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Abstract

In response to inquiry from Sole Pineapple Co., BC Consulting engaged in efforts to improve resource management and cost efficiency while remaining within current company demands and guidelines. This technical summary explains modeling details for recommended Sole Pineapple Co. implementation changes. These details include: problem decomposition, methods and mathematical modeling, assumptions, model output interpretation, and anticipated benefits alongside recommendations from technical insights.

Sole Pineapple CO. ResourcE management

Technical Report: Lead Analyst, Blake Conrad

Technical Report:

Sole Pineapple Co. Resource Management

Lead Analyst, Blake Conrad

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[(all pineapples produced will be sold) 5](#_Toc505147453)

[(current demands are an accurate reflection of the future) 5](#_Toc505147454)

[(inflation rates and additional costs may effect the way the model is interpreted) 5](#_Toc505147455)

[(assumes pineapple prices do not change) 5](#_Toc505147455)

(more assumptions[) 5](#_Toc505147455)

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Table 1: Amount of acres’ issued for each field to produce each product

Table 3: Product information, standards, and constraints.

Table 2: Supplier information, standards, and constraints.

**Technical Report** – Longer, more in-depth paper guiding an engineer through your analysis. After reading the technical report, the engineer should be able to repeat your methods and arrive at the same conclusion.

**1st section – Introduction 1-2 paragraphs**

* Problem statement
* Methods Used
* Recommendation
* Anticipated benefits

**2nd Section –** Assumptions

Make clear the assumptions you make in your analysis (eg. Constant demand, arrival times follow these distributions, maximum investment amount, minimum adjusted return rate, etc.)

**Next Sections –** Methods and Analysis

Go through every step of the methods you applied to reach your conclusion. Again, the engineer should be able to replicate what you did exactly and reach the same conclusion.

**Describe decision variables, sets and parameters.**

**Describe the objective function in English, then give the mathematical notation.**

**Describe each constraint in English followed by the math.**

**Analysis.**

**Analyze the output of the computer.**

**Recommendation and conclusions**

Clearly identify what you recommend the company do.

Some solutions are best represented with words AND figures/tables. (Calendars, production schedules, projected profit graphs, percent of resource utilization over time, etc.)

State projected outcomes – “Our analysis projects a cost savings of…”

Based on the analysis, which method worked best / what you learned from the analysis

Restate Recommendation

Projected Outcome of accepting recommendation “This will save…” or “This will boost profits by…%”

Future work. Find something that remains lacking in their system or a future project based on your analysis.

Introduction

**Problem Statement**

After a thorough discussion with Sole Pineapple Co. Chief Officer of Operations, specific problem patterns continue to arise; resource management. The company at large continues to struggle with fully utilizing its resources to maximize benefit. This causes Sole Pineapple Co. to lose out on a higher stream of income each fiscal year from its current operations. *Problem Statement* definitions from executives in Sole Pineapple Co. have resulted from this prolonged issue:

*“Sole Pineapple Co. must determine if current revenue, cost, and profit generation can be increased by better utilization of pre-existing field resources and pineapple products.”*

**Methods Used, Recommendation, and Benefits**

The results from the analysis show a clear ability to better utilize Sole Pineapple Co. resources. With fiscal year 2017 profits yielding $10,000,000, BC Consulting projects with no additional resources and the exact same field suppliers, fiscal year 2018 profits can yield as high as $76,350,000 (see *Assumptions* for more factors to this profit). This shows a projected $7.6 dollar increase this year for every dollar of Sole Pineapple Co. profits last year; over a 700% change. These benefits can be leveraged by simply restructuring the amounts of acres used from each supplier for particular products. This is shown in *Table 1*.

Table 1: Amount of acres’ issued for each field to produce each product

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Optimal Acre Distribution | Juice  (Gallons) | Whole  (Pounds) | Crushed  (Pounds) | Sliced  (Pounds) |
| Field 1 | 7500 | 10000 | 5000 | 17500 |
| Field 2 | 30000 | 0 | 0 | 0 |
| Field 3 | 22500 | 0 | 5000 | 17500 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Amount of Acres for each Product** | **Juice (Gallons)** | **Whole (Pounds)** | **Crushed (Pounds)** | **Sliced (Pounds)** | Total Acres |
|
| **Field 1** | 11666.7 | 20000.0 | 4000.0 | 4333.3 | 40000.0 |
| **Field 2** | 13333.3 | 0.0 | 8000.0 | 8666.7 | 30000.0 |
| **Field 3** | 35000.0 | 0.0 | 0.0 | 0.0 | 35000.0 |
| **Total Product** | 60000 | 20000 | 12000 | 13000 |  |

