Christopher Dillard 12/10/2023
BAN 530 - UNCW

Capstone Project Reflection Paper

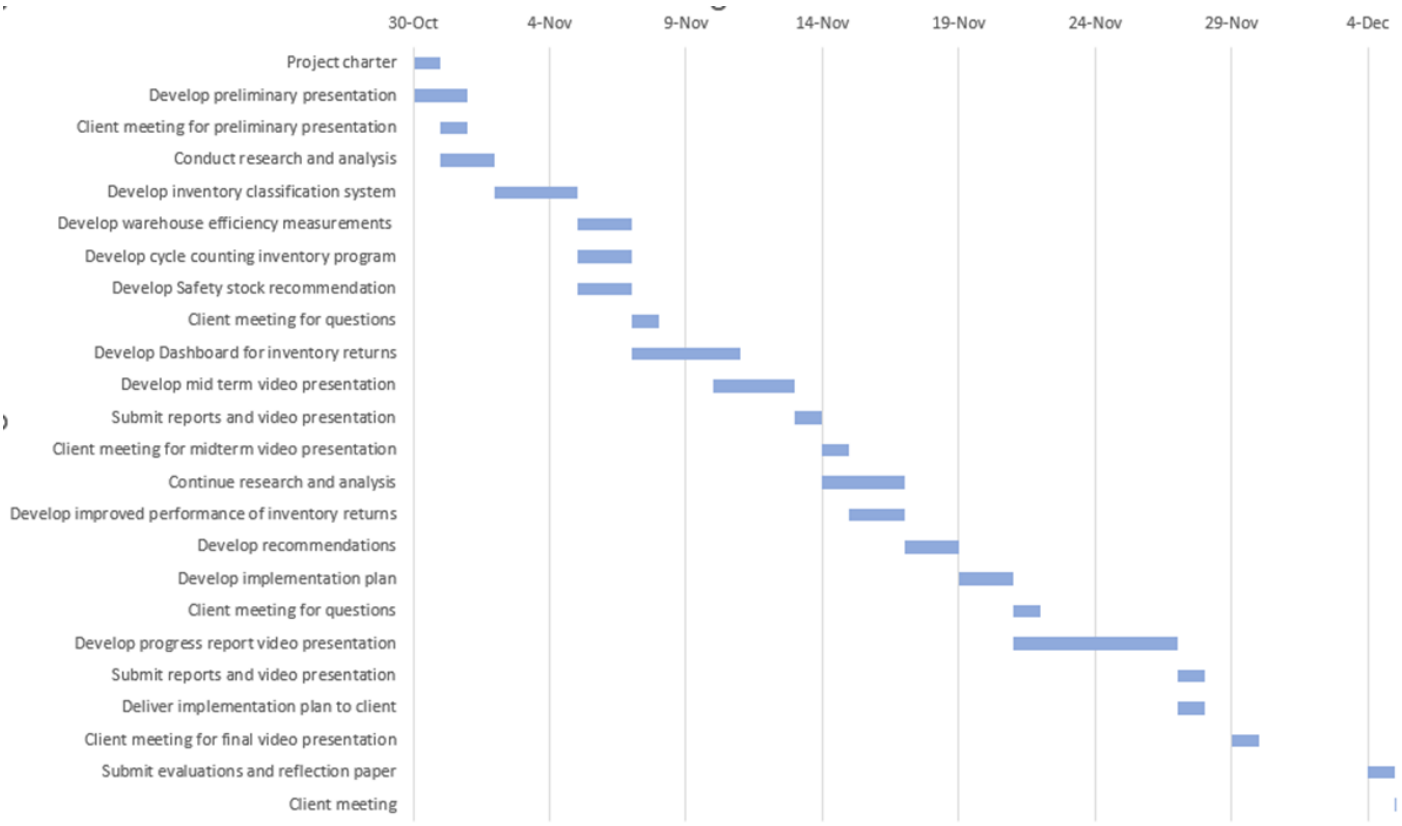
1. Introduction

As part of my Applications in Business Analytics course (BAN 530), I completed a capstone project that marked the culmination of my master's program in Business Analytics from the University of North Carolina at Wilmington. This project gave me the opportunity to implement many of the skills I have acquired over the past year while analyzing data from a multimillion-dollar company within the forensics and tactical medical supplies industries (hereafter referred to as the pseudonym "HT" or as the "client(s)"). In this paper, I will explain the analytical techniques that I employed throughout the project and the logic behind each step, along with all reliable findings in detail while maintaining client confidentiality.

Although this project was a collaborative effort between me and two other classmates, I will solely go into detail about my personal contributions throughout this report, including all supporting figures and tables. My group was tasked with developing a multicriteria inventory classification system over the course of 5 weeks that incorporated topics such as warehouse efficiency, inventory turns, cycle counting, and profitability measures like the Gross Margin Return on Investment (GMROI), which was my primary focus in this project.

During this time, I attended weekly meetings over Zoom with representatives from HT, including the materials manager and the CEO. Along with a PowerPoint presentation and Excel workbooks with all work included, my team also completed an interactive Power BI report as the project deliverable. My team maintained reliable communication using the messaging platform GroupMe and held private Zoom calls when necessary to ensure that everyone was aware of the evolving project needs, as well as share our individual findings and synthesize these into a concise, weekly update for the client. Clear communication and individual responsibility were pivotal in ensuring success throughout this project by meeting weekly deadlines and appropriately addressing potential challenges such as conflicting schedules, the fair delegation of tasks among team members, and upholding the tentative schedule that is outlined in the Gantt chart below:

Figure 1 *Gantt Chart for Project*



2. Project Role and Contribution

I was tasked with calculating the Gross Margin Return on Investment (GMROI) and designed a classification system by this figure that would address the company's unique needs and the many intricacies of the data at hand. This required the creation of an ad hoc approach that would ensure that my system would continue to be useful for the company when entering new, future data. This process entailed a lengthy analysis of the raw data and the correct reformatting of the HT's files, particularly as it pertained to dating each row when combining files where the dates did not line up perfectly. Once the data was fit to use, I needed to determine the best methodology for calculating the final GMROI ranks and how to integrate my completed work into my team's final ranking system that incorporated other ranks by sales, hits, and inventory turnover. My final ranking system for GMROI is the result of several weeks of developing alternative methods and deciding on the best fit given the client's feedback.

The final methodology used, which I will explain in detail in the following section, achieves this goal by assigning overall GMROI ranks for each item as a cumulative average of their monthly GMROI ranks in Excel. After calculating both monthly and overall ranks, I analyzed the data using Tableau and Power BI and produced useful graphs and tables that

illustrated my findings. These were shared with the client in a power point presentation and copies were provided for their personal records.

3. Data Analysis and Methodology

GMROI is a measure of profitability that derives from dividing the gross profit of an item by the cost of the item's average inventory during the specified time frame. In other words, this tells us how profitable items are per unit after accounting for the cost of selling these items at their average inventory level.

$$Gross\ Margin\ Return\ on\ Investment = (Sales\ \$ - Cost\ of\ Goods\ Sold) \div Cost\ of\ Average\ Inventory$$

This formula accounts for the reality of most items being sold by the company, in that they are rarely produced on a per-unit-sold basis, but rather in batches to either capitalize on the power of economies of scale or simply anticipate future demand of the product. Exceptions to this rule are items that are labeled as Build to Order (BTO) and customizable items that are sold under a unique item number where the inventory may be listed as 1 unit yet be the result of many inputs of raw materials and other finished goods that in turn have their own average inventory costs.

