Optimizing Profit for the Hershey Company

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Growing COCOA for Good

COCOA IS ONE OF THE MOST IMPORTANT INGREDIENTS

we use at The Hershey Company, so its long-term availability—and the well-being of the communities that cultivate it—is a top priority.

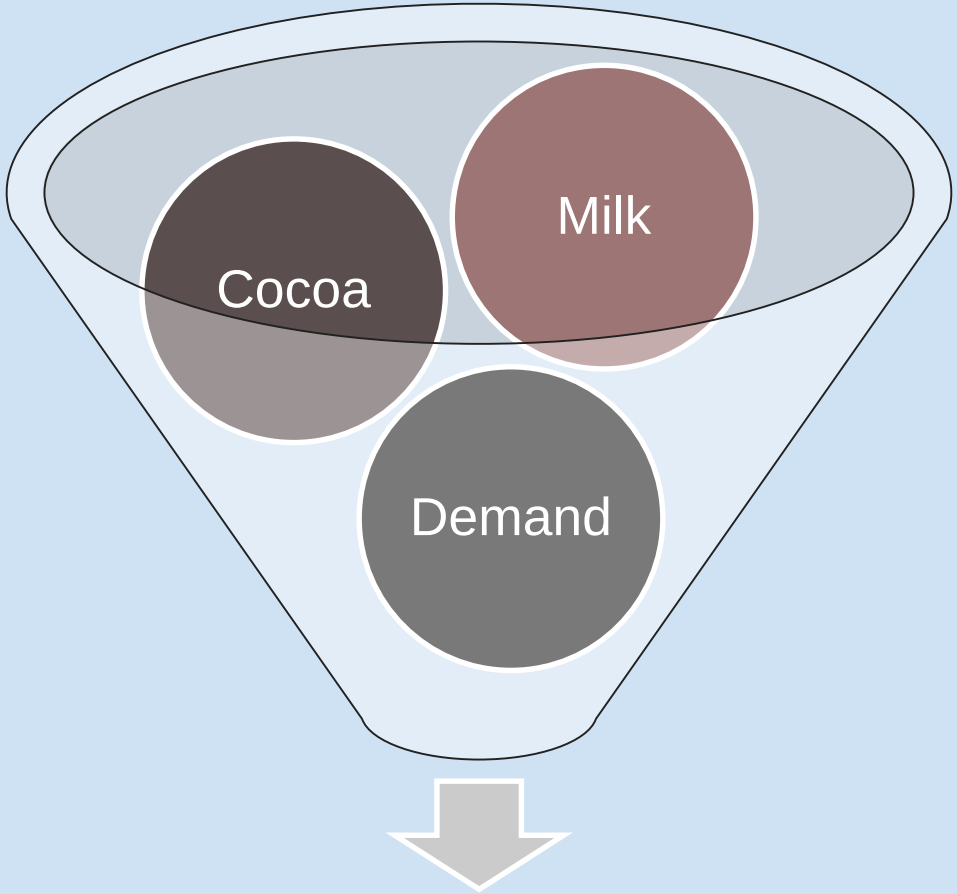
In late 2012, we committed to purchasing 100 percent certified and sustainable cocoa by 2020. At the end of 2016, we were more than halfway to our goal, certifying 60 percent of our cocoa as sustainable. But to truly make cocoa "sustainable," certification alone is not enough. We have also been creating programs and initiating partnerships that allow us to bring agricultural best practices, health and community infrastructure, and entrepreneurship education to cocoa communities.

Taken together, these approaches are helping advance sustainable farming practices while improving living standards for cocoa farmers, and their communities, across our cocoa supply chain.