Assumptions

**Profit Factors**

Factors involved in the ability to obtain a consistent profit for fiscal year 2018 as 2017 include: supplier, product, political, and economic fluctuation. Supplier fluctuation may occur when costs by field, shipping costs, maintenance, labor costs fluctuate in any varying degree, or the ability to obtain new suppliers. Any and all of these ripple effects will either directly or indirectly influence the costs, revenues, and profits. Product fluctuation may be any cost involving the products themselves, these charges may occur in the event pineapples or the processes that induce pineapple change. Examples of product flux could include risk in the ability for a product to actually contain the quality the supplier issued or additional products available for creation and purchase to the general public. Political and economic fluctuation can cause more ripple effects than any, including FDA restrictions on pineapples, minimum wage standards changes, cost of living, increase CO2 emissions placing restrictions on food industry standards, competition in the food industry, inflation or any other legal changes that influence the way people can or choose to do commerce in the food industry. Perhaps the greatest assumption of all is that the pineapples produced are sold; no excess, spoilage, or inability to sell. All of these varying degrees of risk, change, and influence have been scoped out of the analysis to enable a robust and quantifiable solution on the current problem statement.

Analysis

## **Decision Variables, Sets, and Parameters**

The process to solve this problem begins with the *Problem Statement*,

“*Sole Pineapple Co. must determine if current revenue, cost, and profit generation can be increased by better utilization of pre-existing field resources and pineapple products.”*

After decomposing this problem, we were able to acquire more information about the suppliers and products; pre-requisite information is listed in *Table 2* and *Table 3*. Before beginning, a single tableau was constructed to represent all information to be input into the excel solver. Initial efforts involved *LINGO*, a product of LINDO Systems Inc., however this approach was abandoned to a sufficient working solution in Excel.

*Table 2:*

Supplier information, standards, and constraints.

|  |  |  |
| --- | --- | --- |
| Field Information | **Grade** | **Maximum Acres** |
| **Field 1** | 9 | 40000 |
| **Field 2** | 7.5 | 30000 |
| **Field 3** | 7 | 50000 |

*Table 3:*

Product information, standards, and constraints.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Product  Information | **Juice (Gallon)** | **Whole**  **(Pound)** | **Crushed**  **(Pound)** | **Sliced**  **(Pound)** | **Pineapple Per Acre** |
| **Pineapple Conversion** | 0.5 | 1 | 1 | 1 | 1000 |
| **Cost** | 0.2 | 0.05 | 0.3 | 0.25 |  |
| **Revenue** | 1.5 | 1.75 | 1.25 | 1.25 |  |
| **Average Quality** | 7.5 | 9 | 8 | 8 |  |
| **Maximum Production** | 30000000 | 20000000 | 50000000 | |  |
| **Minimum Production** | 10000000 | 10000000 | 10000000 | 10000000 |  |

Acquiring necessary and sufficient information for the problem, mathematical definitions are to become defined to represent the real world system of our problem statement. First, clear understanding of how many fields and how many products at hand must be understood. Alongside fields and products, we must understand what must be able to change across any given combination of products and fields. Both of these representations are defined in *Equation 1*, which will be referred to for the remainder of this report.

*Equation 1*:

Representation of decision variables in resulting analysis.

Decision variable will be utilized to represent information about fields and products. Throughout the report we will show combinations of these variables and how they will represent total amounts of products, pineapples, and acres. More derivation of the explicit definitions listed in *Equation 1 are* defined in *Equation 2* to address more detailed information.

*Equation 2*:

How decision variables in combination represent the system.

Total Juice Produced (Gallons)

Total Whole Pineapples Produced (Pounds)

Total Crushed Pineapples Produced (Pounds)

Total Sliced Pineapples Produced (Pounds)

Total Field 1 Acres Used

Total Field 2 Acres Used

Total Field 3 Acres Used

Total Field 4 Acres Used

After seeing definitions in *Equation 2* to represent total amounts of products produced and fields used, costs and revenues can become defined to represent an objective function which will display how each decision variable interacts with the whole.

**Objective Function**

An objective to the problem reflects the current problem statement. We can say that we want to maximize the total amount of profit made from products across all fields of production; . This is represented as a two-fold equation with revenue and costs. The total revenue must represent the amount of positive cash flow brought in from each acre given to a product. Contrary, the total cost must represent the amount of negative cash flow incurred from each acre given to a product. We represent both and their corresponding relationship in *Equation 3*.

*Equation 3*:

Component and aggregate level view of the objective function.

Product Cost – Maintenance & Shipping Cost

**Constraints**

**Model Output and Interpretation**

Conclusion

## **Recommendation**

## **Appendices A**

References

*Linear Programming* <https://en.wikipedia.org/wiki/Linear_programming>

*Excel Solver* [*https://en.wikipedia.org/wiki/Solver*](https://en.wikipedia.org/wiki/Solver)

*Problem Statement* [*https://en.wikipedia.org/wiki/Problem\_statement*](https://en.wikipedia.org/wiki/Problem_statement)

*LINGO* [*https://www.lindo.com/index.php/products/lingo-and-optimization-modeling*](https://www.lindo.com/index.php/products/lingo-and-optimization-modeling)