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Optimizing and Rationalizing Product Portfolio for the Poultry Processing Industry

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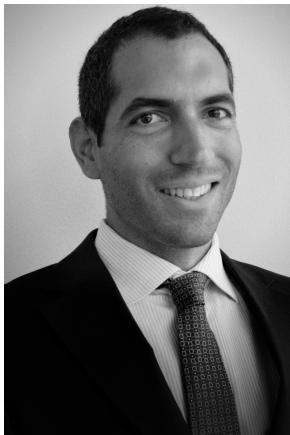
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Optimizing and Rationalizing Product Portfolio for the Poultry Processing Industry

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Summary: Apart from the poultry industry's micro- and macro- economic challenges, its products' fixed nature is perhaps the most pervasive decisive factor affecting its effectiveness. The chicken part imbalances that emerge, ensuing from the uneven demand of different poultry part products, result to huge opportunity costs and processing inefficiencies for the industry, as the industry's processing capacity is utilized by both useful and wasteful poultry yield. Consequently, this thesis aims to identify the forces that influence the poultry industry's profitability and processing efficiency by improving its usefulness output yield ratio.



José Carlos Frances Xanthakos holds a bachelor's degree in Management from Bentley University. Prior to joining the MSCM program at the Malaysia Institute for Supply Chain Innovation, José Carlos worked in the Apparel & Fashion Industry as a Director of Retail Operations, International Business Development Manager, and Retail Area Manager for a leading European corporation and was involved in a start-up in the Food & Beverage Industry, focusing his efforts primarily on strategic planning, brand development, project management, and process development.

KEY INSIGHTS

1. The high demand imbalances of different chicken parts that occur in the poultry processing industry result in huge waste outputs for the industry if the excess chicken parts cannot be consumed, affecting both the industry's potential profitability level and its processing efficiency.
2. Improving a poultry processing plant's processing efficiency by reducing its waste output can boost substantially the plant's overall potential profitability with only a disproportionate increase in its processing capacity utilization, if required.
3. If the demand for poultry products can change or shift following certain market stimuli, the industry may not only improve its processing efficiency and therefore overall profitability, but also improve further its potential profitability by selling same chicken part products with higher contribution margins.

Introduction

CKN Corporation¹ is a member of a leading Malaysian food manufacturer enterprise, operating in the poultry processing industry. It currently operates one of the largest broiler² processing plants in Malaysia, able of processing up to 6,000 birds per hour with a plan to fivefold its daily processing capacity by 2015. The group also operates parent stock farms, broiler breeding farms, and feed mills, which increases its control over the broiler chicken quality and supply, as well as its costs, gross margins, and reliability in meeting its processed poultry demand with highly competitive prices, classifying it as an integrator³.

CKN Corporation has emerged as the preferred supplier to all the major market segments in the country ranging from the international fast food chains, hypermarkets, supermarkets, hotels, restaurants, and airlines to food manufacturers, offering a wide range of processed poultry products.

Research Scope and Methodology

While CKN Corporation may have an advantage over several of its competitors, as it is part of an integrator group, its

¹ Identities of the sponsoring company and its channel partners have been withheld on request.

² Young chickens that are bred and raised for commercial meat production are referred to as “broilers” in the industry literature. In this paper, the terms “broiler”, “broiler chicken”, and “poultry” will be used interchangeably.

³ An individual company is called an integrator when it performs all or most aspects of production. In the poultry industry, integrators maintain the ownership of the birds over their entire life cycle.

profitability is still threatened by the industry’s mature nature, demand variability, and declining profit margins. Moreover, the fixed nature of poultry products increases the complexity of planning for production and managing the poultry processing plant so that it can meet market demand in a profitable and efficient way.

As poultry product demand varies significantly not only on a day-to-day basis but also on a ‘part-to-part’ basis, it has become imperative for the industry that it explores alternative avenues for improving profitability other than changing its production capacity, quality offering, or product characteristics. Therefore, dealing with these chicken part demand imbalances has created a huge challenge for the industry on how to optimize and rationalize its product portfolio in order to achieve the highest possible earnings. Moreover, as contribution margins for the same processed poultry SKUs⁴ differ among customers of different market segments, another challenge arises on how to market and allocate goods to multiple market segments.

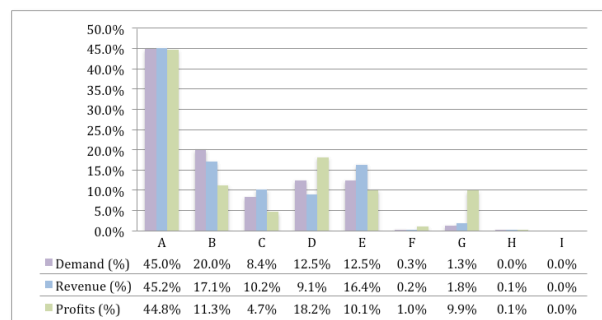


Figure 1: Demand, Revenue, and Profits percentage of processed SKUs to the total of CKN Corporation per

⁴ A stock-keeping unit or a SKU is a unique identifier assigned to each of a company’s distinct products or services that can be sold to their client.

market segment (A,B,...,I), from January 1, 2012 to October 31, 2012

Source: CKN Corporation

Consequently, revenue management turned out to be a logical approach to optimize CKN Corporation's product portfolio within each of its market segments to increase its competitiveness in the industry while reducing its processing costs and increasing its operational efficiencies through the process. However, balancing the market's requirements for product proliferation with the industry's effort for product diminution creates yet another challenge.