Greenland
Canada
North Pacific Ocean
North Atlantic Ocean
South Pacific Ocean
South Atlantic Ocean
Almonds
Milk Fat
Mexico
Cuba
Colombia
Brazil
Bolivia
Paraguay
Argentina
Iceland
Norway
Sweden
Germany
Belarus
Ukraine
Spain
Turkey
Tunisia
Algeria
Libya
Egypt
Mali
Niger
Sudan
Iraq
Iran
Saudi Arabia
Democratic Republic of the Congo
Madagascar
South Africa

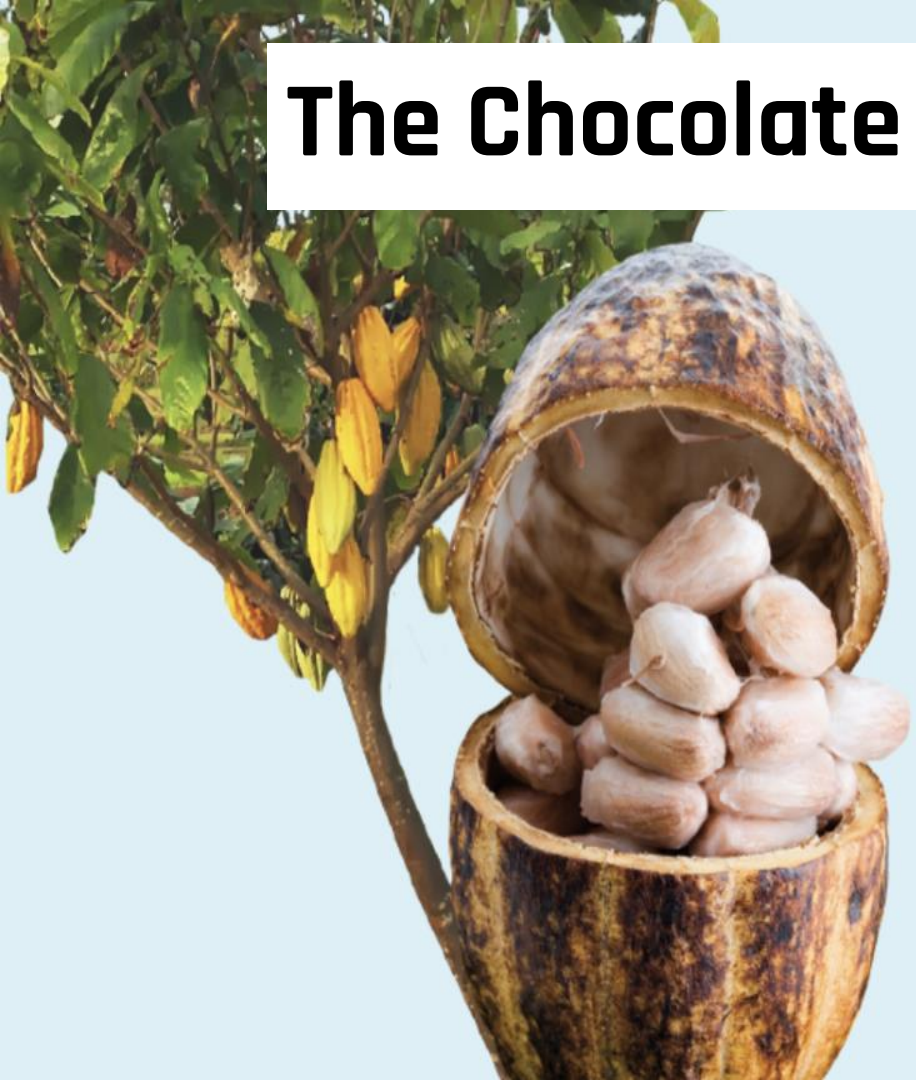
SOURCEMAP

Central Question



Maximize the monthly profit of the Hershey's Kiss department given weekly constraints

The Chocolate Making Process



It all starts with the cacao pod

- Seeds dry and ferment (about 1.5 weeks)
- Roasted to bring out flavor
- Winnowed to get the nibs
- Conching -> chocolate liquor

Cocoa

Organic Cocoa Proportionality

- Currently set at 60%
- Goal is 100% by 2020

Minimum and Maximum Cocoa Supply

- The range of cocoa to be ordered to proportionally compliment milk supply

Locally Sourced Milk

- Milk is mixed with sugar and condensed, then mixed with unsweetened chocolate
- Variables: amount purchased weeks 1-4 & carryover inventory
- Constraints: demand & supply

Machine Hours

- Roast the beans for 35 minutes
- Pick out the nibs (called winnowing)
- Nibs are ground into chocolate powder
- Mixed with milk and sugar
- Next, conching begins to create chocolate (up to 16 hours)
- Pour into molds and let dry
- 70 million Hershey’s Kisses per day