Knowledge of GMROI is most valuable for the company when assessing this figure on a monthly, quarterly, or annual basis to evaluate broad trends. So, I did not calculate "daily GMROI" at any step of this process, especially since instances of missing data from no recorded sales are much more likely at this level. Given that the data came from a real-world source and implied the combination of millions of rows of data, data filtering and general cleaning was necessary in the preliminary analysis phase of this project. In the case of GMROI, source files for the inventory and sales figures needed to be reformatted before creating a consolidated workbook where all calculations would take place.

The client's data was provided in several Excel files, so all data manipulation and GMROI calculations were also done in Excel, while most visualizations and the final report were created using Power BI and Tableau. Using Excel's Power Query tool, I imported nearly one million rows of data from all 87 inventory snapshots into a single, consolidated worksheet, specifically including columns corresponding to the quantity on hand and the current costs of each item. For the sake of better understanding the data, I imported the item descriptions and item class codes, which help provide insight into the nature of HT's products when analyzing the final GMROI ranks. The consolidated inventory snapshot worksheet needed to be cleaned up by reformatting the "Source.Name" column into a date, which was possible since the files followed a similar naming scheme to "Inv Value 01-04-2022.xlsx". To do so, I used the Find and Replace

tool (Ctrl + H) and replaced all instances of “Inv Value “ and “.xsls” with blank space. Excel automatically reformatted the cell contents in this column as dates by replacing all dashes with forward slashes. I also imported transaction profit data from the daily sales transactions following a similar process and, lastly, I filtered out any blank rows or data inconsistencies from both worksheets.

Unique item numbers were taken from the consolidated inventory snapshot worksheet using the UNIQUE formula and then entered into a blank monthly GMROI template that I designed to easily be replicated and modified should the client need to add new items at the bottom of the table in future months. Using VLOOKUP, averages were calculated for items by retrieving data from the consolidated worksheets from inventory snapshots and sales transactions by matching the unique item number in the monthly template within the specified date range in the first two columns. While the sales data had dates for nearly every day, the inventory data for quantity on hand was dated by when it was recorded in the file name, where each month could have multiple instances of recorded inventory for the same product on random dates. For this reason, GMROI can only be evaluated starting at the monthly level.

The following formula corresponds to the Average Quantity on Hand, with an IFERROR function to return “No Inventory” if there is no recorded value between the specified dates:

=IFERROR(AVERAGEIFS('Inventory Values Combined'!$E$2:$E$633707, 'Inventory Values Combined'!$A$2:$A$633707, D2, 'Inventory Values Combined'!$B$2:$B$633707, ">="&$A$2, 'Inventory Values Combined'!$B$2:$B$633707,"<="&$B$2), "No Inventory")

Figure 2 *Example of Monthly Template with Descriptive Statistics to the Right of the Table*

Start Date	End Date	Date	Item Numbe	Item Class Cod	Item Description	Avg Qty On Hand	Avg Current Cost	Avg Profit	Avg Inventory C	GMROII	RANK
1/1/2022	1/31/2022	1/1/2022	[redacted]	RE-RAW	[redacted]	158.75	0.03	No Sales	3.97	No GMROI	No Rank
		1/1/2022		RE-RAW		1.25	0.00	No Sales	0.00	No GMROI	No Rank
		1/1/2022		RE-RAW		123.75	0.00	No Sales	0.00	No GMROI	No Rank
		1/1/2022		RE-RAW		272.50	0.01	No Sales	2.99	No GMROI	No Rank
		1/1/2022		RE-RAW		812.50	0.18	No Sales	144.42	No GMROI	No Rank
		1/1/2022		RE-RAW		71.25	0.01	No Sales	0.89	No GMROI	No Rank
		1/1/2022		RE-RAW		101.25	0.05	No Sales	5.06	No GMROI	No Rank
		1/1/2022		RE-RAW		62.50	0.15	No Sales	9.38	No GMROI	No Rank
		1/1/2022		RE-RAW		151.25	0.10	No Sales	14.68	No GMROI	No Rank
		1/1/2022		RE-RAW		404.69	0.04	No Sales	15.18	No GMROI	No Rank
		1/1/2022		RE-RAW		105.00	0.00	No Sales	0.00	No GMROI	No Rank
		1/1/2022		RE-RAW		355.00	0.04	No Sales	13.81	No GMROI	No Rank
		1/1/2022		RE-RAW		47.50	0.04	No Sales	1.78	No GMROI	No Rank

Monthly Statistics

GMROI Thresholds		Rank Counts and %/Total		Summary Statistics	
-89.06%	X	65	4%	Min	-89%
0%	D	870	48%	Q1	1%
4%	C	522	29%	Median	4%
18%	B	261	14%	Q3	13%
92%	A	87	5%	Max	21054%
	No Rank	7653		Average	53%
Total w/o No Ranks		1805			

Note: Values have been scaled to maintain client privacy, as well as blacking out item SKU numbers and their descriptions. Zoom in for better clarity.

One important takeaway from the Rank Counts section of the Monthly Statistics table is that there were 7688 items during the month of January, 2022 that did not have any recorded

GMROI due to at least one missing input in the formula. Absences of GMROI for many items are to be expected in different amounts, as well as for items that have no recorded GMROI for any month if they never had any recorded sales.

Altogether, 21 months' worth of GMROIs were calculated for each item when possible, as Average Profit / Average Inventory Cost (columns I/J in the worksheet), spanning from January 2022, where the earliest inventory data was available, to September 2023. Each item's monthly GMROI was dated as the first of the month to be able to easily visualize this data and assess trends starting at the monthly level once uploaded to the Power BI report or in Tableau.

The RANK column in the template applies a special threshold criteria to the calculated GMROIs and splits the items into A, B, C, or D classes, as determined by which percentile their GMROIs fell into for that month. By virtue of design, these thresholds are bound to change given differences in monthly GMROI values. The idea of setting fixed percentiles for GMROI ranks, as opposed to assigning them based on the GMROI values themselves, is to ensure consistency in data and address the vast differences in GMROI that can be expected across each month. This way, the client can keep the same ranking criteria while the company ideally grows and improves its inventory management without the worry that classes A and B would grow too far above their ideal share of 5% and 15% of items, respectively. This is especially important since these items would need to be counted more frequently than the other classes.

The formula used to assign the ranks excludes all negative values and instances of "No GMROI" that resulted from lack of sales data and/or inventory data in the given month. Any negative GRMOIs were automatically assigned to class X to easily identify unprofitable items in each month. Under the following criteria, the highest 5% of GMROIs were assigned a rank of A for the month and were the most profitable items. As explained earlier, items in this rank should be counted most frequently and prioritized over all other classes, which descend in profitability in alphabetical order from B to X.

