Process Improvement Project

Reducing Restaurant Expenditures

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Process Improvement Project – Reducing Restaurant Expenditures

Process Owner: Dan Caley

Key Date Team Launch	Define: 1/20	Measure: 2/3 – 2/16	Analyze: 2/17 – 3/2	Improve: 3/3 – 3/17	Control On-going

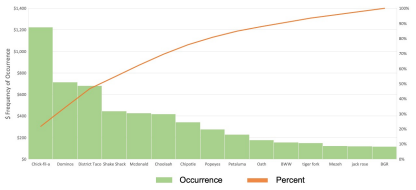
DEFINE

- My restaurant expenditure is high and ripe to apply cost cutting solutions. On average I spend daily $22.56.
- **Goal: A 35% reduction to $14.66 per day would equate to an annual savings of $2,882.04.**
- That savings extrapolated over a 10-year period can be $28,882.40.
- Sigma Quality Level = 1.4 for the original Process.

SQL = 1.4

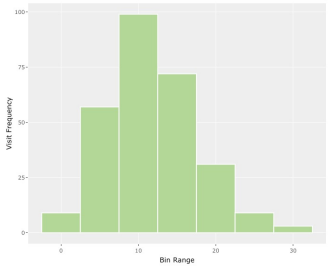
MEASURE

Pareto Chart



- The Pareto chart illuminated the amount of money I spend on the top 15 restaurants.

Dollars Spent at Each Restaurant



- Of the top 5 in the Pareto Chart above the Histogram illustrates the frequency at which I spend roughly $10 - $15 on each meals.
- If I was to shift my costs to the $5 to $10 dollars bins, I could bring my costs down in order to hit my goal.

ANALYZE

	>= $22.50 Restaurant Expense	< $22.50 Restaurant Expense	Totals
Not Weekend	110	194	304
Weekend	40	82	122
Total	150	276	426

Chi-Square Test showed no relationship between restaurant expenditures and weekend vs weekday.

	f (Observed)	F (Expected)	(f-F)^2 / F
Not Weekend / >= $22.50 Expense	110	107.04	0.08
Not Weekend / < $22.50 Expense	194	196.96	0.04
Weekend / >= $22.50 Expense	40	42.96	0.20
Weekend / < $22.50 Expense	82	79.04	0.11
Total	426	426	**0.44** <-- chi-square

Calculate degrees of freedom:
df = (r - 1) * (c - 1) = (2 -1) * (2 - 1) = 1
p-value = 0.51
Alpha = 0.10

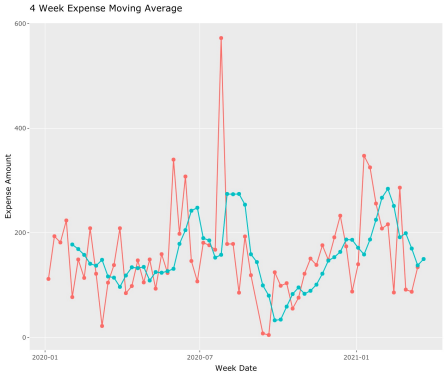
Two Sample Hypothesis Test
Z-test upper 1 tail test
Ho = Avg. Restaurant Expenditures <= Avg. Restaurant Expenditure Post Process Change
Ha = Avg. Restaurant Expenditures > Avg. Restaurant Expenditure Post Process Change
Ho = U1 <= U2
Ha = U1 > U2
Z = 2.43
P-value = 0.007 so p = 0.007 < 0.10 therefore reject the null hypothesis

Hypothesis Testing Significant P<0.10

- I, can with 90% confidence, reject the null hypothesis.
- Therefore, Avg Restaurant Expenditure before new process is greater than post my process change.

IMPROVE

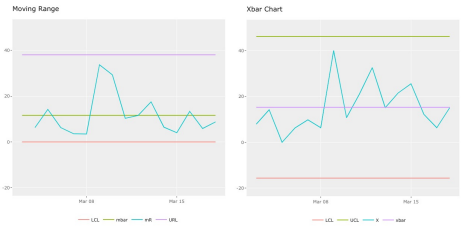
Reduced Expenditures by 47% equaling $3,540



SQL = 1.7

Control

New Process is in control based on the xbar control chart.



