Information Systems for Grain Storage in Brazil

Prof. José Vicente Caixeta-Filho and Thiago Guilherme Péra

ESALQ-LOG

New Delhi, India
November 9th 2016
Outline for this presentation

• Overview of grain storage in Brazil
• Our project: Information Systems for Grain Storage in Brazil
• Providers of grain stock information in Brazil
Overview of grain storage in Brazil

Why is grain storage important?

- Product quality conservation
- Supply in the off-season of the product
- Commercialization strategy to maximize profit or revenue

Long queues (storage on wheels)

Storage under open sky
Overview of grain storage in Brazil

Current scenario of storage

• Inadequacy of existing facilities (poor conditions in some production regions)
• Inadequate location (large distances -> higher logistics costs for farmer)

Storage capacity: 147 million t

Grain production*: 265 million t

Storage deficit: 45%

* Grains: oats, rye, barley, beans, sunflower, corn, soybean, sorghum, wheat and triticale

Sources: Conab and IBGE
Overview of grain storage in Brazil

Defficiency in the capacity installed on the farms ...

Source: Conab
Overview of grain storage in Brazil

Distribution of storage capacity by region¹:

<table>
<thead>
<tr>
<th>Grain storage capacity (% of production)</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 30%</td>
<td>10%</td>
</tr>
<tr>
<td>From 31% to 60%</td>
<td>35%</td>
</tr>
<tr>
<td>From 61% to 90%</td>
<td>30%</td>
</tr>
<tr>
<td>From 91% to 120%</td>
<td>15%</td>
</tr>
<tr>
<td>From 121% to 150%</td>
<td>5%</td>
</tr>
<tr>
<td>Over 151%</td>
<td>5%</td>
</tr>
</tbody>
</table>

¹ Micro-region level at Brazilian Midwest
Overview of grain storage in Brazil

STORAGE BENEFITS

Current scenario with poor storage infrastructure

- Price
- Harvesting
- Logistic costs

Concentrated flows

Scenario with additional storage infrastructure

- Price
- Harvesting
- Logistic costs

Less concentrated flows

Source: NovaAgri
Information Systems for Grain Storage in Brazil:

- To perform research on key storage features, especially on agricultural products (soybean and corn)

  - Reduce information asymmetry on the market
  - Storage rates
  - Locational models for warehouses
  - Investment analysis
  - Qualitative analysis
  - Strategic storage use
Information Systems for Grain Storage

Method

- **Identification** of the soybean and maize warehouses
- Primary data **collection**

Data analysis

Results (Prices)
Information Systems for Grain Storage

- Data collection **by phone**
- Collected **data**:  
  - Storage **rate**  
  - Storage **capacity**  
  - Receiving and shipping **flows**  
  - Stored **grains**  
  - Current **investments**
- **Frequency**: Annual
- **Consulted agents**: around 100 companies (cooperatives and warehouses)
- **Available** (free) on: http://esalqlog.esalq.usp.br/siarma
Storage Tariff

It consists of three types of rates:

- **Fixed Rate**: it refers to the charge related to the use of warehouse, regardless of the storage period. It includes the reception operations, pre-cleaning, drying (it was adopted the standard of 17% of moisture), purge and shipping operations.

- **Variable Rate**: it refers to the rate of the storage operation for a period of 30 days, after the grace period negotiated.

- **Technical Loss**: it refers to the contractual tolerance related to the physical losses during storage service, in %.

For each product and region, there are grace periods in which only the fixed rate is charged. After such a period, the storage rate starts to be charged accordingly.
Storage Price

It refers to the price of storage service, charged for a specific period in the contract. It is calculated according to the previously reported rates, and it can be calculated by the following equation:

\[ P_{ARM_{i,n}} = TF_i + \frac{(n - c_i)TV_i}{30} + qt_i \cdot pc_i \]

for \( n < c \), \( TV_i = 0 \)
PARM_{i,n} = TF_i + \frac{(n - c_i)TV_i}{30} + qt_i pc_i

for n < c, TV_i = 0

where:

