<td>Presentation and Discussion</td>
<td>• Participants Handout 6: <em>What Warehouse Contracts Cover?</em></td>
<td>15 mins.</td>
</tr>
</tbody>
</table>
| 5. **Warehousing Operation.** | Presentation and Discussion | • Participants Handout 7: *Commercial Storage & Warehouse Processes*  
• Participants Handout 8: *Moisture Content & Temperatures*  
• Participants Handout 9: *Warehousing Operations* | 30 mins. |
| 6. **Storage Losses & Costs** | Presentation and Discussion Transportation Cost of Agricultural Produce | • Participants Handout 10: *Types of Losses During Storage*  
• Participants Handout 11: *Educating Farmers About Warehousing* | 30 mins. |
| 7. **Other Risks** | Presentation by Facilitator and Discussion | | 5 mins. |
| 8. **Managing Risks** | Presentation and Discussion | • Participants Handout 12: *Managing Risks* | 20 mins. |
| 9. **Commercial Warehousing in Structured Trade.** | Presentation by Facilitator, and Discussion | | 10 mins. |
| 10. **FIELD TRIP to a Commercial Warehouse.** | Prepare Participants for a Field trip to a Commercial Warehouse and facilitate discussion on Site. | • Facilitate Visit by Participants to a Commercial Warehouse | 120 mins. |

**TOTAL** 3 hours, 25 Mins.
1. Welcome and Introduction.
(Presentation by the Facilitator: 15 minutes)

Welcome to the Module Commercial Grain Handling, Storage and Warehousing.

Centralised bulk storage facilities which receive grain from farmers and safely store it for maybe 12 months or until it can be exported or disposed of domestically, provide a combination of strategic, commercial and buffer storages advantages. Their essential purpose is nevertheless that of long-term operational storage in that they provide a buffer between harvest receivals and the markets or consumers of grain.

The type of store most suitable for a particular situation often depends on the purpose for which it is to be built.

Compared to most other foodstuffs, such as meats and vegetables, grains are relatively easy to store. If grain is kept insect-free and below its safe moisture content, it will keep for many years with minimal loss of quality or nutritional value. Low temperature is an important factor in minimising insect activity and in maintenance of nutritional quality in general.

In a recent World Grain survey it was noted that “Drivers for new construction of large storage facilities are growing population, climate change and water scarcity, as well as increasing industrialization in Asia, Africa and Latin America”. Securing agricultural products in quantity and quality is a growing concern and challenge for many customers. Populations are growing, water scarcity will lead to major changes in grain supplies, and healthy and safe food will become the standard.

There is great demand for new construction at collection points close to the harvest areas, especially in regions where industrialization is not completed yet, the supplier said.

“Furthermore, we see demand for large-size trading terminals to transport the products from countries/regions of cultivation to the people demanding food,” the survey concludes.

Above all, safe and Commercial storage remains an important part of structured trade.

The objectives of this Module, therefore, are that you will be able to improve your understanding of the beneficial utilization of Commercial Warehousing in your Output Marketing trading and improve the benefits to your businesses, by understanding:

1. Commercial Grain Handling and Storage.
2. Why use Commercial Storage Services?
3. Warehousing Contracts.
5. Risks associated with use of Commercial Warehousing and Risk Management.
6. Commercial Warehousing in Structured Trade
7. Undertake a Field Trip to a Commercial Warehouse in the vicinity of the Training.

After considering the objectives could each participant mention one thing you hope to learn in this Module?

2a. Lesiolo Grain Handlers Limited (LGHL)
(Discussion: 10 minutes)

Introduction
Lesiolo Grain Handlers Limited (LGHL) is a grain handling and storage firm in Kenya that handles maize, wheat, barley and sorghum. The company has its own storage facility with a capacity of 30,000 tonnes and has leased another 50,000-tonne facility from the National Cereals and Produce Board. LGHL intends to expand its capacity by 60,000 tonnes by constructing facilities in Nakuru and Kitale. LGHL handles over 100,000 tonnes of grain a year. Its services include grain grading, weighing, cleaning, drying, seed-dressing, fumigation and storage. LGHL was the pilot certified-warehouse operator under the Eastern Africa Grain Council’s warehouse receipting system, launched in 2008. Since then, over 3,000 tonnes of grain have been handled under this system. By storing their grain until the market price is high enough for sale, farmers have benefited from commodity financing and higher margins. LGHL intends to expand its services across East Africa.

This Module covers the commercial storage and warehousing of grain. It describes the advantages of commercial warehouses, how they operate, the types of grain losses that may occur while the grain is in storage, how the warehouse operator deals with risks, and how warehouses fit in the structured grain trading system.

2b. Commercial Grain Handling and Storage.
(Discussion: 10 minutes)

COMMERCIAL GRAIN HANDLING AND STORAGE
Commercial grain handling, storage and warehousing companies are businesses that offer their services to grain depositors (farmers, traders, co-operatives, nongovernmental organizations, etc. who place their grain in the warehouse for a fee). These handling and warehousing companies aim to make a profit. They are answerable to the depositors for the grain left in their custody.

Warehouse operators do not own the grain that they store; they earn their money from the handling and warehousing fees they charge. This means, for example, that if they go bankrupt, the grain cannot be sold off to pay their debts.

Commercial warehouses have to meet certain minimum standards.

They need to have:
• Professional workers trained in grain handling and safety.
• Equipment for weighing, grain analysis and storage.
• Procedures to ensure that the grain is safely handled and stored.
• Security to ensure the safety of the grain, equipment, employees and the public.

Distribute Participants’ Handout 3 and 4.

Figure 16. Lesiolo Grain Handlers’ warehouses in Nakuru, Kenya

WHY USE COMMERCIAL STORAGE SERVICES?