Table 1 *GMROI Ranking Criteria and Formulas Used to Calculate Monthly GMROI Thresholds*

Rank	Conditions	Formula Used
X	Any Negative GMROIs	=PERCENTILE.INC(IF(($K$2:$K$9459 < 0) * ($K$2:$K$9459 <> "No GMROI"), $K$2:$K$9459), 0)
D	From 0% to below 50%	=PERCENTILE.INC(IF(($K$2:$K$9462 >= 0) * ($K$2:$K$9462 <> "No GMROI"), $K$2:$K$9462), 0)
C	From 50% to below 80%	=PERCENTILE.INC(IF((K4:K9461 >= 0) * (K2:K9461 <> "No GMROI"), K4:K9461), 0.5)
B	From 80% to below 95%	=PERCENTILE.INC(IF(($K$2:$K$9460 >= 0) * ($K$2:$K$9460 <> "No GMROI"), $K$2:$K$9460), 0.8)
A	95% and above	=PERCENTILE.INC(IF(($K$2:$K$9459>= 0) * ($K$2:$K$9459 <> "No GMROI"), $K$2:$K$9459), 0.95)

The data from January 2022 produced the following table, where the percentages for each class in the "%/Total" output is a realistic expectation for the class splits in all months. Differences in class percentages of the total item count for A through D, which excludes items with no recorded GMROI, can be attributed to the number of negative GMROIs in each month.

Figure 3 *Screenshot of Table with Monthly Statistics*

Monthly Statistics					
GMROI Thresholds		**Rank Counts and %/Total**		**Summary Statistics**	
-89.06%	X	65	4%	Min	-89%
0%	D	870	48%	Q1	1%
4%	C	522	29%	Median	4%
18%	B	261	14%	Q3	13%
92%	A	87	5%	Max	21054%
	No Rank	7653		Average	53%
Total w/o No Ranks		1805			

Once all 21 months were calculated, the Ranks could be imported into a master sheet, using VLOOKUP, where each month's Rank was placed in its own column as shown below, again blacking out any revealing information:

Figure 4 *Sample of Master Sheet with Overall Scores and Ranks*

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Item Nu	Item Clas	Item Descript	Overall Score	Overall Rank	Jan 2022	Feb 20	Mar 20	Apr 20	May 2(	June 2	July 20	Aug 20	Sep 20	Oct 20
2	[redacted]	RE-RAW	[redacted]	3.00	B	No Rank	No Rank	No Rank	No Rank	B	No Rank	No Rank	No Rank	No Rank	No Rar
3		RE-RAW		0.00	X	No Rank	No Rank	No Rank	No Rank	X	No Rank	No Rank	No Rank	No Rank	No Rar
4		RE-RAW		1.00	D	No Rank	No Rank	No Rank	No Rank	No Rank	D	No Rank	No Rank	No Rank	No Rar
5		RE-RAW		2.50	C	No Rank	B	No Rank	C	No Rank	No Rank	No Rank	No Rank	No Rank	B
6		RE-RAW		0.00	X	No Rank	No Rank	No Rank	No Rank	X	No Rank	No Rank	No Rank	No Rank	No Rar
7		RE-RAW		0.00	X	No Rank	No Rank	No Rank	No Rank	X	No Rank	No Rank	No Rank	No Rank	No Rar
8		RE-RAW		2.71	C	No Rank	No Rank	No Rank	No Rank	D	A	B	No Rank	No Rank	B
9		RE-RAW		1.00	D	No Rank	No Rank	No Rank	No Rank	No Rank	No Rank	No Rank	No Rank	D	No Rar
10		RE-RAW		4.00	A	No Rank	No Rank	No Rank	No Rank	No Rank	No Rank	No Rank	No Rank	No Rank	No Rar

Note: Columns for monthly ranks span from January 2022 to September 2023. "No Ranks" were not factored into the average.

The overall ranks were based on the average score of all 21 monthly ranks across the item's row, using the following formula:

=IFERROR(AVERAGE(IF(F2:Z2<>"No Rank",IFERROR(VLOOKUP(F2:Z2,$AB$7:$AC$10,2,FALSE),0))),"No GMROI")

The absolute reference in this formula refers to the value that each monthly Rank should be given when converting them to numerical format from 4 to 0 for classes A through X, shown in cells AB7:AC10 in the following screenshot:

Figure 5 *Table with Final GMROI Rank Criteria*

AA	AB	AC	AD	AE	AF	AG
	Final GMROI Rank Criteria					
	Monthly Ranks & Weights				Class Counts & %/Total	
	A	4		A	270	6%
	B	3		B	869	19%
	C	2		C	1389	30%
	D	1		D	1980	42%
	X	0		X	176	4%
	No Rank	0		No GMROI	4774	
			Total Final w/o the No Ranks:		4684	
		Percentile Thresholds for Overall Classes			0	X
		>95%	A	4	1	D
		>80%-<=95%	B	3	2	C
		>50%-<=80%	C	2	3	B
		0-<=50%	D	1	4	A
			X	0	No GMROI	No GMROI
			Final GMROII ranks are based on the assumption that the upper 5% of GMROIs that weren't negative belongs to A, next 15% belongs to B, 30% after is C, and lowest 50% is D.			

Once the overall score is calculated, the overall rank can be determined using VLOOKUP with an approximate match between each integer in cells AF15:AG20 from the screenshot.

=VLOOKUP(D2,$AF$15:$AG$20,2,1)

With an approximate match, any overall score that falls between two numbers is assigned an overall rank that corresponds to the lower of the two integers (ie. an overall score of 3.8 would yield an overall rank of B since items that were only ever A's would have a perfect 4.0).

To validate this rationale, I used the PERCENTILE.INC formula again in cells AE16:AE20 which yielded the expected integers, as shown in Figure 6 below:

Figure 6 *Displaying Formulas used in the Final GMROI Rank Criteria Table*

	AB	AC	AD	AE	AF	AG
4	**Final GMROI Rank Criteria**					
5						
6	Monthly Ranks & Weights				Class Counts & %/Total	
7	A	4		A	=COUNTIF($E$2:$E$9458,"A")	=AF7/$AF$13
8	B	3		B	=COUNTIF($E$2:$E$9458,"B")	=AF8/$AF$13
9	C	2		C	=COUNTIF($E$2:$E$9458,"C")	=AF9/$AF$13
10	D	1		D	=COUNTIF($E$2:$E$9458,"D")	=AF10/$AF$13
11	X	0		X	=COUNTIF($E$2:$E$9458,"X")	=AF11/$AF$13
12	No Rank	0		No GMROI	=COUNTIF(E:E,"No GMROI")	
13				Total Final w/o the No Ranks:	=SUM(AF7:AF11)	
14						
15		Percentile Thresholds for Overall Classes			0	X
16		>95%	A	=PERCENTILE.INC(IF(($D$2:$D$9458 >= 1) * ($D$2:$D$9458 <> "Negative GMROI"), D$2:$D$9458), 0.95)	1	D
17		>80%-<=95%	B	=PERCENTILE.INC(IF(($D$2:$D$9458 >= 1) * ($D$2:$D$9458 <> "Negative GMROI"), D$2:$D$9458), 0.8)	2	C
18		>50%-<=80%	C	=PERCENTILE.INC(IF(($D$2:$D$9458 >= 1) * ($D$2:$D$9458 <> "Negative GMROI"), D$2:$D$9458), 0.5)	3	B
19		0-<=50%	D	=PERCENTILE.INC(IF(($D$2:$D$9458 >= 1) * ($D$2:$D$9458 <> "Negative GMROI"), D$2:$D$9458), 0)	4	A
20			X	=PERCENTILE.INC(IF(($D$2:$D$9458 <1) * ($D$2:$D$9458 <> "Negative GMROI"), D$2:$D$9458), 0)	No GMROI	No GMROI

After calculating the GMROI final ranks, I then proceeded to analyze the data further in Tableau and Power BI to produce informative results for the client.