- \textit{PARM}_{i,n} is the storage price for the region }i\textit{, for }n\textit{ days stored (R$/t);} 
- TF_i is the fixed rate of the use of warehouse in the region }i\textit{, regardless of the storage period (R$/t);} 
- TV_i is the variable rate related to the operation of storage in region }i\textit{. Usually, this rate is negotiated for thirty-day contracts. In this case, it was decided to standardize the rate based on the number of days of storage.}
- n is the number of days the grain get stored. 
- c is the number of days of the grace period. 
- qt_i is the technical loss (%). 
- pc_i is the price of the grain (R$/t).
## Indicators of average parameters for storage fee - Soybeans

<table>
<thead>
<tr>
<th>Average Parameters</th>
<th>Unit</th>
<th>GO</th>
<th>MT</th>
<th>MS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grace period (c)</td>
<td>Days</td>
<td>29</td>
<td>41</td>
<td>20</td>
</tr>
<tr>
<td>Variable Rate (TV)</td>
<td>R$/t</td>
<td>R$ 4,95</td>
<td>R$ 4,12</td>
<td>R$ 4,92</td>
</tr>
<tr>
<td>Fixed Rate (TF)</td>
<td>R$/t</td>
<td>R$ 22,96</td>
<td>R$ 24,31</td>
<td>R$ 23,04</td>
</tr>
<tr>
<td>Technical Losses (qt)¹</td>
<td>%</td>
<td>0,30</td>
<td>0,30</td>
<td>0,30</td>
</tr>
<tr>
<td>Price of the grain (pc)²</td>
<td>R$/t</td>
<td></td>
<td>R$ 1.177,50</td>
<td></td>
</tr>
<tr>
<td>Technical Losses in R$/t (qt x pc)</td>
<td>R$/t</td>
<td>R$ 3,53</td>
<td>R$ 3,53</td>
<td>R$ 3,53</td>
</tr>
</tbody>
</table>

Amounts related to the standard moisture of 17%

¹ Technical Losses (qt): represent the amount of losses tolerated by contract in the storage operations (% of the amount stored).

² Soybean price: April/2015; Source: Cepea/ESALQ-USP
### Indicators of average parameters for storage fee - Corn

<table>
<thead>
<tr>
<th>Average Parameters</th>
<th>Unit</th>
<th>GO</th>
<th>MT</th>
<th>MS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grace period (c)</td>
<td>Days</td>
<td>28</td>
<td>40</td>
<td>15</td>
</tr>
<tr>
<td>Variable Rate (TV)</td>
<td>R$/t</td>
<td>R$ 6,16</td>
<td>R$ 4,18</td>
<td>R$ 3,42</td>
</tr>
<tr>
<td>Fixed Rate (TF)</td>
<td>R$/t</td>
<td>R$ 21,57</td>
<td>R$ 26,21</td>
<td>R$ 23,55</td>
</tr>
<tr>
<td>Technical Losses (qt)¹</td>
<td>%</td>
<td>0,30</td>
<td>0,30</td>
<td>0,30</td>
</tr>
<tr>
<td>Price of the grain (pc)²</td>
<td>R$/t</td>
<td></td>
<td>R$ 488,33</td>
<td></td>
</tr>
<tr>
<td>Technical Losses in R$/t (qt x pc)</td>
<td>R$/t</td>
<td>R$ 1,46</td>
<td>R$ 1,46</td>
<td>R$ 1,46</td>
</tr>
</tbody>
</table>

Amounts related to the standard moisture of 17%

¹ Technical Losses (qt): represent the amount of losses tolerated by contract in the storage operations (% of the amount stored).