After harvest, farmers are faced with a choice: sell the grain immediately, or store it? If they store it, they have to decide whether to put in their own or a cooperative store, or in commercial storage.

Traders face a similar choice: they can immediately sell the grain they have bought, or keep it until they find a purchaser who is ready to pay the right price.

Commercial storage services offer farmers and traders a number of advantages:

• Lower costs. The farmer or trader does not have to invest in his or her own storage facilities and equipment, or in the staff to manage the grain.
• Storage space. Farmers or traders often have little storage space, or it may be unsuitable for storing grain for long periods. They may have more grain than they can safely store themselves.
• Grain-handling equipment. Individual farmers and traders cannot afford grain-handling equipment such as dryers, cleaners and fans. Commercial grain handlers have such facilities.
• Convenience. When the farmer or trader deposits the grain in a commercial warehouse, the warehouse operator takes over responsibility for handling and storing it, in return for a fee. This leaves the depositor free to do other things.
• Quality management and pest control. Grain storage is one of the major challenges farmers and traders must deal with. Some lack the skills and experience in managing grain on-farm or in cooperative stores, so their grain deteriorates quickly. They may not be allowed to use restricted pesticides (such as phosphine) for fumigation. Commercial grain handlers offer such services at an affordable fee.
• Security. Individual farmers or cooperatives may be unable to protect the grain from thieves, leaky roofs or fire. They may find it difficult to get insurance for a crop in their own store. Commercial grain handlers are normally insured, and are obliged to compensate depositors if the grain is stolen or spoiled. They must be insured if they are to issue warehouse receipts.
• Professional services. Commercial grain handlers provide professional services so they can attract repeat customers, compete with other handlers, and avoid having to compensate depositors for spoilt grain.

The Facilitator should prepare his Flip Chart on Use of Commercial Storage Services ahead of time.

The Facilitator should ensure that there is discussion with participants on each point.

Facilitator to write these up on a Flip Chart in rank order.

Distribute Participants’ Handout 5.
• Transfer of ownership. If the grain is in commercial storage, the grain depositor can sell it to a buyer without having to move it somewhere else. This reduces losses and costs due to bagging or re-bagging, spillage, theft, etc.
• Linkage to markets and structured trade. Some commercial storage providers link farmers and traders to opportunities for structured trade and commodity financing, by issuing warehouse receipts and facilitating commodity financing (see Module 6). Some commercial warehouses also have a network with buyers and can link farmers to better markets (or actually arrange buyers) for the stored grain. Because commercial storage firms store grain from many producers, larger buyers can come there to purchase large quantities of grain. That saves such buyers money: they do not have to go around many places to buy small amounts at each location.

(Presentation and Discussion: 15 mins)

WAREHOUSING CONTRACTS

Normally, when a farmer or trader delivers grain to a commercial grain handler, he or she is given a contract to sign. This is an agreement between the depositor and the warehouse operator to provide certain particular services (such as drying and storage), in exchange for payment in cash or grain (valued at the market price). Box 10 lists the items covered by a typical contract.

<table>
<thead>
<tr>
<th>Box 10. WHAT A WAREHOUSE CONTRACT COVERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>The parties to the contract</td>
</tr>
<tr>
<td>The services requested by the depositor</td>
</tr>
<tr>
<td>Standards to be met</td>
</tr>
<tr>
<td>Payment for the services</td>
</tr>
<tr>
<td>Procedure for delivering or collecting grain</td>
</tr>
<tr>
<td>The handling losses expected</td>
</tr>
<tr>
<td>Responsibilities of the parties involved</td>
</tr>
<tr>
<td>Arbitration, applicable laws and jurisdiction</td>
</tr>
<tr>
<td>Insurance and compensation for losses</td>
</tr>
</tbody>
</table>

Facilitator to lead this process with Participants making their contribution and the role of facilitator mainly being to provide clarity.

List points on the Flip Chart.

Discuss each of the main characteristics of Warehouse Contract via group discussion and produce final list of characteristics.

Distribute Participants’ Handout 6.
5. **Warehousing Operations**  
*(Presentation and Discussion: 30 mins)*

**WAREHOUSING OPERATIONS**

Grain warehousing involves various operations to ensure that grain is in good condition when it is received, and stays in good condition until it leaves the warehouse. The grain from a warehouse should meet certain market standards; depending on its intended use (see Module 3).

The warehouse has the duty to care for the grain in its custody. The grain depositors pay for its services, and they expect to get value for their money.

The warehouse operator keeps track of the services it provides and charges the clients accordingly.

To maintain grain quality, the warehouse has to control various factors that can affect that quality. These include:

- **Biotic factors:** rodents, birds, insects and moulds.
- **Abiotic factors:** grain rubbish, broken kernels, temperature, humidity and moisture content.

Warehousing operations can be divided into:

- **Primary services.** These deal with the grain directly and generate revenue for the warehousing company. They include such services as receipt of the grain, grading, weighing, drying, cleaning, storage, bagging and dispatching. These operations ensure that the grain is put into a suitable condition to be stored for a long time at good quality.

- **Supporting processes.** These make the primary operations efficient and effective. They include quality management, human resource management, inventory management, equipment maintenance, health and safety, and procurement (Figure 17).

Below is a description of the typical commercial grain storage and warehousing processes.

Distribute and walk through in turn Participant Handouts 7, 8, and 9.

The facilitator will have made flip charts with the key points from the handouts and walk participants through, allowing time for questions and clarifications.
Grain sampling, grading and quality management

When a depositor delivers grain to the warehouse, it is first graded. A warehouse staff member takes a sample of the grain for analysis, and checks it against the standards that the warehouse uses (see Module 3). The results of the analysis allow a warehouse operator to accept or reject the grain, and to classify it for storage or marketing.