4. Results

The unique item numbers that I used when creating the monthly templates were taken from the inventory snapshots where several thousands of these were not present in the sales transactions files. For the cells that the overall rank formula returned "No GMROI" in the master sheet, the vast majority of these items were listed as Raw Materials or had some variation of "Raw" in their item class code. This finding aligns perfectly with my a priori assumptions given that the quantity and unit costs of raw materials should reasonably be listed in the inventory snapshots and, if the item is purely an input for a final good, it will not have its own profit figure

in the sales transactions file. So, Figure 7 below displays the items from the inventory snapshots that never had any recorded sales.

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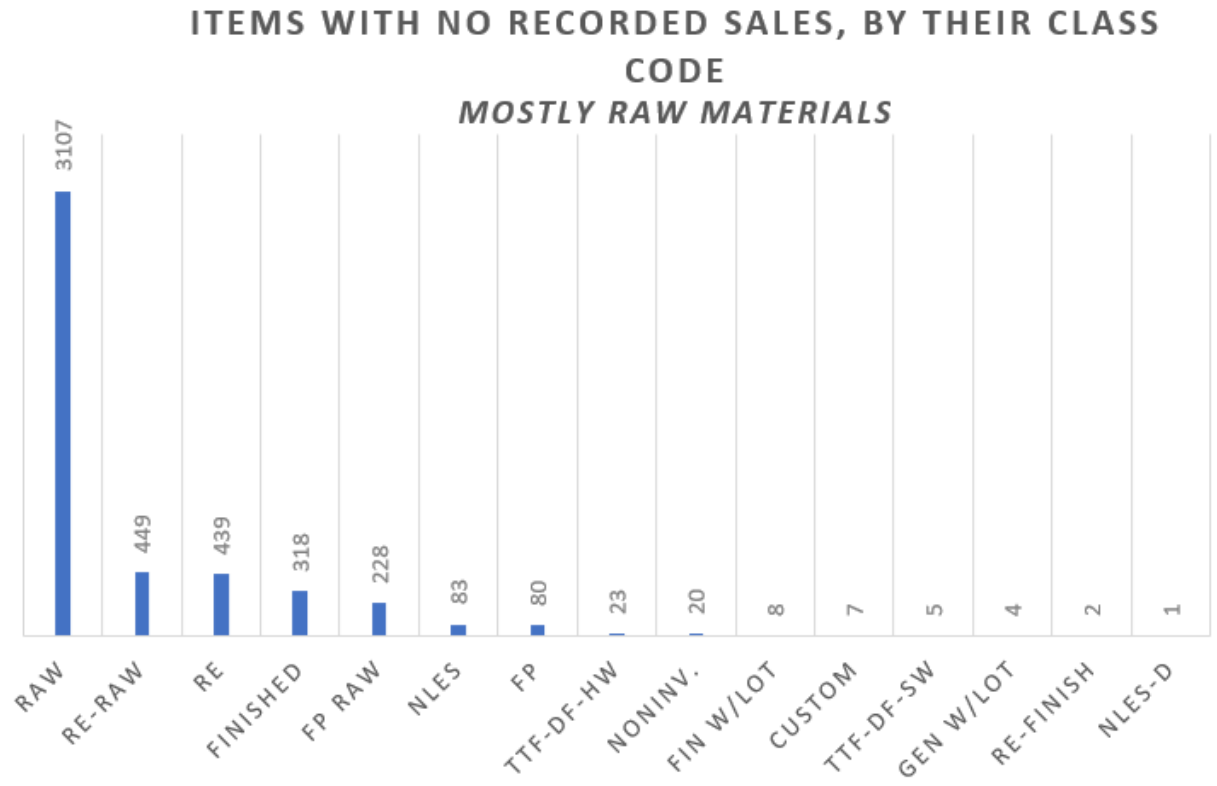
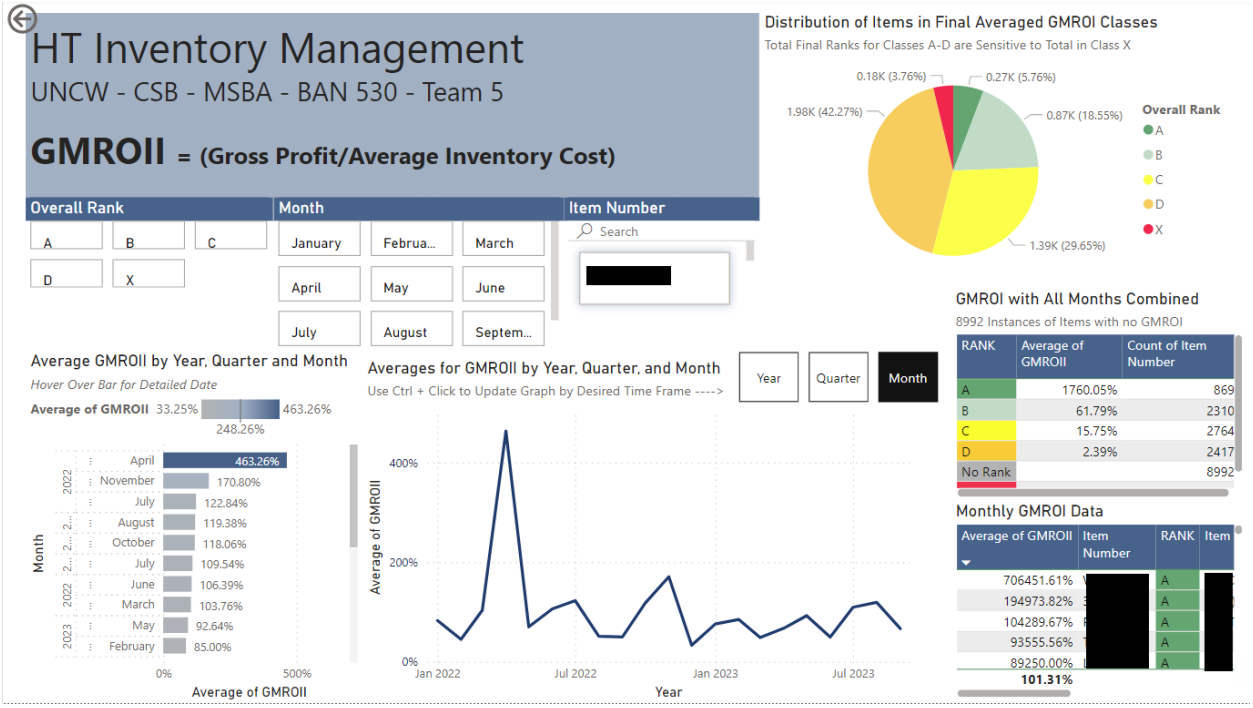
Figure 7 *Distributions of Items With No Recorded Sales, by Their Class Code*