This thesis aims to provide essential input for the optimization of the poultry industry's product portfolio, by analyzing the industry's structure, summarizing relevant literature review, studying the company's SKUs by market and product segmentation, developing a model to run the optimization, and analyzing the results to identify ways to improve the industry's profitability and processing efficiency.

The research questions addressed in this thesis are:

- Q1: What is the best way to optimize revenue for the poultry industry given the constraint of its product's fixed body part nature?
- Q2: What are the forces that influence the industry's profitability and processing efficiency subsequent to the persisting chicken part demand imbalances that occur?

Consequently, the revenue management optimization performed has focused on improving the industry's per bird contribution margin of its processed broilers, while simultaneously reducing the

waste produced from the processing of the same broilers following the demand imbalances of different chicken parts that occur by understanding the relationships between its market segments, product types, and single SKUs.

Market Segment	Wings	Legs	Breast
A	55.9%	--	71.5%
B	54.7%	25.7%	--
C	39.0%	7.5%	--
D	--	41.1%	27.3%
E	92.6%	74.0%	--
F	--	89.8%	99.5%
G	--	100.0%	100.0%
H	100.0%	--	100.0%
I	54.1%	--	2.4%
TL	38.4%	19.5%	--

Table 1: Waste percentage per chicken part of total poultry processed per market segment of CKN Corporation, from January 1, 2012 to October 31, 2012

Source: CKN Corporation

Model Overview

The determination of what quantity combinations of each SKU for each market segment to produce is an important and major management decision, as the production output at the end of each time interval will determine the level of production effectiveness and process profitability of the company.

This revenue management model has two highly interconnected objectives:

- First. Maximize the per bird contribution (profit) of the company, and
- Second. Minimize the per bird waste (levy) produced by the

demand or forecasted demand fulfillment.

The aim of this model is to identify the model dynamics that affect the per bird contribution and waste to improve the industry's effectiveness subject to different fulfillment discrepancy allowances, different per chicken part maximum processing allowances, different volume price discounts, chicken part composition constraints, and attaining customer satisfaction, while producing within the plant's maximum capacity.

The linear programming optimization equation that is solved for this problem is⁵:

$$\begin{aligned}
 Z^* = & \left[\left(\sum_{i=1}^n \sum_{j=1}^m (Q_{ij} \times C_{ij}) + \sum_{i=1}^n \sum_{j=1}^m (R_{ij} \times F_{ij}) \right) \right. \\
 & \div \left(\max \sum_{i=1}^n \sum_{j=1}^m \left(\frac{(Q_{ij} + R_{ij}) \times p_i}{b_i \times p_i} \right) \right) \\
 & + \left[\left(\sum_{i=1}^n \sum_{j=1}^m (D_{ij} + Y_{ij}) \right) \right. \\
 & \left. - \left(\max \sum_{i=1}^n \sum_{j=1}^m \left(\frac{(Q_{ij} + R_{ij}) \times p_i}{b_i \times p_i} \right) \right) \right. \\
 & \left. \times \sum_{i=1}^n \sum_{j=1}^m (X_{ij} \times b_i) / \sum_{i=1}^n \sum_{j=1}^m X_{ij} \right) \times g \\
 & \left. \div \left(\max \sum_{i=1}^n \sum_{j=1}^m \left(\frac{(Q_{ij} + R_{ij}) \times p_i}{b_i \times p_i} \right) \right) \right]
 \end{aligned}$$

The above revenue management model has been built to yield different production outputs per SKU and market segment from the company's actual or forecasted demand.

⁵ For more information on the whole problem, with constraints and variable definitions, refer to the Thesis subsection "Model Formulation"

The different model outputs have resulted from changes in the following variables for 2 distinct demand or forecasted demand and product type model sample sets of 27 runs each:

- Minimum required order fulfillment percentage of the original order or forecast of the company
- Maximum output allowance of each chicken part or SKU for each market segment
- Discount applied on each SKU for each market segment that can be used to stimulate a demand increase or a demand shift to a different direction
- Maximum processing capacity of the plant

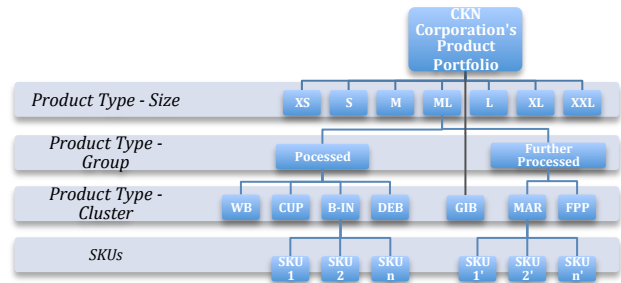


Figure 2: Illustration of CKN Corporation's product portfolio structure used in the optimization