Grading is part of quality management. This is something that warehouse operators do to monitor and keep the grain at an optimum state throughout the entire handling and storage process. That, in turn, is important because it determines how long the grain can be stored, and how successful the warehousing firm is.

Quality management aims to ensure that:

.kafka The grain received meets some minimum quality standards.
.kafka The moisture content is measured correctly when the grain is received, and it is monitored after drying and during storage.
.kafka The grain is stored only for as long as it is safe, at the right temperature and relative humidity, and these factors are
monitored at appropriate intervals.

- Records of operations on the grain are kept.
- Pest management is carried out appropriately and at the required time, and its effectiveness and efficacy are monitored.

Some countries require that only certified graders are allowed to grade grain.

The graders are normally certified by the national standards body. Grain graders and inspectors need a minimum set of equipment to do their job.

**Weighing and receipt of the grain**

After grading, the next step is to weigh the consignment of grain, using scales, a portable platform or a weighbridge. Knowing the weight provides the basis for storage, handling and trade. It also determines how much the warehouse will charge the depositor. The weighing must be done accurately, and the warehouse must have a certificate showing that the scales have been inspected and calibrated. The depositor may ask to see this certificate.

The warehouse informs the depositor how much he or she has delivered.

After weighing, grading and receiving the grain, the warehouse operator is able to calculate how much grain the depositor is entitled to get back.

The grain entitlement is the amount that was received, less the amount of foreign matter as analysed during grading, and less the amount of moisture that will be lost during drying.

The warehouse operator usually gives the depositor the following documents:

- A weight certificate (e.g., the weighbridge ticket) showing how many kilograms of grain have been delivered.
- A grading certificate showing the results of the grain analysis.
- A goods-received note indicating the ownership of the grain that has been deposited. (In some cases, a weight certificate may act as a goods-received note.)

If the warehouse operates a warehouse receipt system, the
The weight on the warehouse receipt is the weight the depositor is entitled to after accounting for moisture loss and removal of foreign matter.

**Drying**

If the grain contains too much moisture, the warehouse operator will have to dry it so it can be stored for a long time without deteriorating too quickly.

Drying improves storability because it reduces the respiration of the grain, and makes it harder for insect pests and fungi to survive.

Drying may be done by sun drying or using mechanical dryers (see Module 2). Commercial grain storage firms normally use mechanical dryers that blow hot air through the grain to remove the moisture. If the grain cannot be dried straight away, it heats up because of respiration.

That can reduce the viability of grain that is to be used for seed or for brewing, and may encourage heat damage, fungi and eventually pests. To prevent it from deteriorating, the warehouse operator may spread it on a tarpaulin or plastic sheet, or blow cool air through a silo to remove the excess heat.

How long grain can be stored depends on a number of things. Considering just moisture content and temperature:

- At a temperature of 25°C, grain with a moisture content of 22% will keep for only 3–5 days without drying.
- If dried to 13% moisture, the same grain can be stored at the same temperature safely for 160–240 days (Figure 18).

Lower climatic temperatures make it possible to store grain for longer. But the warehouse cannot control climatic temperatures, so must keep the grain well aerated to keep its temperature as low as possible. This makes drying to the right moisture level all the more important.
Inventory control

Inventory control means recording and accounting for the grain the warehouse receives, stores and dispatches. The warehouse makes adjustments on the quantity delivered to reflect the rubbish and any moisture content removed, along with any allowable handling loss. This is a very important part of warehousing and may determine the success of the entire business.

A good inventory management system involves monitoring a number of activities, including identifying and minimizing handling losses, accounting for moisture losses during drying and aeration, accurately determining weights and quality parameters during receipt and delivery of the grain, monitoring quality degradation during storage, mitigating theft, and minimizing grainspillage. It also includes physically verifying the grain in stock. This is done to check that the actual stock in the warehouse is the same as the records indicate. Some firms, banks, collateral managers etc. (Module 6) may require verifications to determine physical quantities.

Storage

Grain is easier to store than many other products. If it is kept free of insects, at a low moisture content and at the right temperature and relative humidity, it will keep for some years with minimal loss of
quality. Warehouse operators fumigate the grain at regular intervals to control pests (see below). In humid areas, the grain may gradually pick up moisture from the air, so the operators may need to dry it again to bring it below the required moisture content.

However, mostly they control this by aerating the grain when the relative humidity is below 65%. The operator needs to check the grain regularly for temperature, moisture content and insect infestation (usually every 2 weeks).

Commercial warehouses maintain a laboratory to conduct these checks.

**Pest management**

Pest management is vital to maintain the quality of grain. It starts when the depositor delivers a consignment of grain. At this time the warehouse operator eradicates any pests (or makes sure they are below an acceptable threshold) by physical treatment (e.g., drying the grain) or chemical means (e.g., fumigation). To choose the best method, the warehouse operator must identify the pests in the grain. Afterwards, the operator must monitor the grain to make sure the control has been effective. Some warehouse operators may require the depositor to deliver grain free from pest infestation, and may reject any grain that is infested.

Most commercial warehouses use mixed pest management. This involves using several methods (both physical and chemical) to keep pests at acceptable levels.

The choice of methods depends on how long the grain will remain in storage.

Some of the methods used merely reduce the incidence of pest infestation.

These include good sanitation (hygiene) and grain-receiving procedures and processes. The warehouse operator samples the grain periodically to decide when and how to treat it. The idea is to keep the cost of managing pests lower than the loss of market value they cause. Most facilities aim at reducing the reliance on chemical interventions: these are used as a last resort.
Bag storage

Grain can be stored in bags or in bulk. Bag storage is more common in small and medium-capacity commercial warehouses. Commercial operators stack bags on wooden or plastic pallets to prevent the grain from getting damp and to make it easier to manage pests. Bag storage requires the bags to be stacked, restacked, loaded and unloaded for operations such as drying and pest control. Fumigation also tends to be more difficult in bag storage than in bulk facilities. These things tend to make bag storage more expensive and labour-intensive than bulk storage.