Define

Business Impact

The baseline measurement for daily restaurant expenditures is on average $22.56, this could be money saved and re-invested in a 401k. In sum, I spend $8,234.40 per year on just restaurant expenditures. If I can reduce that number by 35% or $2,882.04, will be able to save that money for investing. Over a 10-year period I would save $28,882.40. Since a 401k targeted fund on average returns 11% annually over a 10-year period, I will be able to earn an additional $317.02 per year on top of the saving incurred from reducing my restaurant expenditures.

- Calculations:
  - 35% of $8,221.05 equals $2,882.04 in an annual savings.

- Output for improvement:
  - Y(output) = F(x) decrease restaurant expenditures from $8,221.05 to $2,882.04, 35% reductions

Goals

The goal of this project is to reduce my daily average restaurant expenditures by 35% or said differently reduce my annual restaurant expenditures from $8,234.40 to $2,882.04, which ultimately will allow me to invest that money into my 401K.

Project Scope

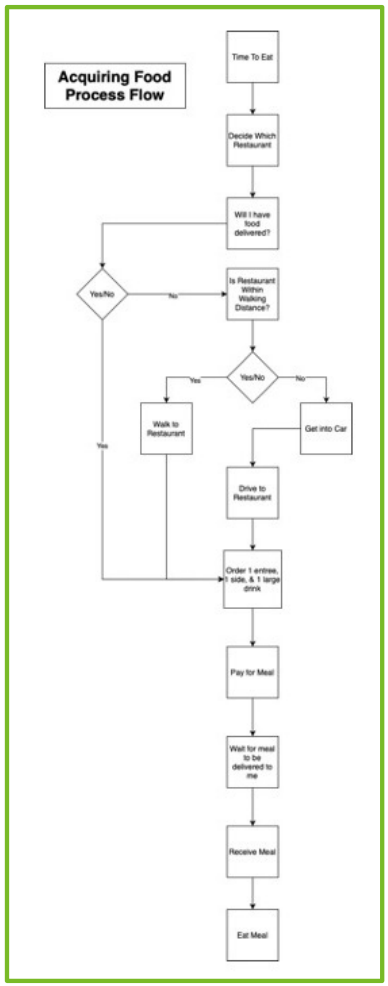
Analyze my financial data in regard to restaurant expenditures; what specific restaurants are contributing to the biggest expenses, and inversely which restaurants are helping reduce my expenditure. I will not be considering grocery expenses, the cost of gas, or time spent traveling in the scope of the project.