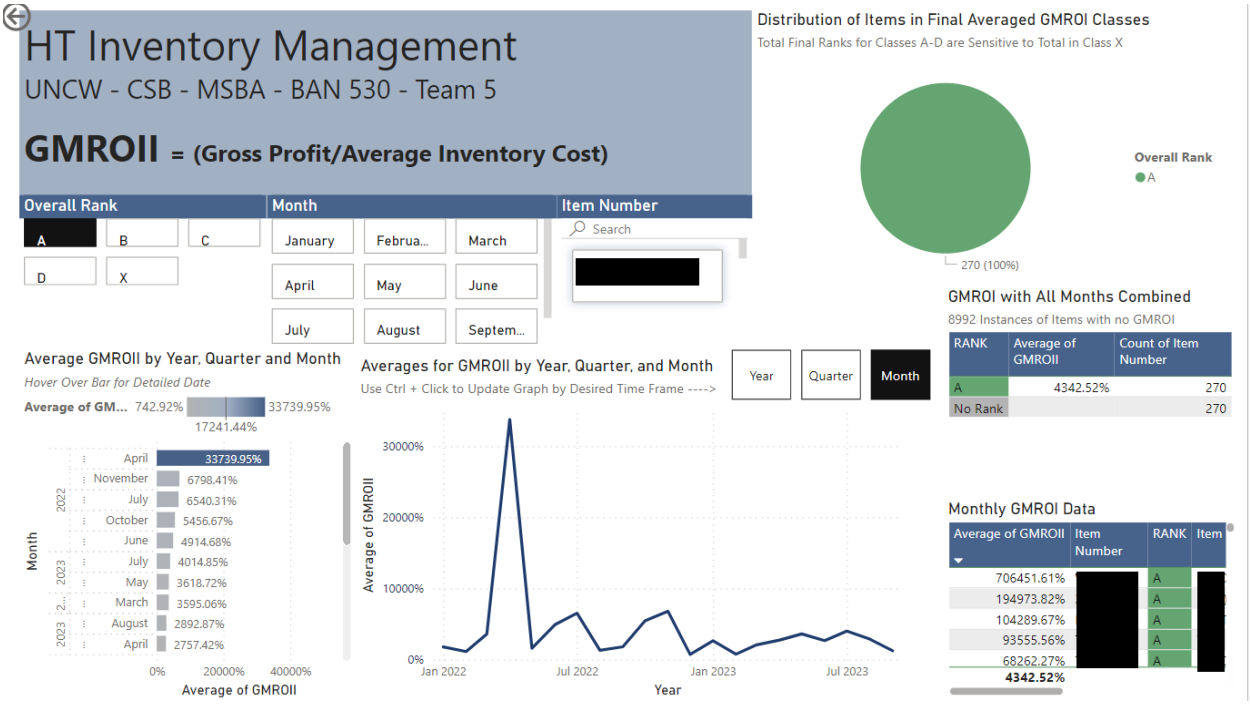
The primary deliverable in the project was an interactive report using Power BI for all classifications. I created a dashboard within this report that corresponded to GMROI, as shown in Figure 8:

Figure 8 *GMROI Dashboard in Power BI Report*



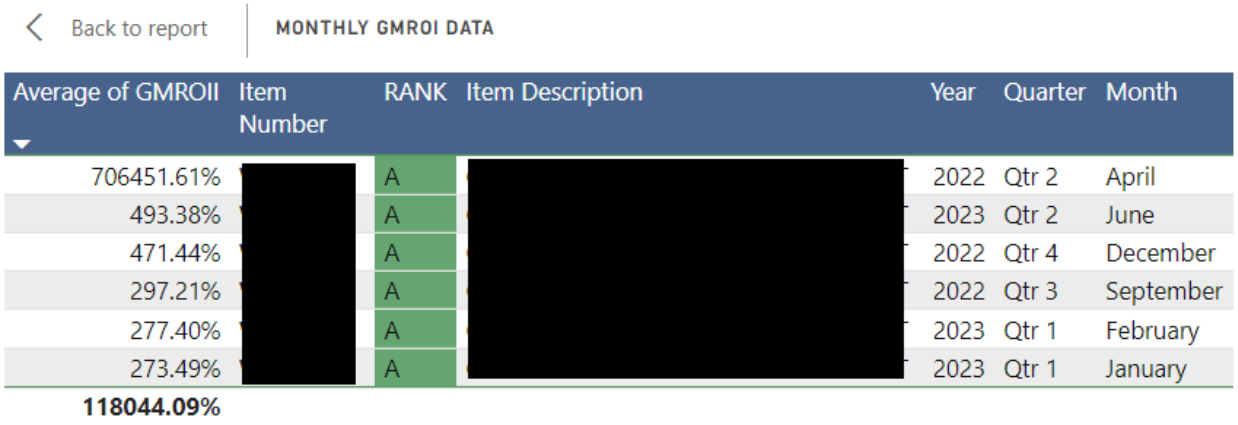
One key issue when developing the report pertained to how my team would collaborate on this final deliverable given the tight deadlines, along with limitations like the inability to edit the report within Microsoft teams, where all our files were uploaded. So, members could not simultaneously implement changes in different dashboards throughout the report. Furthermore, two Power BI reports could not be merged into one if they were not created in the same workspace. This required us to individually download the report and all files for the data used across the report locally to our own devices and reupload changes once completed.

Figure 9 *GMROI Dashboard in Power BI Report Filtered for Items in Final Rank "A"*



By filtering for items in the A rank, it becomes clear that the peak seen in April of 2022 is skewed towards the comparatively high monthly GMROIs in this rank, as shown with the first items listed in the table on the bottom right of the dashboard in Figure 9. By copying the first item's SKU and pasting this value into the Item Number slicer in the center of the dashboard, the table automatically reveals all monthly averages for this product. Figure 10 below reveals a much higher GMROI in April of 2022, supporting the notion that this point is an outlier in the data, either from an abnormally highly profitable sale or erroneous data entry.

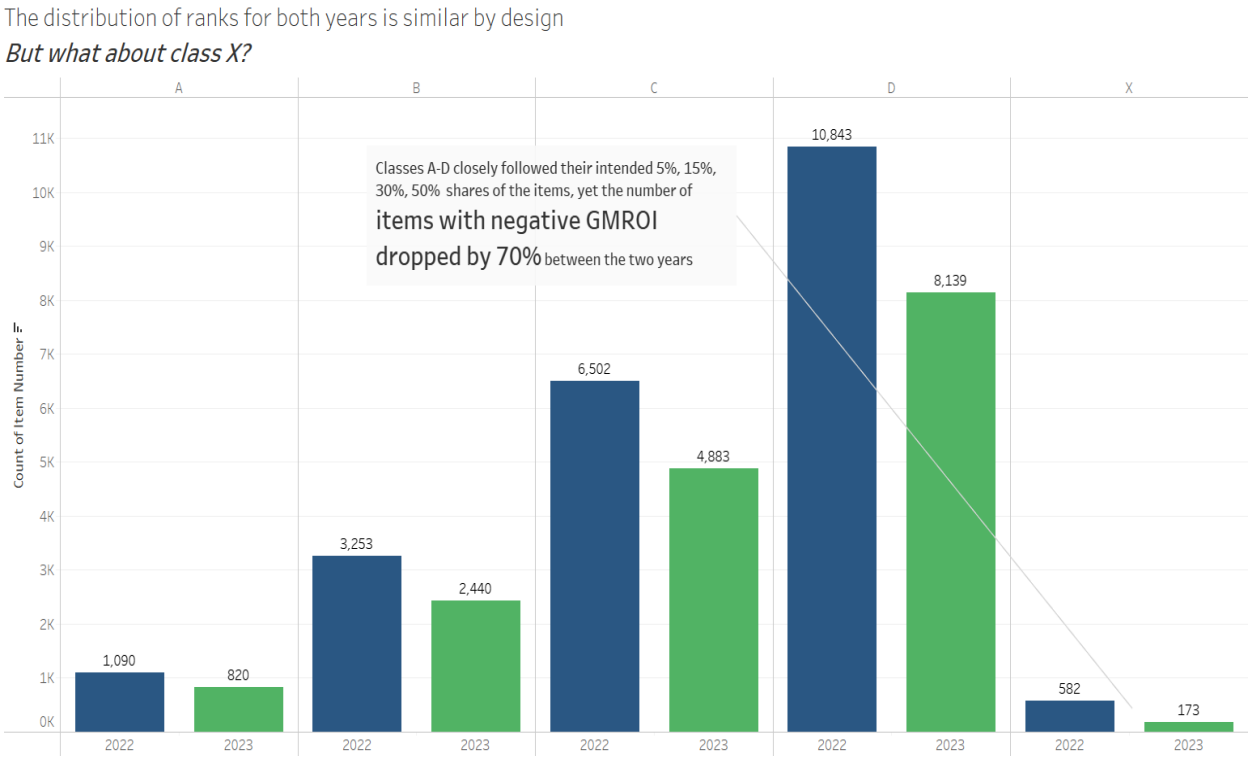
Figure 10 *All Monthly GMROIs for the Item with the Highest GMROI in April 2022*