Piling the bags properly in stacks makes it possible to easily:

- Count the bags when verifying the physical stocks.
- Control pests by covering the stacks with a tarpaulin after applying a fumigant.
- Aerate the grain by leaving gaps between the stacks.
- Receive and dispatch grain.
- Store the maximum amount of grain while leaving gangways between and around the stacks to allow the warehouse to be cleaned and the stock to be inspected.

The stacks must not be too high: they must allow workers to move about on top of them, and be stable so they do not fall over and injure someone or spill the grain.

Bulk storage

Bulk storage involves keeping grain without packaging in a storage structure such as a silo, underground storage or flat store. Bulk storage is more common in large warehouses. It normally involves mixing grain of the same grade and variety (or some other categorization) from several different depositors.

Identity-preserved versus commingled storage

Identity-preserved storage means keeping the grain of each depositor or of a certain type (such as grain from a non-genetically modified variety) separate from the other grain in the warehouse. For example, a cooperative may deliver grain to a warehouse and ask that its identity be preserved. The grain is put in its own silo (or is stacked in bags separately from consignments from other depositors).
If the grain does not fill the silo or the number of bags does not permit a stackup to the maximum permitted height, the extra capacity goes to waste. That is why warehouse operators usually charge more to preserve the identity of grain.

Why should depositors want the identity of their grain preserved? After all, one bag of Grade-1 yellow dent maize is the same as any other. But in practice, depositors may want the identity preserved for various reasons:

- It may be required by their contract.
- They may want to use their own grain for seed.
- They may have grain of a particular quality (such as organic) that they do not want mixed with grain from other sources.

Commingled storage involves putting grain with similar characteristics into the same silo or storage structure. Grade-1 grain from various farmers all goes into the Grade-1 silo or stack, while Grade-2 grain goes into another silo or stack.

This means that the individual depositor’s grain loses its identity. When the depositor withdraws the grain, he or she gets the quantity, grade and variety he or she brought in, but not the exact same grain.

**Dispatch of the grain**

The warehouse may require the grain owners to give prior notice of when they want to collect the grain. This is because the warehouse deals with a number of customers and has to plan how to serve them. For security reasons, the warehouse may also need to know the quantity of grain, who is authorized to pick it up, and the vehicle they will use.

The grain dispatched should meet the specifications in the warehouse contract that the depositor and warehouse operator signed. For example, if the contract says “1,000 kg of Grade-1 yellow dent maize”, the warehouse operator must provide exactly this to the depositor, minus any allowed deductions due to moisture changes, allowable losses, etc. (see below).

If the warehouse operator returns too little grain, or the wrong quality, the depositor may make a complaint, requiring the operator to correct the mistake or compensate for the loss.
6. Storage Losses  
(Presentation and Discussion: 20 mins)

STORAGE LOSSES

Commercial warehouses have to take care of the grain in their custody. Losing or spoiling a customer’s grain is a big problem. Many things can go wrong even with the most diligent warehouse operator. The warehouse may be flooded or catch fire.

It may be damaged in a storm and the grain may get wet. Thieves may break in, or employees may fiddle the records or try to benefit some dubious customers.

Various losses may occur during storage in a warehouse. Some are avoidable; others are unavoidable:

△ Avoidable losses result from improper handling of the grain. Examples are over-drying, pest damage, loss in viability, theft, spillages, flooding, contamination, and using un-calibrated equipment. Warehouse operators should compensate depositors for any avoidable losses.

△ Unavoidable losses result from making the grain ready for safe storage.

Examples are moisture loss due to drying, and the removal of foreign matter and broken grains. Warehouse operators do not have to compensate depositors for unavoidable losses.

Normally, commercial storage service providers are allowed a further 0.5% to 2% handling losses. These are to be expected since machines are not 100% efficient. They should be stated clearly on the handling contract, and the depositor must be made aware of them.

We can also categorize losses into four types: physical, quality, biological, and nutritional (Table 3).

<table>
<thead>
<tr>
<th>Table 3. Types of losses during storage</th>
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</thead>
<tbody>
<tr>
<td>Caused by</td>
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<tr>
<td></td>
</tr>
<tr>
<td>Physical losses</td>
</tr>
<tr>
<td>Loss in grain weight</td>
</tr>
</tbody>
</table>

Distribute Participant Handouts 10 and 11.

Facilitator should lead the discussion from each handout. In doing so be sure to ask participants if they are involved with a particular Agricultural product and/or they have experienced product losses due to shrinkage or other causes and how they have dealt with such losses.
<table>
<thead>
<tr>
<th></th>
<th>Theft, fraud Poor security and stock control Fire, natural disasters Human error</th>
<th>Removal of dust and broken grain</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quality losses</strong></td>
<td>Acceptance of poor grain on arrival Poor storage conditions Grain respiration Insect and mould attacks Drying Flooding Contamination</td>
<td>Loss in quality of grain stored for a long time (e.g., more than 1 year)</td>
</tr>
<tr>
<td><strong>Biological losses</strong></td>
<td>Overheating during drying Grain respiration Insect and mould attacks Fumigants</td>
<td></td>
</tr>
<tr>
<td><strong>Nutritional losses</strong></td>
<td>Pest damage</td>
<td></td>
</tr>
<tr>
<td><strong>Handling losses</strong></td>
<td>Faulty equipment Improper handling</td>
<td>Even well-maintained equipment is not 100% efficient (0.5–2% allowable) (check the warehouse contract)</td>
</tr>
</tbody>
</table>

**Physical losses**

These are losses in the weight of the grain. They may be avoidable or unavoidable:

- Moisture loss due to drying, and the removal of dust and broken grains through cleaning and conveying operations are unavoidable losses.
- Weight loss due to insect infestation and theft is avoidable.