Constraints, Production & Resources

- Machine Hours
  - Reflects total max production capacity
  - Hugs require 10% more machine hours
- Labor Hours
  - Capacity of production workers
  - Converted into units of production

Demand

- The demand for Kisses & Hugs are based off an estimate of weekly production capacity with fluctuating demand across the weeks of the month to simulate realistic commercial variability
- Other demands such as cocoa, milk, and milk chocolate are based off the estimates of total factory production capacity
- Whatever amount that exceeds the weekly demand carries over and is stored to be used in a later's week production

Constraints - Product Demand

Maximize

- Monthly Profit

Subject To

- Four Weeks of Constraints

- Projected Profit
- Interpret Results

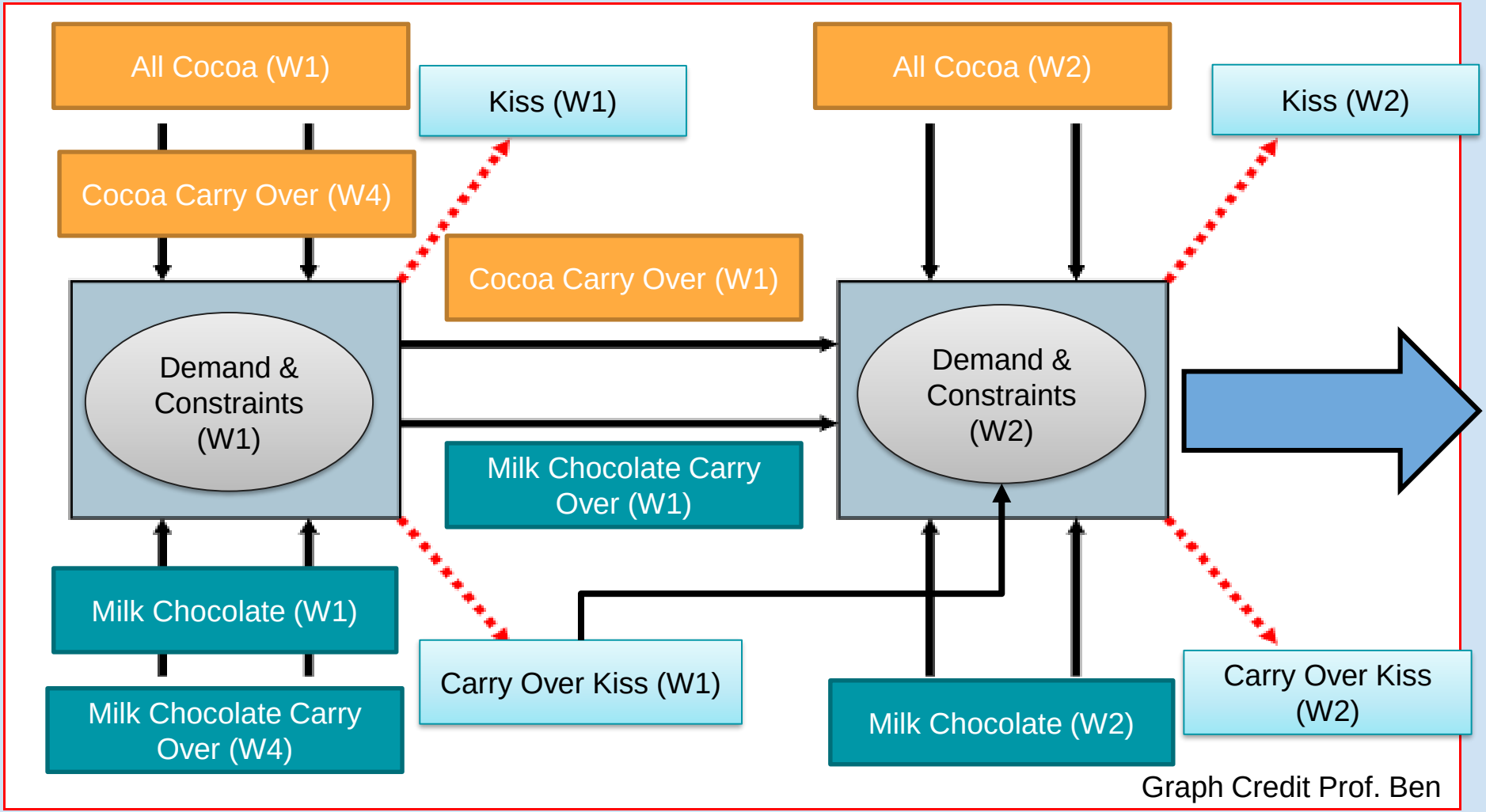
$$= \sum_{\{Week\}}^{4} \sum_{i=1} S_{i,x}X_i - S_{i,y}Y_i - S_{i,z}Z_i$$