Average of GMROII	Item Number	RANK	Item Description	Year	Quarter	Month
706451.61%	[redacted]	A	[redacted]	2022	Qtr 2	April
493.38%		A		2023	Qtr 2	June
471.44%		A		2022	Qtr 4	December
297.21%		A		2022	Qtr 3	September
277.40%		A		2023	Qtr 1	February
273.49%		A		2023	Qtr 1	January
118044.09%						

After I created the dashboard in Power BI, I wanted to identify any additional patterns in the data with Tableau. The following Figures, starting with Figure 11, illustrate several key trends in the data regarding GMROI at the broader level (between the two available years), as well as explore the relationship between each item's characteristics (i.e., product class code, unit cost and price, demand, etc.) and its final GMROI rank.

Figure 11 *Distribution of Item Counts in Each Rank between Both Years*

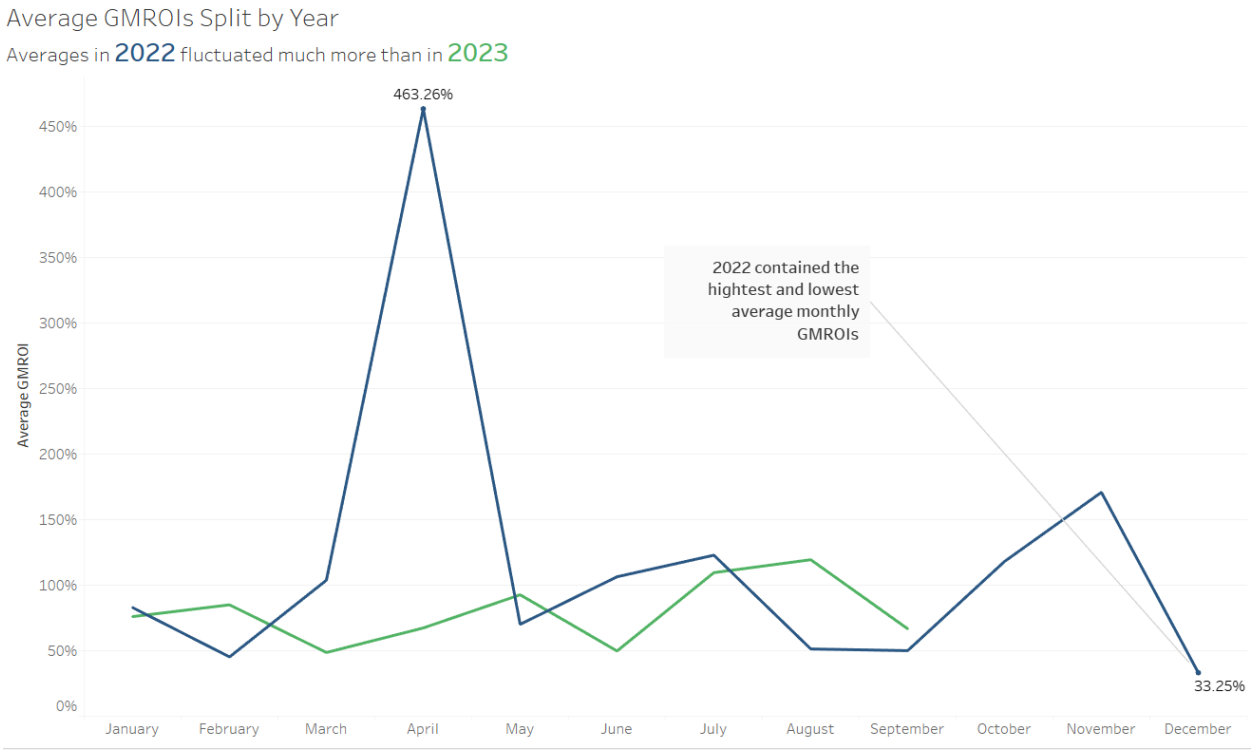


Each month's ranks were created following a standard percentile schedule. So, the near-proportional distribution of the sum of all 21 monthly item counts between both years is to be expected, at least for ranks A-D (2023 did not have data for October through December which led to less item numbers in each rank for this year). That being said, items were assigned to the X class when their monthly GMROI was a negative value. Thus, any decrease or increase in the counts in class X can partly reveal whether or not the company has improved its inventory management between the two years. In this case, the counts above the bars corresponding to class X show a decrease by 70% from 2022 to 2023, which is much higher than we should expect when accounting for the 3 months of missing data, which would otherwise be around a 25% decrease if all conditions remained the same. In conclusion, the sum of items with negative monthly GMROIs decreased from the previous year, which can be attributed to a mix of either better inventory management (a reduction in the average inventory cost or the denominator of the

GMROI formula), lower unit costs through more cost-efficient production measures, or an improvement in the sales strategy to sell items at a higher price.