Some types of losses are apparent rather than real. The most common causes are improper weighing of the grain, or inaccurate determination of moisture or rubbish content. These may be caused by defective or inaccurate equipment, or by human error. Fraudulent employees may record the wrong weight and collude with grain depositors. All these things cause the warehouse records to be wrong. Such problems are common in the grain industry, and warehouse operators must guard against them.
### Box 11. Educating Farmers About Warehousing

It is important for warehouse operators to educate farmers about the likelihood of losses during storage. The most frequent complaint is that farmers deposit a certain weight of grain (say, 1,000 kg), and are angry when the warehouse operator returns less than this (say, 950 kg). The warehouse operator must be able to explain the reason for the difference: moisture loss, removal of dirt, handling losses, etc. In addition, the contract must specify the allowable amount of handling losses. When they understand these issues, most farmers readily accept the explanation.

### 7. Quality losses.

*(Presentation and Discussion – 10 mins.)*

#### Quality losses

These are mostly avoidable losses. They are generally caused by grain respiration, moulds and insects. They can result in high protein and uric acid content, toxins, off-flavours, insect excrement, and fragments in the grain (and the end product).

Drying may also cause a loss in the milling quality of the grain. If a warehouse operator does his or her work well, these problems will not occur.

Grain inspectors may downgrade grain damaged by mould and insects, and may classify it as unfit for food or feed. Millers may pay less for grain that has heat damage.

Quality losses are, however, unavoidable when grain is stored for a long time.

For this reason, some commercial warehouses downgrade grain by one grade for every year the grain remains in storage.

#### Biological losses

These are mostly avoidable. An example is the loss in the viability or germinating capacity of grain meant for seed or beer brewing. This is normally caused by heating the grain above 43°C during drying. It may also occur if the grain is harvested with a high moisture content and is not dried promptly: respiration may heat up the grain and damage the germ.
Grains may also lose their viability due to insect and mould attacks. Some fumigants, such as methyl bromide, destroy the viability of seeds.

**Nutritional losses**

These are avoidable losses. In commercial storage, nutritional loss is normally caused by pest damage. Grain that is damaged by insects is less nutritious than whole grain because the pests feed on the germ and endosperm, the most nutritious parts of the grain.

| 8. **Other Risks.** *(Presentation and Discussion with Facilitator taking Lead, 5mins)* |

**OTHER RISKS**

Warehouse operators also have to deal with various other types of risks:

- Disputes arising from non-delivery of grain, non-payment for grain delivered, errors and omissions, and disagreements over ownership of the grain.
- Market-related risks, such as uncertainty about access to the market, including inability to find a buyer and lack of market information, and price risk (such as prices falling instead of rising as expected).
- Policy-related risks, such as import and export bans and subsidies that disrupt normal prices.

The Facilitator should lead the participants in analyzing the risks related to Warehouse operation.

Ask participants to indicate some particular risks they are familiar with, at this moment?

Ask what problems arise when business people do not take into account all the risks involved in doing business and the effect on their profits.

| 9. **Managing Risks.** *(Presentation and Discussion by Facilitator. 20 mins)* |

**MANAGING RISKS**

These risks, and the costs of running the warehouse, push up the

Distribute Participants’ Handout 12.
costs of warehousing. Warehouse operators must try to avoid all these problems but still reduce costs where possible. They should analyse the risks and decide how to manage them. Here are some ways they can do this.

Take normal precautions
The warehouse operator takes normal precautions to reduce the risks.
Some examples:
- Use properly calibrated equipment.
- Have storage facilities inspected and approved.
- Hire competent, well-trained and motivated staff.
- Have robust internal control and monitoring procedures, such as unannounced physical stock audits.

Prepare a disaster-management plan
This contains all possible scenarios that might compromise the firm’s operation, and describes how to avoid them. One possible risk at times of food shortage is that national or local government bodies may decide to seize stocks of grain for “food security” reasons, or to control its price. When prices rise, traders and millers are often, misguidedly, accused of “hoarding”. If stocks are seized, the allocation of loss is important. Does it represent “force majeure” with no blame attached to the warehouse company? Should the loss be shared? Who takes responsibility for legal action for the return of the grain?

Take out insurance
Warehouse operators should have insurance to cover them in the event of a problem, and potential depositors should confirm the warehouse has such insurance. Common forms of insurance cover the operator against:
- Fire, flood, etc.
- Theft. This covers theft of grain from the warehouse by other parties than the employees.
- Mis-performance, whether due to incompetence or fraud, of the warehouse operator’s staff. It should also cover fraud by the top management.
- Political risk and terrorism. Standard insurance excludes risks arising from politics, sabotage and terrorism. Separate cover is needed for these risks.

Go through the points in the Participant Handout 12.
Get certified

The other parties (depositors, banks, buyers and sellers) in grain transactions want to be confident that the warehouse is trustworthy professionally managed and financially secure. Some countries have a certification scheme, where a government or independent agency inspects warehouses and gives them a certificate. Certification is usually a requirement for a warehouse to participate in a warehouse receipt scheme (see Module 6).

Keep workers safe

Commercial storage providers have to operate in a safe environment. In addition to the normal workplace hazards, they also face special types of risks. A dust explosion or fire, for example, can cause injuries and deaths, and can render a company bankrupt very quickly. Injuries in the workplace may result in the company being held liable for huge sums in compensation, and the firm may be shut down if it has a poor safety record. Warehouses and grain-handling facilities must maintain safe working procedures to reduce such hazards.

