



Identifying Post Seasonal Missed Sales Opportunities using Automated Data Analysis

Bria Garcia (Project Manager), Brooke Larkin, Ty Martindale, Hector Ramos, and Alejandro Torrico
2018-2019 University of Arkansas Industrial Engineering Capstone Experience



Introduction

The Hershey Company is a global snacking powerhouse and the undisputed US leader in confection, producing iconic products like Reese's, Hershey's Kisses, and Jolly Ranchers. Not only does The Hershey Company produce these products year-round, but they also have a large portfolio in four traditional seasons: Valentines, Easter, Halloween, and Holiday. The Strategy, Planning, and Analytics (SPA) team at the Bentonville office is tasked with identifying missed sales opportunities (MSOs) after each completed season. They also provide the sales team with additional information during negotiations with Walmart. The process of identifying MSOs can be completed by following three different methods:

- Method 1: when the on-hand inventory is zero during a season.
- Method 2: when the on-hand inventory does not meet demand and when the on-hand inventory is zero during a season.
- Method 3: accounting a proportion of method two's MSOs based on each store's performance index.

Our team was tasked with automating the methods of identifying MSOs in order to decrease the time of the analysis. This deliverable consists of our tool, The S.M.O.R.E.. Our team also created an optimization model that acts as an extra selling point for Hershey.

Baseline Analysis

To evaluate Hershey's current system, we decided to use Lean Six Sigma practices because it puts a focus on minimizing waste and reducing variation. To spot these occurrences, the value stream mapping method shown below was most useful because it visualized the flow of information needed to perform Hershey's analysis and it highlighted problems and inefficiencies in the process.



The two red symbols on the map identify the main problem areas within Hershey's Seasonal Analysis process. The first red symbol recognizes issues within the analysis for finding missed sales opportunities performed by the SPA team. Our former contact, Matthew Kleinlauth, states "the current process is very manual, and lengthy." Therefore, since analysts don't have a lot of extra time to spare, they cannot perform an in depth analysis that better represents the total amount of missed opportunities.

Different methods can have very large variances in results. Therefore, the method used by the analyst has a major impact on the recommendations given for how much more or less of each product Walmart should buy. The second red symbol identifies problems with the communication of the completed seasonal analysis from the SPA team to the Sales team. The sales person's understanding of the analysis then impacts how effectively they show results to Walmart Buyers when convincing them to buy more product.

Optimization Model

We provided Hershey with an optimization model that can act as an extra selling point in their negotiations with Walmart. Due to a lack of Hershey profit data, the model calculates the optimal quantity of each item Hershey should sell to Walmart in order to maximize Walmart profit. This gives Hershey insight into what products benefit Walmart the most. Our optimization model is provided below:

Optimization Model

$$\text{Maximize } \sum_{i=1}^n p_i * x_i \quad (1)$$

$$\text{Subject to: } \sum_{i=1}^n UC_i * x_i \leq B \quad (2)$$

$$x_i \leq \frac{N_i * ST_i}{0.9} \quad \text{for } i = 1, 2, \dots, n \quad (3)$$

$$x_i \geq \frac{500,001}{RP_i} \quad \text{for } i = 1, 2, \dots, n \quad (4)$$

Decision Variables

x_i = quantity of each item i to sell to Walmart for $i = 1, 2, \dots, n$

Parameters

n = number of items

p_i = Walmart profit per item i for $i = 1, 2, \dots, n$

UC_i = Unit Cost per item i for $i = 1, 2, \dots, n$

N_i = Net ship quantity per item i for $i = 1, 2, \dots, n$

ST_i = Sell Thru percentage obtained by item i for $i = 1, 2, \dots, n$

B = Optimal buy dollar value input by the Hershey team

RP_i = Retail price for item i for $i = 1, 2, \dots, n$

- The objective function (1) is what makes this optimization model an extra selling point for Hershey; it finds the optimal quantity of each product that will maximize Walmart profit.
- The first constraint (2) makes sure the total cost of the items is less than the amount available to be spent.
- The second constraint (3) sets the maximum limit on the quantity of products to sell while taking into consideration Hershey's goal of meeting 90% sell thru.
- The last constraint (4) sets the minimum quantity of each product that must be sold to Walmart.