Source: CKN Corporation

Data Analysis and Conclusion

Following the 27 optimization runs performed for each demand or forecasted demand and product type model sample set, Figure 3 and Figure 4 below display the resulted scatter point plots of the per bird profit contribution and waste levy per model run for sample set 1 and 2⁶. The x-axis portrays the waste levy per bird,

⁶ For more information on the sample sets used, refer to the Thesis subsection "Model Runs"

growing from left to right, and y-axis the profit contribution per chicken, growing from bottom to top. The values displayed are in proper scale when compared one to another; however, their distance from the axes is disproportionate.

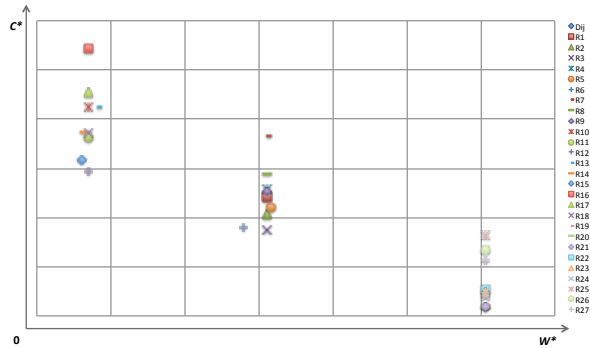


Figure 3: Consolidated scatter chart of the per bird profit contribution and waste levy for sample set 1

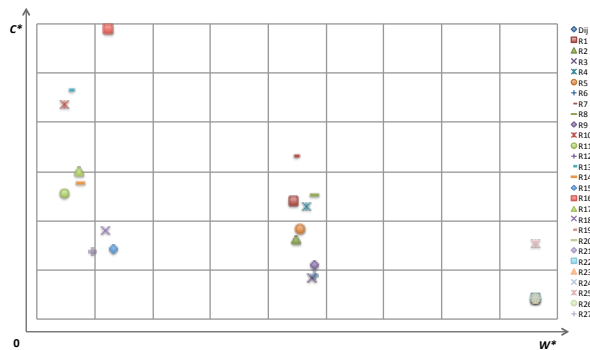


Figure 4: Consolidated scatter chart of the per bird profit contribution and waste levy for sample set 2

Both models seem to have the same three outcome consortiums from a low profit contribution and high waste levy on the far right, an average profit contribution and waste levy in the middle, and a high profit contribution low waste levy on the far left. Moreover, the outcome locations on the chart of each model run of each sample set reflect more or less one another, which verifies the uniformity of the result among the industry's different product type SKUs to equal adjustments in minimum order fill rate, maximum processing capacity, and discount rate allowances.

The models' conclusions are as follows:

First, the runs with a higher permitted production allowance over demand per chicken part produced the highest return in the per bird profit contribution and waste levy if assuming that all processed quantity can be sold, as the excess production resulted to a lower waste output and an increased useful yield, which not only increased the company's expected profitability, but also the plant's processing efficiency.

As processing capacity is a perishable quality, it is essential that it is used as productive as possible. Hence, improving processing efficiency should be an important priority of the company, as a minute increase in its capacity utilization, with the goal of improving processing efficiency, yields a disproportionately large increase in its total profits.

Second, the runs with a lower required order fulfillment rate also produced the highest return in the per bird profit contribution and waste levy, as the model suggested alternative same part SKUs to fulfill the quantity ordered in a more profitable way. If customers can be influenced to move part of their orders, or eventually the whole of their orders to include SKUs with higher contribution margins of the same chicken part they initially desired, huge profitability improvements can be achieved in the poultry processing industry.

Moreover, this parameter can be used to prioritize SKUs to customers and market segments to optimize customer service levels with the plant's overall profitability. As not all customers and market segments bear the same weight and as live broiler supply in terms of size is almost as variable

as poultry product demand, a service output prioritization will optimize the available supply of live birds to customers' orders, in terms of contribution margin, volume, contract engagements, or desired customer satisfaction.

And last, the runs with a zero discount policy also produced the highest return in the per bird profit contribution and waste levy, as zero discounts return the highest contribution margins. However, as discounts can stimulate a growth and shift of ordered SKUs in demand, they were included in this exercise to demonstrate that providing discounts on the quantity sold over a customer's initial order fulfilled can still improve the company's per bird and overall profitability while facilitating the improvement of the plant's efficiency by reducing its total waste output.

To conclude, as revenue management is about understanding, predicting, and influencing customer behavior, if the company's minimum order fulfillment rates, maximum processing output per chicken part, and discount pricing policies are adjusted to meet its customers' service expectations and willingness to pay, CKN Corporation will not only manage to optimize its processing plant's profitability, efficiency, and level of service from the exploitation of its opportunity costs, but also rationalize its product portfolio to provide the right product, to the right customer, at the right time, at the right price.