10. Commercial Warehousing in Structured Trade
(Presentation and Discussion 10mins)

COMMERCIAL WAREHOUSING IN STRUCTURED TRADE

Commercial storage is an important part of structured trade. Unlike on-farm, village or cooperative stores where farmers store grains for themselves, commercial storage providers have no direct interest in the grain other than the handling and storage charges. This puts them in a position where they can act as collateral managers (see Module 6). In this position, they can guarantee the quality and quantity of the grain in the store and can hold grain on behalf of a financier or buyer. Plus, they offer professional services.

Keeping grain in a commercial warehouse minimizes the risk for commodity financiers and buyers, and puts warehouse operators in a unique position in structured trade systems. Such warehouses make it possible for farmers, traders and buyers to transfer ownership of the grain without having to move it. This makes warehouse receipt systems (Module 6) and commodity exchanges (Module 7) possible.
Warehouses used in warehouse receipt systems may be private or public.

Private warehouses
A private warehouse is controlled privately by:
- A trader to store goods for its trading activities
- A group of farmers to store their goods prior to sale
- A processor to store raw materials or finished goods, or
- A wholesaler to manage inventory.

The main business of the controlling company is not warehousing but production, manufacturing, wholesaling or retailing.

From a bank’s point of view, the big disadvantage of private warehouses is security. The bank has no way of knowing that the grain is in fact in the warehouse. The warehouse owner may take the grain away without asking or even informing the bank. Plus, the bank cannot be sure of getting the grain if the borrower defaults on a loan. That makes the bank reluctant to lend money to the owner of grain in a private warehouse.

The solution? Convert the private warehouse into a public warehouse, by putting it under the control of a collateral management company (see Module 6).

Public warehouses (commercial warehouses)

The title “public warehouse” does not mean that the warehouse is managed by the government. Rather, it is a warehouse that is open to the public: anyone can deposit grain there. It is operated by a warehousing company which does not own the grain stored in it. The warehousing company provides a service for a set fee.

It is much easier to establish that bailment (Box 14, Module 6) exists in a public warehouse than in a private warehouse.

There are two types of public warehouses: terminal warehouse and field warehouse.
- Terminal warehouse. A terminal warehouse, or commercial warehouse, is physically separate from the company that owns the grain stored in it. Most terminal warehouses store grain from many different depositors.
- Field warehouse. A field warehouse is a private warehouse that is under collateral management. It is located at or near the company that owns the grain stored in it. The collateral manager
takes control of the warehouse and its contents, so creating a legally independent facility.

### 11. **Field Trip to a Commercial Warehouse.**
*(Presentation and Discussion: 120mins)*

If the Workshop is being held at a location where there exists a Commercial Warehouse; arrangements should be made in advance to seek permission for the participants to visit the facility on an educational trip. Preferably a senior member of the management team of the warehouse should be available to facilitate discussions. A two-hour session should be set aside to undertake the visit; and the Facilitator will prepare delegates in terms of what to expect and the questions they may seek clarification on, including what has been covered in the workshop so far.

Lead Participants in asking relevant Questions, and to seek clarification during the Field Trip to a Commercial Warehouse.

### 12. **Review of Module.**
*(Discussion: 15 mins)*

**Module Review:**
Process the discussion on Participants views from the lessons learnt during the field trip.

The Facilitator should lead the participants in a summarizing their views and lessons learnt during Field Trip to Commercial Warehouse in the area.

Distribute Participants’ Handout 13.

Summarize each of the sessions in this Module, referring to the Flip Charts, Participant Contributions and to the conclusions.

Then the Facilitator should refer back to the Flip Chart with
participant objectives for the Module and ensure that all participants are satisfied and all questions answered.
**PARTICIPANT HANDOUT 1**

**Module Objectives**

<table>
<thead>
<tr>
<th>✴ The benefits of Commercial Grain Handling and Storage.</th>
<th>✴ What constitutes Warehousing Contracts and Warehousing operations?</th>
</tr>
</thead>
<tbody>
<tr>
<td>✴ Why they may need to utilize Commercial Storage Services.</td>
<td>✴ Risks associated with Commercial Warehousing of Grain and how to manage the Risks.</td>
</tr>
<tr>
<td>✴ The value of Commercial Warehousing in Structured Trade.</td>
<td></td>
</tr>
</tbody>
</table>
Figure 16. Lesiolo Grain Handlers’ silos in Nakuru, Kenya

Figure 16. Lesiolo Grain Handlers’ silos in Nakuru, Kenya
PARTICIPANT HANDOUT 4

STATEMENT BY: LESIOLO GRAIN HANDLERS LIMITED

Grain Handling and Storage
We store grain in our 30,000 metric tons capacity silos. Our annual grain handling turnover is on average 110,000 metric tons of grain. Our silos have temperature monitoring systems and are each outfitted with 8 temperature sensors and 2 aeration fans each.

Why use our services? What are the benefits of storing grain with LGHL?

7 Reasons why you should store your grain with us

1. **Lower costs**: you do not have to buy expensive equipment and a storage facility which lies idle the most part of the season, or hire staff to manage the grain. Put your money where it is needed and where it is most productive.

2. **Convenience**: When you deposit grain with us, we take over the responsibility for handling and storage. This leaves you to concentrate with other duties. Leave your grain storage worries to the professionals.

3. **Quality management and pest control**: Grain is a living thing. It heats up, picks or loses moisture and is susceptible to pests. It requires constant monitoring and our staff are there to sample every two weeks to check if it is still okay and whether any corrective action is needed (fumigation, conditioning or aeration). This is why grain stores longer in our silos are compared to when you store it at home.