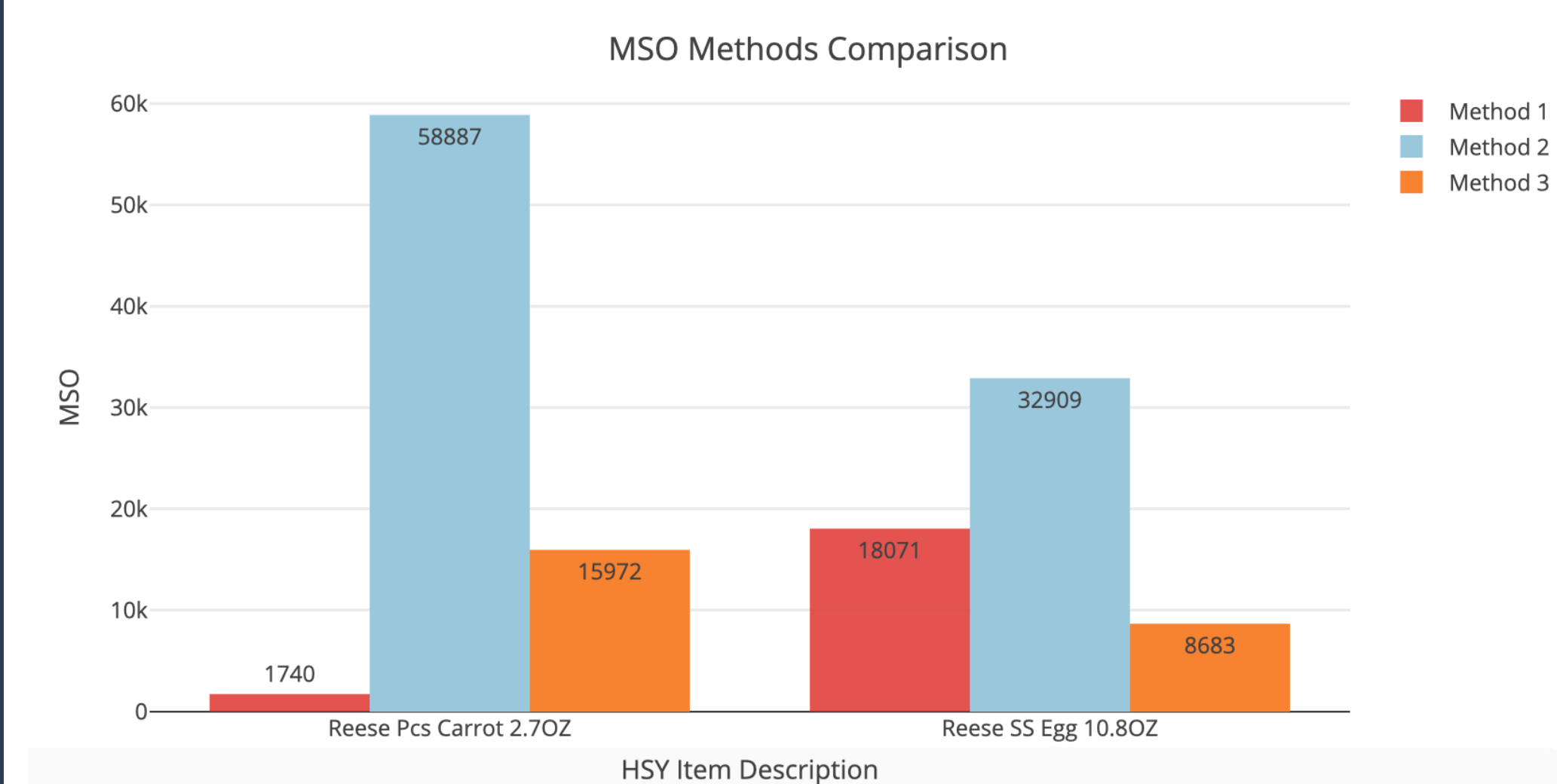
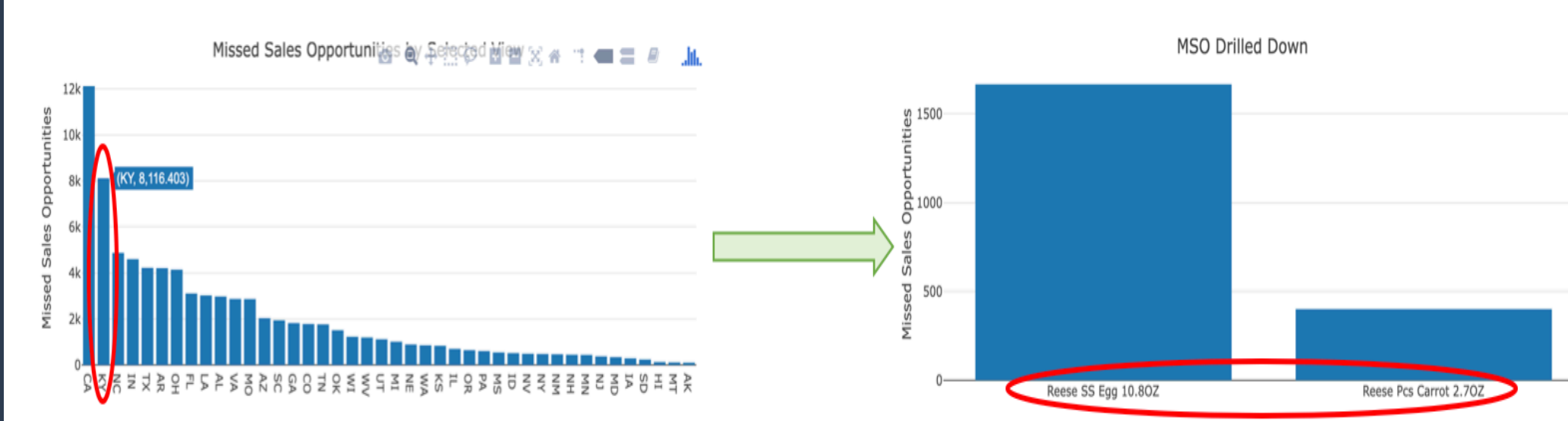