$S_i = Profit|Loss$

$X_i = Demand\ of Product$ [2]

$Y_i = Inbound\ Supply$ [4]

$Z_i = Carry\ Over\ Supply$ [5]


All Cocoa (W1)
Kiss (W1)
All Cocoa (W2)
Kiss (W2)
Cocoa Carry Over (W4)
Cocoa Carry Over (W1)
Demand & Constraints (W1)
Demand & Constraints (W2)
Milk Chocolate Carry Over (W1)
Milk Chocolate (W1)
Carry Over Kiss (W1)
Carry Over Kiss (W2)
Milk Chocolate Carry Over (W4)
Milk Chocolate (W2)
Graph Credit Prof. Ben

Constraints - Production - Input Demand

Demand Cocoa, Demand Milk & Demand Milk Chocolate

- Calculates resource needs based on units produced
- Constraint is set to equal 0 so that no product is wasted
- Can be adjusted to reflect waste goals

CaK	3	-0.075	-											
CaK	4	-0.075	-											
H	1	0.0435	20,825,000	pieces		Demand	W1	Milk	0	=	0			
H	2	0.0435	17,150,000			Demand	W2	Milk	0	=	0			
H	3	0.0435	-			Demand	W3	Milk	0	=	0			
H	4	0.0435	17,150,000			Demand	W4	Milk	0	=	0			
CaH	1	-0.075	-	pieces										
CaH	2	-0.075	29,400,000			Supply	W1	Milk Choco	0	=	0			
CaH	3	-0.075	-			Supply	W2	Milk Choco	0	=	0			
CaH	4	-0.075	-			Supply	W3	Milk Choco	0	=	0			
						Supply	W4	Milk Choco	0	=	0			
		Total Profit	**$**	**28,729,465**										
		Revenue	$	69,273,750.00		Machine Hours	W1	K+H	418,582,500	≤	490,000,000			
		Costs	$	(40,544,284.87)		Machine Hours	W2	K+H	445,655,000	≤	490,000,000			
						Machine Hours	W3	K+H	490,000,000	≤	490,000,000			
						Machine Hours	W4	K+H	344,715,000	≤	490,000,000			
Profit at 60% Organic			**$**	**29,617,559.00**										
						Demand	W1	Kiss	395,675,000	=	395,675,000			
Profit at 100% Organic			**$**	**27,841,371.00**		Demand	W2	Kiss	325,850,000	=	325,850,000			
						Demand	W3	Kiss	558,600,000	=	558,600,000			
Loss			**$**	**(1,776,188.00)**		Demand	W4	Kiss	325,850,000	=	325,850,000			
						Demand	W1	Hug	20,825,000	=	20,825,000			
						Demand	W2	Hug	17,150,000	=	17,150,000			
						Demand	W3	Hug	29,400,000	=	29,400,000			
						Demand	W4	Hug	17,150,000	=	17,150,000			

Input of Gross Daily Factors

Cocoa Organic Proportion	
80%	
Minimum Daily Milk Supply	
300,000	gallons
Maximum Daily Milk Supply	
350,000	gallons
Minimum Daily Cocoa Supply	
35,475	pounds
Maximum Daily Cocoa Supply	
41,388	pounds
Minimum Daily Milk Chocolate Production	
322,500	pounds
Maximum Daily Milk Chocolate Production	
376,250	pounds
Operating Hours per Day	
24	
Days Open per Week	
7	

Total Profit	
$	(574,220,396)

Manually Adjustable Variable

Auto-Calculated Variable

% of Milk in MC
12%
% of Cocoa in MC
11%
of Workers
5
% of Machine Uptime
100%
Kisses Demand Proportion
95%
Hugs Demand Proportion
5%
Proportion of Total Production
1.5%


Q & A


Thank You