4. **Security**: When you store grain with us, you are guaranteed to get it back. We have insurance against a number if perils including stock loss, fire, theft, flooding and collapse of silos.

5. **Transfer of ownership**: You could sell grain that you have stored with us and the buyer picks it up from our premises. This saves you the inconvenience of transporting the crop to the buyer and reduces losses and costs due to bagging or re-bagging, spillage, theft en route, etc. Besides, many large buyers like buying bulk and prefer buying from grain handlers like Lesiolo Grain Handlers.

6. **Linkage to markets and commodity financing**: We link farmers and traders to various market opportunities including commodity financing. We have a network with buyers and can link farmers to better markets. Moreover, we are certified to issue **Warehouse Receipts** which are recognized by commercial banks. This allows you the client to use your grain as collateral for a loan. Learn more about warehouse receipting...

7. **Agrégation**: We store grain from many producers; larger buyers come here to purchase large quantities of grain. That saves such buyers money- they do not have to go around many places to buy small amounts at each location.
WHY USE COMMERCIAL STORAGE SERVICES?

Commercial storage services offer farmers and traders a number of advantages:

- **Lower costs.** The farmer or trader does not have to invest in his or her own storage facilities and equipment, or in the staff to manage the grain.

- **Storage space.** Farmers or traders often have little storage space, or it may be unsuitable for storing grain for long periods. They may have more grain than they can safely store themselves.

- **Grain-handling equipment.** Individual farmers and traders cannot afford grain-handling equipment such as dryers, cleaners and fans. Commercial grain handlers have such facilities.

- **Convenience.** When the farmer or trader deposits the grain in a commercial warehouse, the warehouse operator takes over responsibility for handling and storing it, in return for a fee. This leaves the depositor free to do other things.

- **Quality management and pest control.** Grain storage is one of the major challenges farmers and traders must deal with. Some lack the skills and experience in managing grain on-farm or in cooperative stores, so their grain deteriorates quickly. They may not be allowed to use restricted pesticides (such as phosphine) for fumigation. Commercial grain handlers offer such services at an affordable fee.

- **Security.** Individual farmers or cooperatives may be unable to protect the grain from thieves, leaky roofs or fire. They may find it difficult to get insurance for a crop in their own store. Commercial grain handlers are normally insured, and are obliged to compensate depositors if the grain is stolen or spoiled. They must be insured if they are to issue warehouse receipts.

- **Professional services.** Commercial grain handlers provide professional services so they can attract repeat customers, compete with other handlers, and avoid having to compensate depositors for spoilt grain.

- **Transfer of ownership.** If the grain is in commercial storage, the grain depositor can sell it to a buyer without having to move it somewhere else. This reduces losses and costs due to bagging or re-bagging, spillage, theft, etc.

- **Linkage to markets and structured trade.** Some commercial storage providers link farmers and traders to opportunities for structured trade and commodity financing, by issuing warehouse receipts and facilitating commodity financing (see Module 6). Some commercial warehouses also have a network with buyers and can link farmers to better markets (or actually arrange buyers) for the stored grain. Because commercial storage firms store grain from many producers, larger buyers can come there to purchase large quantities of grain. That saves such buyers money: they do not have to go around many places to buy small amounts at each location.
### BOX 10. WHAT A WAREHOUSE CONTRACT COVERS

<table>
<thead>
<tr>
<th>The parties to the Contract</th>
<th>E.g., a Farmer or Farmer Group and the Warehouse operator.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The services requested by the depositor</td>
<td>E.g., Drying, cleaning and storage</td>
</tr>
<tr>
<td>Standards to be met</td>
<td>See Module 3</td>
</tr>
<tr>
<td>Payment for the services</td>
<td>In terms of money or grain of equivalent value</td>
</tr>
<tr>
<td>Procedure for delivering or collecting grain</td>
<td></td>
</tr>
<tr>
<td>The handling losses expected</td>
<td>See the section on Storage losses below</td>
</tr>
<tr>
<td>Responsibilities of the parties involved</td>
<td></td>
</tr>
<tr>
<td>Arbitration, applicable laws and jurisdiction</td>
<td>The jurisdiction is the Country whose laws will be used to settle disputes</td>
</tr>
<tr>
<td>Insurance and compensation for losses</td>
<td></td>
</tr>
</tbody>
</table>
Primary and supportive commercial storage and warehousing processes

Figure 17: Primary and supportive commercial storage and warehousing processes
Moisture Content and Temperatures

Figure 18. The lower the moisture content and the cooler the temperature, the longer grain will keep.
### Warehousing Operations