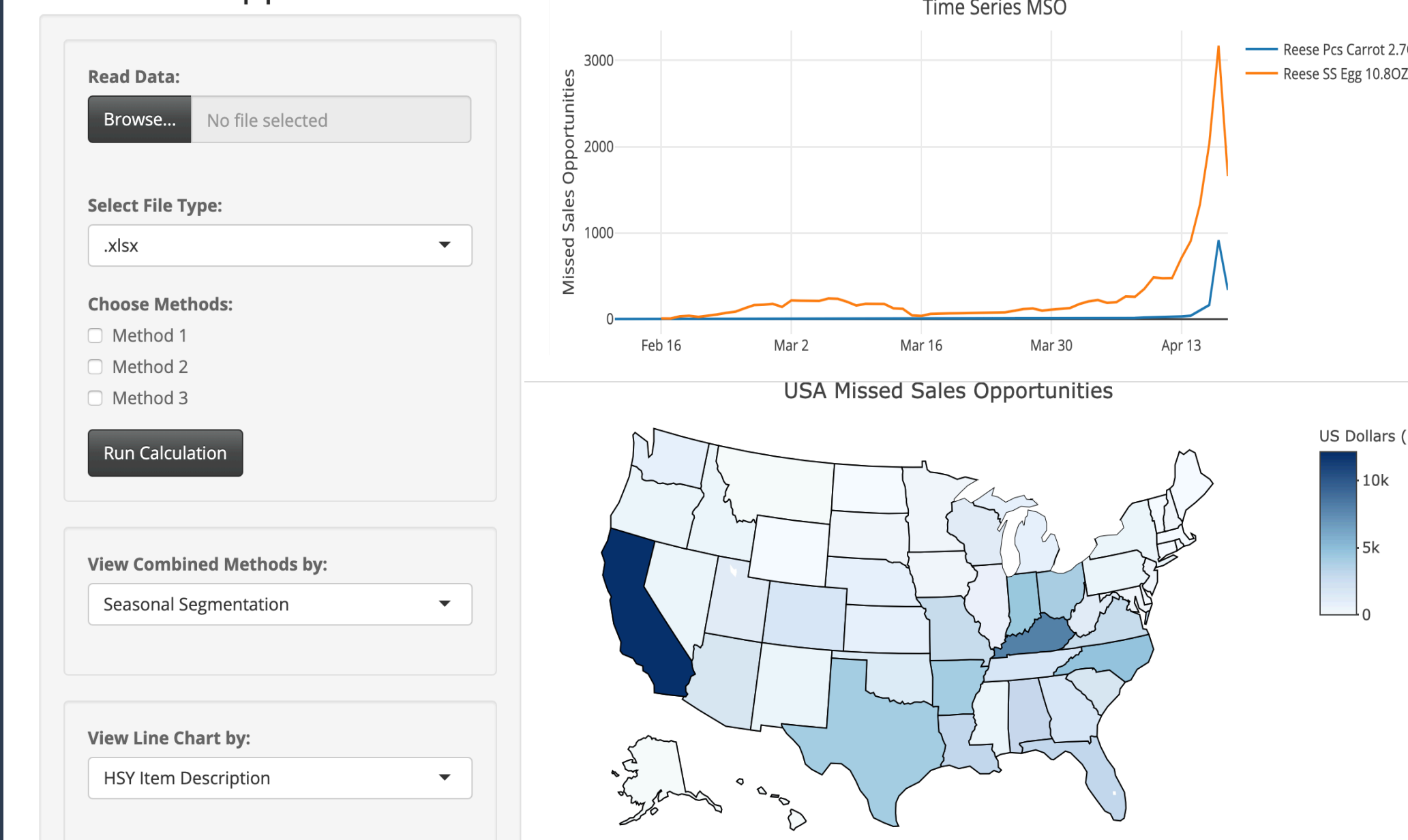
Because Hershey does not have the AMPL software, we suggest they use the free online solver, NEOS server.

