Predictive Analytics in Pork Production

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Senior Manager, Pork Productivity Solutions, Zoetis
An Innovative Predictive Analytic Model

1. What is Predictive Analytics?
2. Application to the Pork Industry
3. Why is this Different?
4. Hogistics, What is it and How does it work?
5. Producer Experiences
6. Questions & Answers
Predictive Analytics by Definition

Predictive Analytics…

Encompasses a variety of statistical techniques from modeling, machine learning, and data mining that analyze current and historical facts to make predictions about future events.

In business, predictive models exploit patterns found in historical and transactional data to identify risks and opportunities.

Models capture relationships among many factors to allow assessment of risk or potential associated with a particular set of conditions, guiding decision making transactions.
So What is Computer Simulation Modeling?

Computer Simulation Modeling…

The imitation of a dynamic and variable system using a computer model in order to evaluate and improve system performance.

In a field of simulation, a discrete event simulation (DES), models the operation of a system as a discrete sequence of events in time.

- Each event occurs at a particular instant in time and marks a change of state in the system.
- Between consecutive events, no change in the system is assumed to occur, thus the simulation can directly jump in time from one event to the next.
Why Do We Simulate?

...to avoid the risk in the error of averages

*I wonder if I have the right “Target Weight” defined to maximize profit this summer.*

**Avg. Depth**

10 ft.

**Danger of basing decisions on averages**
Complex dependencies can lead to **unintended consequences**

Systemic interdependencies and “Real World” variability will **INCREASE** the likelihood that **decisions produce unintended consequences**
Whiteboard and Brute Force

- Can’t answer complex questions
- or
- Help make strategic decisions
Current Pork Production Analytics

Commercial & Customized

Numerous and commercial and home-grown database systems used to collect, organize and utilize data, yet none use sophisticated discrete event simulation (DES) modeling.

No broadly accepted standard solutions to accurately, effectively or dynamically predict growth, mortality and weight distribution in wean-grow-finish phase.
Challenges with Current Practices

- Excel spreadsheets do not deal with variability or change with respect to time.
- Monte Carlo/Excel simulation deals with variability, yet neglects the effect of time-based effects.
- Lack of confidence in the “static” nature of current tools for both operational and strategic purposes.
- DES does not exist in current pork production modeling systems... Until now!
Hogistics – What is it?

An automated, data-driven, predictive analytic model that:

- Acts like a pork producer’s **own production system**
- Takes into account **historical** and **behavioral** aspects of the producer’s finishing operation
- **More accurately** predicts weight, pig flow, mortality and weight distribution by week on feed
- Enables **precise** and **faster** marketing **decision-making**
Producer Subscribes to a Weekly Report

The initial deliverable of Hogistics is the Weight Prediction Report

- Predicts dynamic pig weight over time
- Identifies the high probability “Top Out” week
- Aids Marketing Specialists by informing them of what pigs in what quantities will be available
- Provides the spread of weights of all other pigs so producers can plan follow on cuts
- Web Enabled (downloadable and printable)
### Weight Prediction Report

<table>
<thead>
<tr>
<th>Group</th>
<th>Pig Flow</th>
<th>Prod Wk</th>
<th>Prod Wk</th>
<th>WOF</th>
<th>Deaths</th>
<th>Mkt Hog Sales</th>
<th>Avg Wt Sold</th>
<th>Avg MIN Wt</th>
<th>Avg MAX Wt</th>
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<th>Pig Count</th>
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**Predicted Weight Buckets**

- **221**: 14
- **240**: 11
- **260**: 13
- **280**: 12
- **300**: 18

**Actual Weight Buckets**

- **221**: 14
- **240**: 11
- **260**: 13
- **280**: 12
- **300**: 18

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**Daily/Weekly Weight Prediction Report**

(Not Selling tab)

**WEIGHT ‘BUCKETS’**

How many pigs in what buckets

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**WEIGHT BY WOF**

- How many pigs by weight range?
### Daily/Weekly Weight Prediction Report

**(Selling tab)**

#### Weight Prediction Report

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<tr>
<th>Group</th>
<th>Pig Flow</th>
<th>Start Date</th>
<th>Prod Wk</th>
<th>WOF</th>
<th>Deaths</th>
<th>Mkt Hog Sales</th>
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#### Average Weight If You Sold This Many

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<th></th>
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<th>180</th>
<th>360</th>
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<th>Avg Wt Entire Group</th>
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<td>301.3</td>
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#### Predicted Weight Buckets

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<th>221</th>
<th>240</th>
<th>260</th>
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<th>281</th>
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<td>4</td>
<td>11</td>
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#### WOF Data

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<tr>
<th>WOF</th>
<th>Deaths</th>
<th>Mkt Hog Sales</th>
<th>All Other Outs</th>
<th>Avg Wt Sold</th>
<th>Avg MIN Wt</th>
<th>Avg MAX Wt</th>
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<td>231.5</td>
<td>283.9</td>
<td>14.6</td>
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</table>

**Actual Sales Data**

- First Cut
- 2nd Cut
- 3rd Cut
For me, putting the most amount of pigs in the grid is the primary objective. Everything else revolves around that.

If you get your timing right, you're going to hit those packer grids more consistently.

Right now, you could be scheduling them before you mark them.

If I can eliminate trial and error by having more accurate information, that would help us a lot to make improvements.

Advanced warning of market weight
Hitting the grid more often
Efficient use of manpower
Reduces guess work

zoetis
hogistics™
How Does Hogistics Work?

It is the integration of these historically relevant data sets with status data and true predictive modeling that has not been tried.

And what will make this a robust and repeatable process.
Hogistics Uses Feed to Produce Weights

Utilizing cumulative feed intake tuned with producer historical growth, we have a robust way to more accurately predict pig weight over time.

In addition, the solution has the ability to have the individual Grower-based hog weight population spread on each growth curve.

Pig Weight = Anchor * (Cumulative Feed Intake) ^ Shapea

Pig Weight

Cumulative Feed Intake

Hogistics
zoetis
Hogistics Accounts for Reality

Realistic effects can then be layered on top of the growth curve over time

- Seasonality (summer heat)
- Virtually any other initiative may be modeled (disease outbreaks, etc)

\[ \text{Pig Weight} = \text{Anchor} \times (\text{Cumulative Feed Intake})^\text{Shapea} \]
**Hogistics Accounts for Reality**

**Seasonality Effect Sample**

- Weekly effect of seasonality represented as a % of feed intake above or below the average across any year

**Seasonality Contour vs. Year Week Number**

- Last 9 Wks
- Current Wk
- Next 9 Wks
- Avg
Hogistics Demo

Web Portal Sign-In
Questions & Answers