<table>
<thead>
<tr>
<th><strong>Primary services:</strong> These deal with the grain directly and generate revenue for the warehousing company.</th>
<th>Below is a description of the typical commercial grain storage and warehousing processes.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Supporting processes:</strong> These make the primary operations efficient and effective.</td>
<td></td>
</tr>
<tr>
<td><strong>Grain Sampling, Grading and Quality Management</strong></td>
<td>When a depositor delivers grain to the warehouse, it is first graded. A warehouse staff member takes a sample of the grain for analysis, and checks it against the standards that the warehouse uses.</td>
</tr>
<tr>
<td><strong>Weighing and receipt of the grain</strong></td>
<td>After grading, the next step is to weigh the consignment of grain, using scales, a portable platform or a weighbridge.</td>
</tr>
<tr>
<td><strong>Grain Cleaning</strong></td>
<td>The grain has to be cleaned to remove dirt, sticks, stones, metal and other foreign matter. Warehouses have equipment to do this.</td>
</tr>
<tr>
<td><strong>Drying</strong></td>
<td>Drying improves storability because it reduces the respiration of the grain, and makes it harder for insect pests and fungi to survive.</td>
</tr>
<tr>
<td><strong>Inventory Control</strong></td>
<td>Inventory control means recording and accounting for the grain the warehouser receives, stores and dispatches.</td>
</tr>
<tr>
<td><strong>Storage</strong></td>
<td>Grain is easier to store than many other products. If it is kept free of insects, at low moisture content and at the right temperature and relative humidity, it will keep for some years with minimal loss of quality.</td>
</tr>
<tr>
<td><strong>Pest Management</strong></td>
<td>Pest management is vital to maintain the quality of grain. It starts when the depositor delivers a consignment of grain.</td>
</tr>
<tr>
<td><strong>Bag Storage</strong></td>
<td>Grain can be stored in bags or in bulk. Bag storage is more common in small and medium-capacity commercial warehouses.</td>
</tr>
<tr>
<td><strong>Bulk Storage</strong></td>
<td>Bulk storage involves keeping grain without packaging in a storage structure such as a silo, underground storage or flat store. Bulk storage is more common in large warehouses.</td>
</tr>
<tr>
<td><strong>Identity-Preserved versus Commingled Storage</strong></td>
<td>Identity-preserved storage means keeping the grain of each depositor or of a certain type (such as grain from a non-genetically modified variety) separate from the other grain in the warehouse. Commingled storage involves putting grain with similar characteristics into the same silo or storage structure.</td>
</tr>
<tr>
<td><strong>Dispatch of the Grain</strong></td>
<td>The warehouse may require the grain owners to give prior notice of when they want to collect the grain. This is because the warehouse deals with a number of customers and has to plan how to serve them.</td>
</tr>
</tbody>
</table>
## Table 3. Types of losses during storage

<table>
<thead>
<tr>
<th>Types of Losses</th>
<th>Avoidable</th>
<th>Unavoidable</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Caused by</strong></td>
<td>Poor management</td>
<td>Making the grain ready for safe storage</td>
</tr>
<tr>
<td><strong>Physical losses</strong></td>
<td>Insect infestation</td>
<td>Moisture loss due to drying Removal of dust and broken grain</td>
</tr>
<tr>
<td>Loss in grain weight</td>
<td>Spillage</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Theft, fraud</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Poor security and stock control</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fire, natural disasters</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Human error</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Moisture loss due to drying</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Removal of dust and broken grain</td>
<td></td>
</tr>
<tr>
<td><strong>Quality losses</strong></td>
<td>Acceptance of poor grain on arrival</td>
<td>Loss in quality of grain stored for along time (e.g., more than 1 year)</td>
</tr>
<tr>
<td>Loss in grain quality</td>
<td>Poor storage conditions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grain respiration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Insect and mould attacks</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Drying</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flooding</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Contamination</td>
<td></td>
</tr>
<tr>
<td><strong>Biological losses</strong></td>
<td>Overheating during drying</td>
<td></td>
</tr>
<tr>
<td>Loss in viability or germinating capacity</td>
<td>Grain respiration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Insect and mould attacks</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fumigants</td>
<td></td>
</tr>
<tr>
<td><strong>Nutritional losses</strong></td>
<td>Pest damage</td>
<td></td>
</tr>
<tr>
<td>Loss in nutritional value of the grain</td>
<td>Faulty equipment</td>
<td>Even well-maintained equipment is not 100% efficient</td>
</tr>
<tr>
<td></td>
<td>Improper handling</td>
<td>0.5–2% allowable (check the warehouse contract)</td>
</tr>
<tr>
<td><strong>Handling losses</strong></td>
<td>Faulty equipment</td>
<td></td>
</tr>
<tr>
<td>Loss in weight due to handling</td>
<td>Improper handling</td>
<td></td>
</tr>
</tbody>
</table>
Box 11. Educating Farmers About Warehousing

It is important for warehouse operators to educate farmers about the likelihood of losses during storage. The most frequent complaint is that farmers deposit a certain weight of grain (say, 1,000 kg), and are angry when the warehouse operator returns less than this (say, 950 kg). The warehouse operator must be able to explain the reason for the difference: moisture loss, removal of dirt, handling losses, etc. In addition, the contract must specify the allowable amount of handling losses. When they understand these issues, most farmers readily accept the explanation.
# MANAGING RISKS

## Warehouse operators also have to deal with various other types of risks:

<table>
<thead>
<tr>
<th>Other Risks</th>
<th>Disputes arising from non-delivery of grain, non-payment for grain delivered, errors and omissions, and disagreements over ownership of the grain.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Market-related risks, such as uncertainty about access to the market, including inability to find a buyer and lack of market information, and price risk (such as prices falling instead of rising as expected).</td>
</tr>
<tr>
<td></td>
<td>Policy-related risks, such as import and export bans and subsidies that disrupt normal prices.</td>
</tr>
</tbody>
</table>

## Take Normal Precautions

The warehouse operator takes normal precautions to reduce the risks. Some examples:

- Use properly calibrated equipment.
- Have storage facilities inspected and approved.
- Hire competent, well-trained and motivated staff.
- Have robust internal control and monitoring procedures, such as unannounced physical stock audits.

## Prepare a Disaster-Management Plan

This contains all possible scenarios that might compromise the firm’s operation, and describes how to avoid them. One possible risk at times of food shortage is that national or local government bodies may decide to seize stocks of grain for “food security” reasons, or to control its price.

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Warehouse operators should have insurance to cover them in the event of a problem, and potential depositors should confirm the warehouse has such insurance.

## Keep Workers Safe

Commercial storage providers have to operate in a safe environment. In addition to the normal workplace hazards, they also face special types of risks.
## Private warehouses

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- A group of farmers to store their goods prior to sale
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- A wholesaler to manage inventory.

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## Public warehouses (commercial warehouses)

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