The S.M.O.R.E.

As a solution to the problem areas pointed out in the Baseline Analysis, it was decided that automating the manual process for finding missed sales opportunities would be the best deliverable. The three main methods utilized for identifying instances of missed opportunity were implemented in the R scripting language. Using R, we were able to do the analysis at a more in depth, daily level, instead of the weekly level currently used. The tool is also able to analyze every single item in the season, which wasn't typically done in the current analysis due to time constraints.

A user interface created with the R-Shiny package provides the analyst with an input panel to upload the seasonal data, select which methods will be run, and customize the visualizations generated by the tool. These visualizations include graphs that give extra insight on when and where missed opportunities occur, and a concise summary of the dollar amounts of missed opportunities per method.

S.M.O.R.E. app



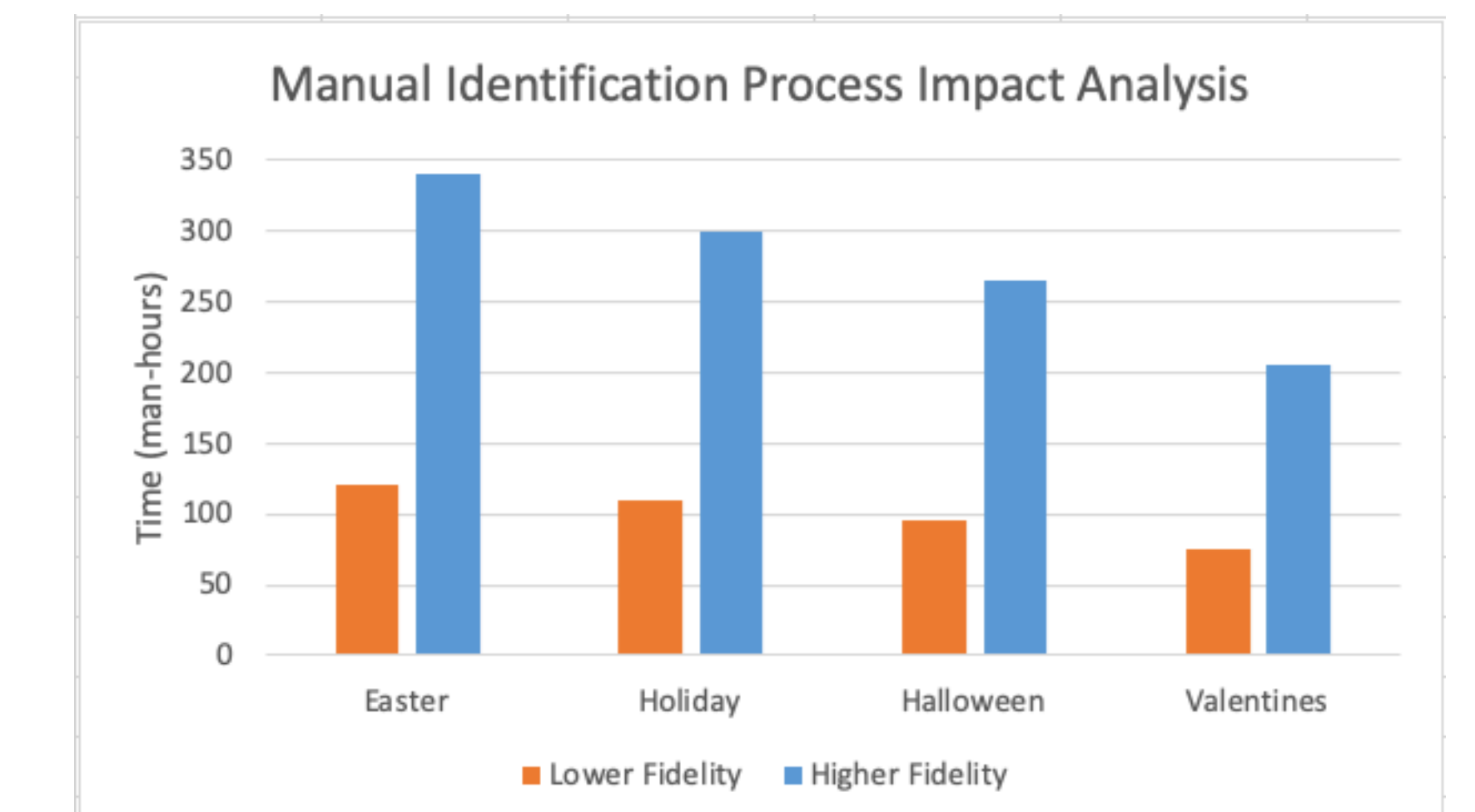
HSY Seasonal Segmentation	Method 1	Method 2	Method 3
1 HWN \$2.98 Carrot	18071	32909	8683
2 HWN \$4.88 Jumbo Chocolate	1740	58887	15972