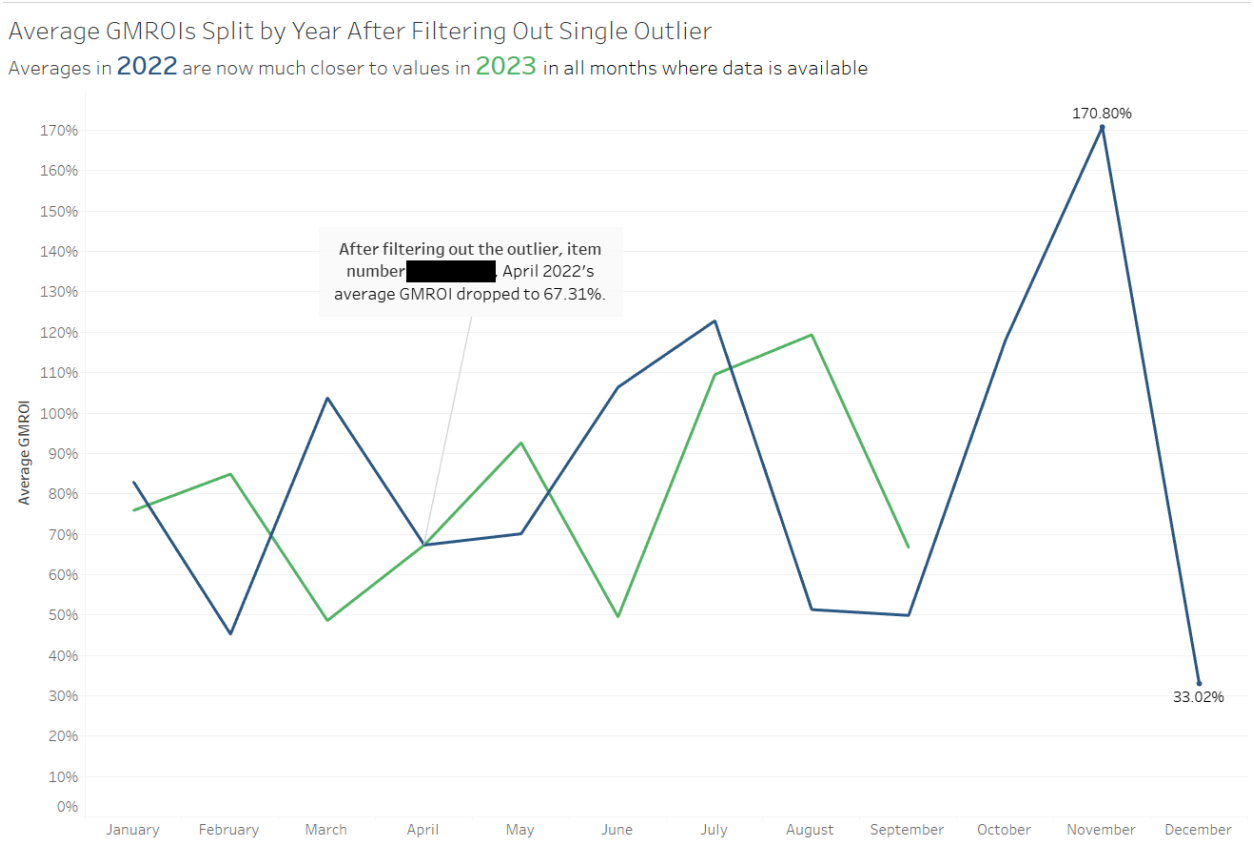
Previously, in Figure 8, I demonstrated how average GMROIs peaked significantly in April of 2022 in the Power BI dashboard. With this data point, it was clear that there was a significant outlier with a value of 706,451% percent. Figure 12 below shows how the inclusion of this value leads us to believe that 2022 was a much more volatile year than 2023 in terms of average monthly GMROI.

Figure 12 *Unfiltered Line Graph for Average Monthly GMROI, Split by Year*



Considering just how much higher the data point for April 2022 was, I wanted to recreate the line graph in Figure 12 after filtering out the single identified outlier, which produced a much different story in Figure 13:

Figure 13 *Filtered Line Graph for Average Monthly GMROI Split by Year*



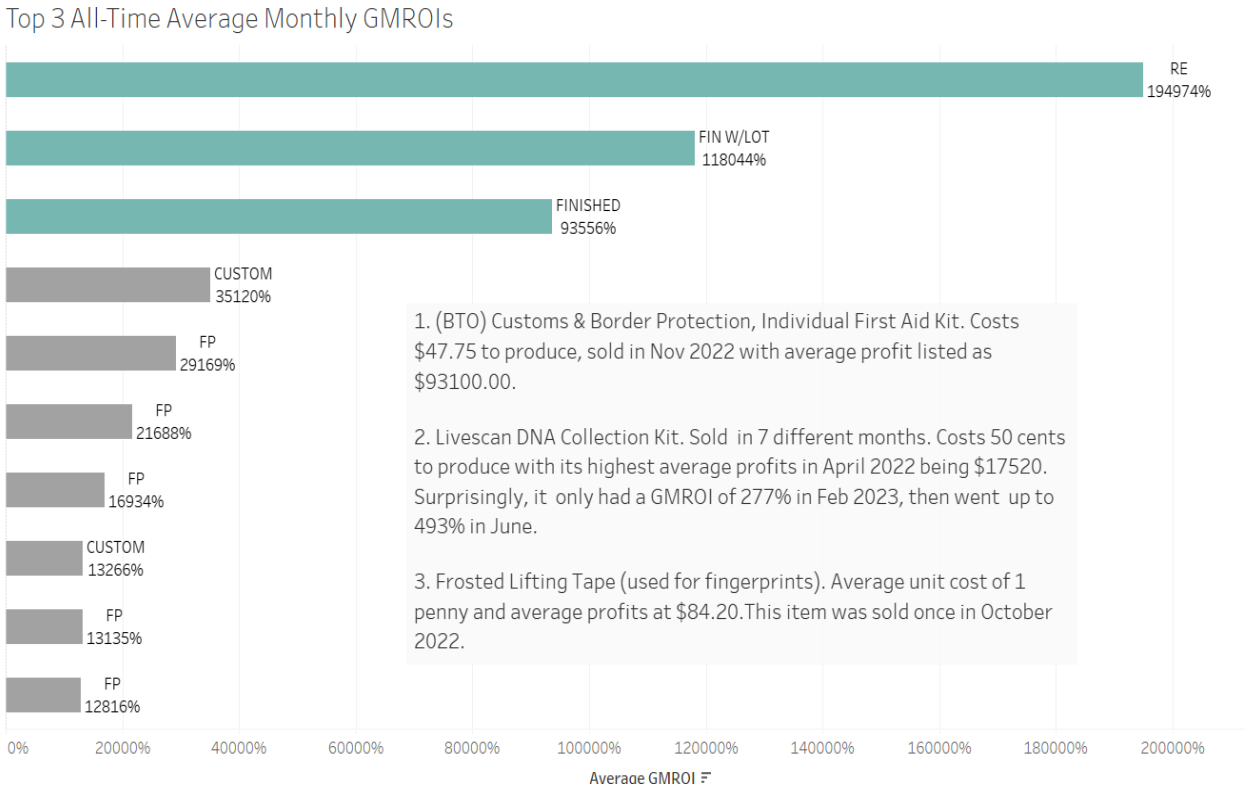
This filtered version of the line graph shows that average monthly GMROIs were much closer to each other, falling between around 40% to 120% in the months where data was available for both years.

Although data is missing for October through December of 2023, it is interesting to note that the new highest and lowest values happen to occur during these months in the previous year. The new peak in the data led me to explore whether this may be another instance of an outlier, considering just how much higher November 2022's average monthly GMROI was than the rest of the data points. Furthermore, it is less likely that the uptick around November could be attributed to an increase in sales around the holiday season considering the nature of the company and its typical clientele.