² Corn price: April/2015; Source: Cepea/ESALQ-USP
Information Systems for Grain Storage

- **Integrated platform**: freight prices, storage prices, soybean prices, static regional storage, production and export statistics
  - Strategic information for **decision makers**
  - **Logistics management support** information
    - Scenario customization
**Sistema de Informações de Armazenagem - Simulador de estratégias logísticas**

**Estática de Armazenagem**

**Preços de comercialização**

**Indicadores de Armazenagem**

**Indicadores de Fretes**

**Parâmetros**

**INDICADORES DE ARMazenagem**

- **Preço de armazenamento (R$/t):**
  - $y = 0,1352x + 30,036$
  - $R^2 = 0,9883$

- **Preço de armazenamento (R$/m3):**
  - $y = 15,478x^{-0,201}$
  - $R^2 = 0,999$

**INDICADORES DOS PREÇOS DE FRETES RODoviÁRIOS**

- **Indicador do Preço do Frete - Sorriso (MT) Paranaguá (PR) - R$/t**
  - Janeiro: R$ 260
  - Fevereiro: R$ 255
  - Março: R$ 270
  - Abril: R$ 280
  - Maio: R$ 290
  - Junho: R$ 300

**INDICADORES DOS PREÇOS DE SOJA**

- **Indicadores dos preços de soja - R$/t**
  - Janeiro: R$ 1,200
  - Fevereiro: R$ 1,250
  - Março: R$ 1,300

**RECEITA LÍQUIDA GERADA COM A ESTRATÉGIA LOGÍSTICA ADOPTADA**

- **R$ 94,82 / tonelada**

**Armazenagem em Abril e Comercialização em Junho**

**Impacto dos custos logísticos no preço de comercialização da soja**

**AVALIAÇÃO DE RECEITA LÍQUIDA LÍQUIDA A PARTIR DO CENÁRIO LOGÍSTICO DE ARMazenAGEM EM ABRIL**

<table>
<thead>
<tr>
<th>Período</th>
<th>Receita Líquida (R$/t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Janeiro</td>
<td>1,000,00</td>
</tr>
<tr>
<td>Fevereiro</td>
<td>900,00</td>
</tr>
<tr>
<td>Março</td>
<td>800,00</td>
</tr>
<tr>
<td>Abril</td>
<td>700,00</td>
</tr>
<tr>
<td>Maio</td>
<td>600,00</td>
</tr>
<tr>
<td>Junho</td>
<td>500,00</td>
</tr>
</tbody>
</table>

**INDICADORES DE CAPACIDADE DE ARMazenAGEM**

- **Produção de grãos (mil t):**
  - 29,256,72

- **Capacidade de Armazenagem (mil t):**
  - 20,120,42

- **Estrada de Ferro: (mil t):**
  - 31,174,18

**Período de 2015**

- **Estrada de Ferro Regional de Sorriso:**
  - -9,125,99

- **Produção de grãos:**
  - -20,311,05

**Produção / Capacidade de armazenagem / Déficit:**

- **Índice de produção:**
  - 51,485,22

**Índice de armazenamento:**

- **Índice de comercialização:**
  - 51,485,22
Providers of grain stocks

**Institution:** National Company of Food Supply (Conab)

Each warehouse in Brazil must have a register at Conab (public information system)

- **Private stocks** for coffee and rice
- **Public stocks** for wheat, sugar, cotton, peanuts, coffee, cassava, beans, corn, soybean, jute, sorghum, milk and others

**Type of information provided:**

- Volume, spatial distribution (by state level) and segment of storage

**Method (private stock):** Questionnaires application by post / e-mail to several registered agents at the public information system of Conab

**Frequency:** annual survey
Providers of grain stocks

**Institution:** Brazilian Association of Vegetable Oil Industries (Abiove)

**Private stocks** for soybean, soymeal and soy oil.

**Type of information provided:**
- Supply, demand, exports and stocks (national level)

**Method:** ABIOVE performs a survey about the soybean volume used by companies with activities in the soybean industry.

**Frequency:** monthly
Our Information Systems

SIFRECA – INFORMATION SYSTEMS FOR FREIGHT VALUES

SIARMA – INFORMATION SYSTEMS GRAIN STORAGE

LOGISTICS STRATEGIES SIMULATOR (SIFRECA AND SIARMA INTEGRATED TOOL)
Available on: http://esalqlog.esalq.usp.br/?p=4826
Thank you!

For further information:

http://esalqlog.esalq.usp.br

+ 55 (19) 3429.4580

email: thiago.pera@usp.br