Impact Analysis

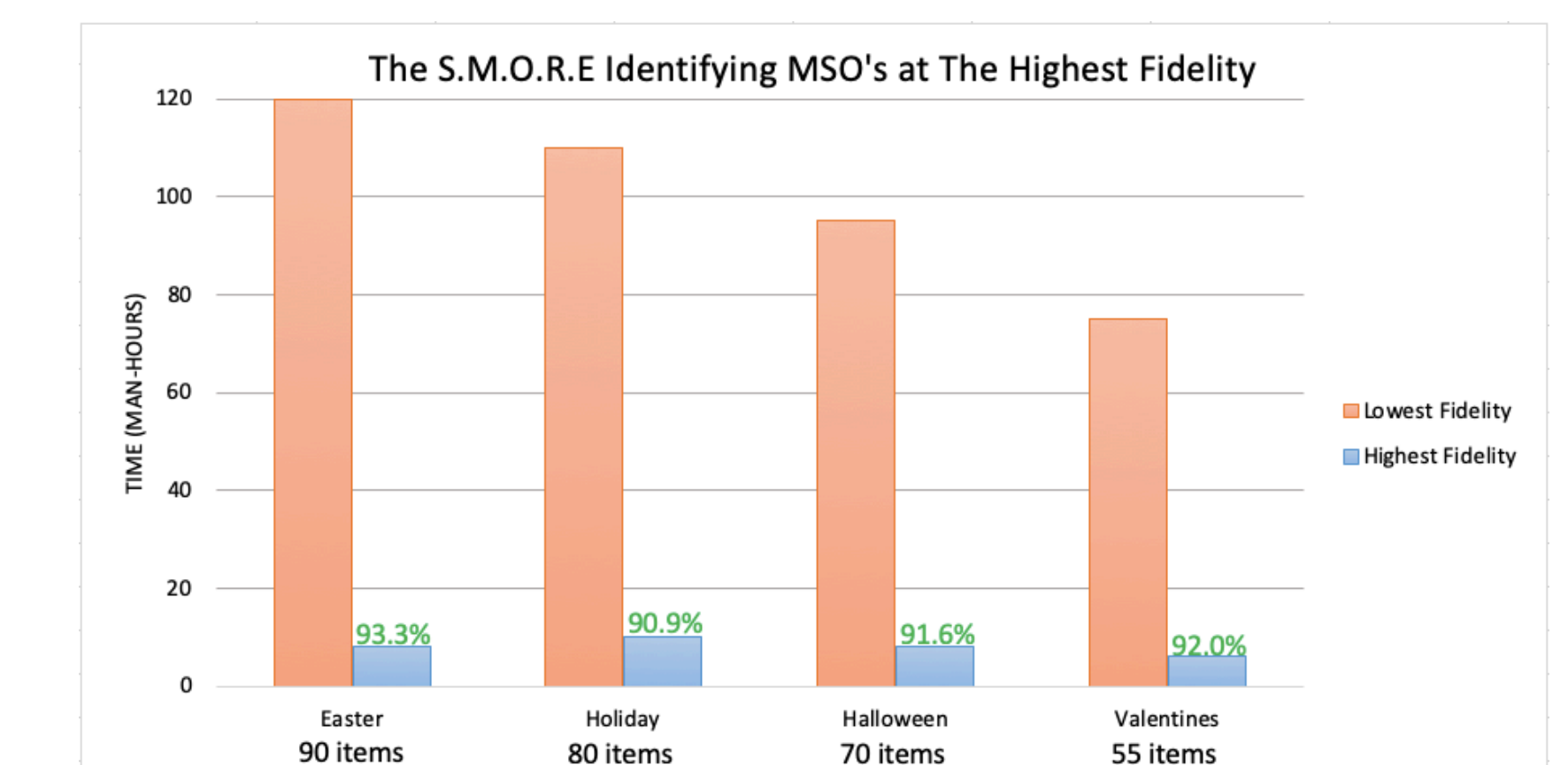
The implementation of our tool, the S.M.O.R.E., impacts Hershey by automating their process of identifying missed sales opportunities which, as a result, reduces the number of man-hours and labor cost of the SPA team.

Season	Easter	Halloween	Holiday	Valentines
Items	90	70	80	55
Man-hours (hrs)	120	95	110	75
Labor cost (\$)	\$5,400	\$4,300	\$4,950	\$3,375
Total Annual Man-hours: 400 hrs				
Total Annual Labor Cost: \$18,000				

Season	Easter	Halloween	Holiday	Valentines
Items	90	70	80	55
Man-hours (hrs)	340	265	300	205
Labor cost (\$)	\$15,300	\$11,925	\$13,500	\$9,225
Total Annual Man-hours: 1,110				
Total Annual Labor Cost: \$50,000				



Automating the process of identifying missed sales opportunities also significantly reduces the time of the analysis by up to 90%.



Acknowledgements

We would like to say thank you to our industry partner representatives Willie Nelson, Raegon Barnes, and our former contact Matthew Kleinlauth for helping us through every step in this project. Thank you Atlas for working with the SPA team at The Hershey Company to get us data. Thank you to our faculty advisor Dr. Ed Pohl for guiding and supporting us along the way. Thank you Dr. Xiao Liu for helping us with any questions or problems we had with the code. Thank you to our Capstone professor Dr. Richard Cassady for helping us make our project the best it could be. Lastly, thank you to our parents for supporting us through this journey.