To explore this point, I created the following bar chart in Figure 14 that includes the top ten monthly GMROIs. I will briefly explain the details of the highest three since they clearly stand out from the other seven items and, given the complexity of the formula used to calculate GMROI, I will emphasize how items within the same rank can be vastly different in their item class code, production cost and sales price per unit, average inventory, and the demand or frequency of the item appearing within the data. By just centering on the items with the three

highest GMROIs, we can attempt to draw some conclusions as to why they stand out so much from the other 7 items in the graph (original item number bar labels have been replaced with the average GMROI percentages and their item class codes to comply with client privacy guidelines):

Figure 14 *Top 10 Average Monthly GMROIs*



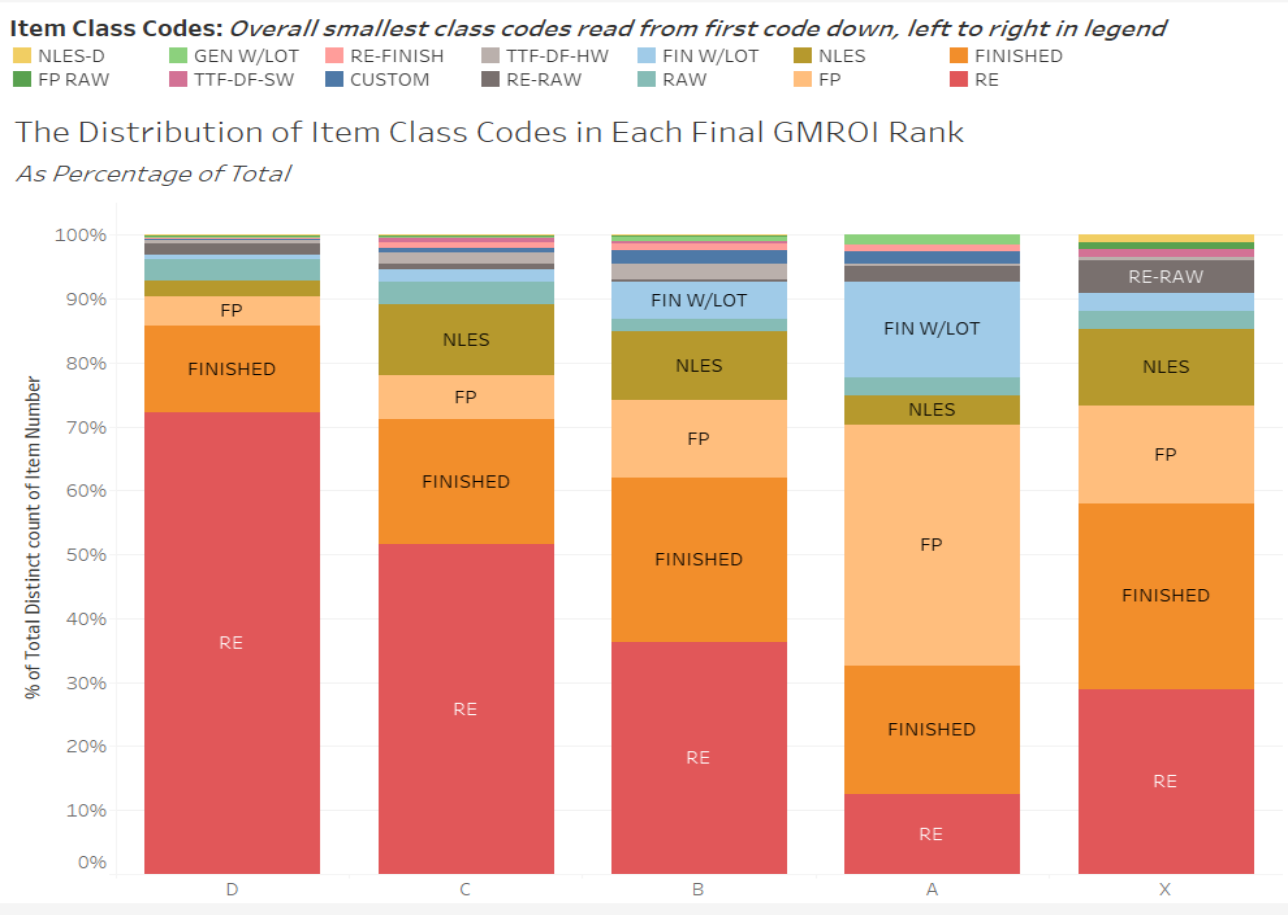
This first item is labeled as a Build-to-Order (BTO) item in its description and, as such, has its own unique item number, as a customized version of a broader group of Individual First Aid Kits commissioned by the Customs & Border Protection agency. These unique versions of products tend to not appear multiple times throughout the inventory snapshots and sales transactions. At just under 195,000% GMROI and appearing exclusively in November 2022, we can assume that this single item had the largest influence in skewing the average monthly GMROIs upwards in Figure 13.

The second item was a Livescan DNA Collection Kit that appeared in 7 different months, where it had the highest monthly GMROI in April 2022 at 706,452%. This item is the same one that I filtered out when constructing the second line graph and has relatively smaller GMROIs for all other months where it was sold, which brought it down to the second highest overall average GMROI. Additionally, this DNA collection kit's unit production cost was nearly one hundredth that of the first item, at just 50 cents.

Finally, the third highest average GMROI was achieved by a Frosted Lifting Tape, which is used for identifying fingerprints. The average unit cost was listed as one penny, and the average profit was $84.20. Furthermore, this product was sold once in October 2023. The high profit margin and very low average inventory costs have led to the very high GMROI percentage for this item.

I included the class code in Figure 15 below to see how this variable might factor into an item's ultimate class ranking. All 10 items in the bar chart belonged to class A with the largest share being labeled as "FP", at 50%. This 100% stacked bar chart reveals how much of each overall GMROI class is represented by the various item class codes:

Figure 15 *100% Stacked Bar Chart for Distribution of Class Codes in Each Final Rank*



The first trend that I noticed in this graph is how the share of items classified as "RE" diminished as the average GMROI increased. Alternatively, items in the "FP" group increased from ranks D to A. In Figure 14, I showed the top 10 average monthly GMROIs where 50% of those items were in the A class. This distribution is fairly consistent with the distribution seen bar corresponding to items in the A rank in Figure 15. So, while the ultimate determinant of the

final ranking is the percentile thresholds set from each item's monthly GMROIs, class codes play a role in an item's rank for those belonging to ranks A-D.

5. Reflection of Learning

Prior to this project, I had not been exposed to Power BI and the many tools available within the desktop version of this program. Power BI is an excellent way to display trends and highlight the most important aspects of the data. Reaching that point in this project, however, required a high level of familiarity with the data and the audience of this report, the latter of which was highly dependent on clearly defining HT's needs during the weekly meetings and producing the results accordingly. To that end, I had to completely modify the methodology I used when of analyzing GMROI mid-way through the project, which, although this was initially taxing, ultimately led to a more robust dashboard within the report and a better worksheet for calculating GMROI that could account for future growth of the company and, therefore, be indefinitely useful for the company. Overall, this was a very rewarding experience for me, and I am extremely proud of mine and my colleagues' work.

6. Conclusions

My most significant takeaway from this project lies in the gratification of delivering actionable insights for HT while developing transferable skills for my post-graduate endeavors. Beyond enhancing my proficiency in data analytics using Excel, Tableau, and Power BI, I also cultivated collaborative skills that are paramount to achieving team synergy within a fully remote setting under stringent deadlines, particularly communication and time management skills. Fortunately, the project ran smoothly without any large setbacks, and both the client and I are very pleased with the results of my team's classification system, which was ultimately finalized and presented a week ahead of schedule.

Appendices

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