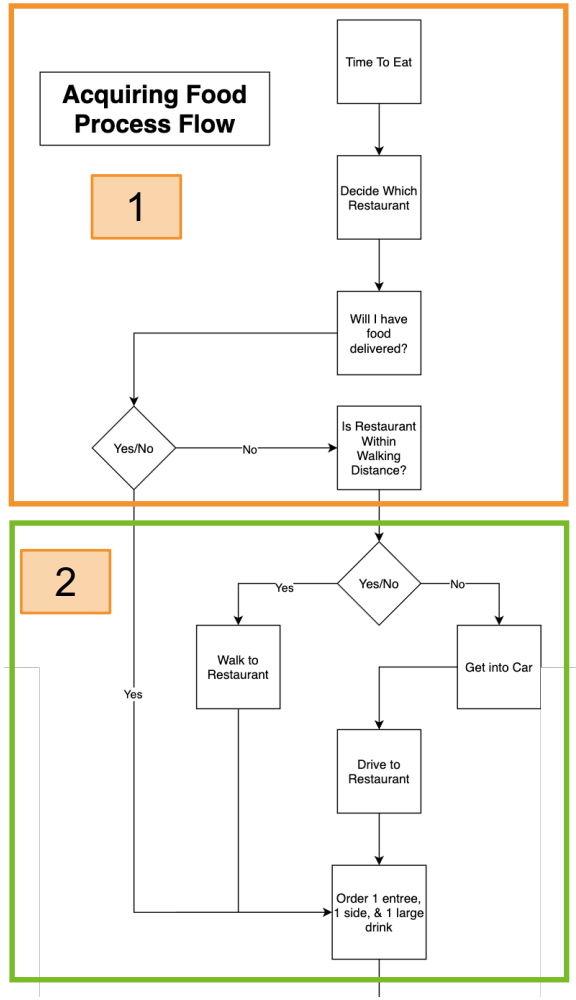
Team

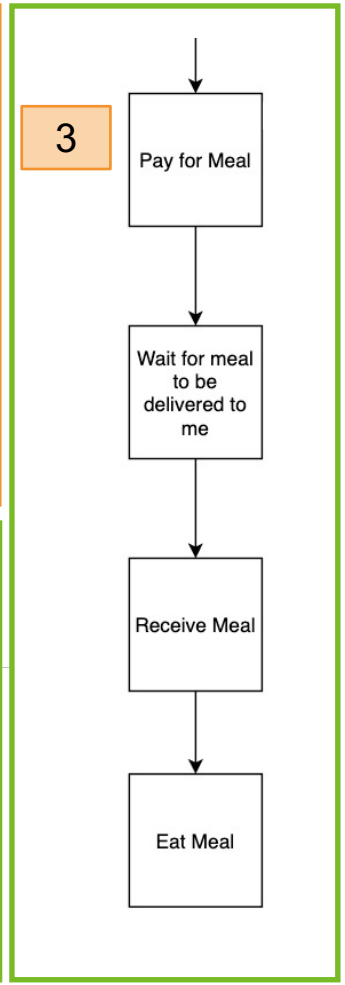
I will be the sole process owner for analyzing this process and summarizing the results.

Define: Process Map

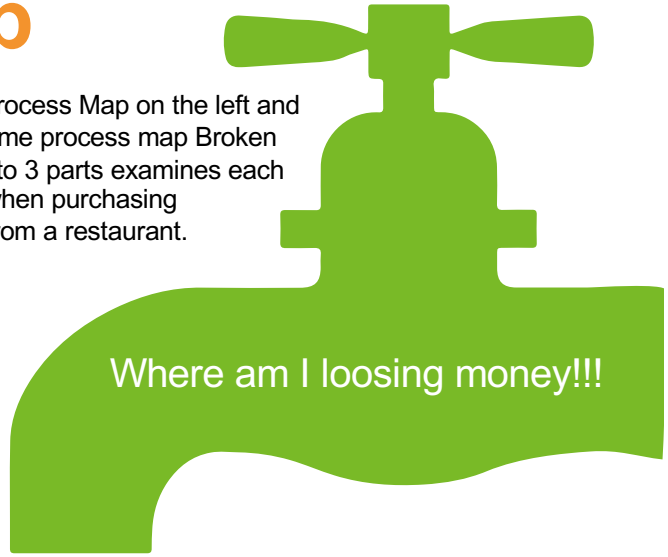
Overall







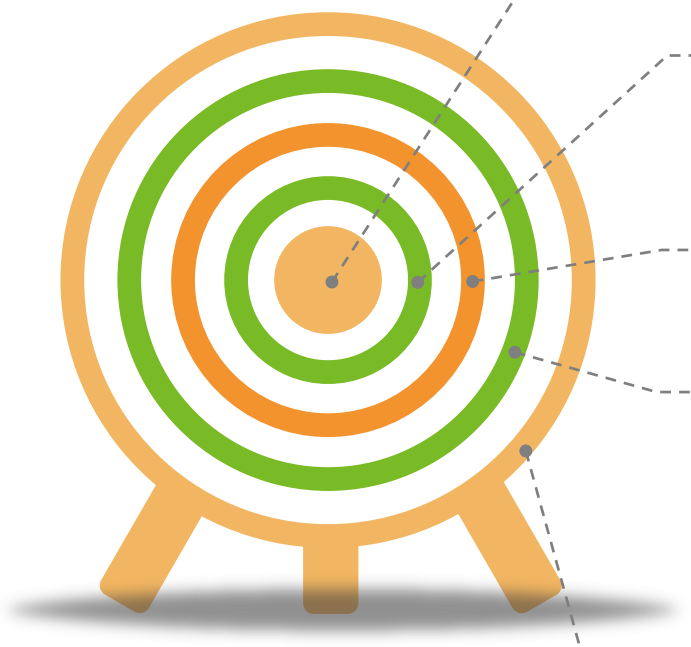
The Process Map on the left and the same process map Broken Out into 3 parts examines each step when purchasing food from a restaurant.



I examined each step to see if there were opportunities to cut extraneous expenses. I did find 3 areas to cut costs:

1. Never Have food Delivered. This is an extra cost that can be cut.
2. Ordering a side and a drink. I can either cut 1 or both to help reduce the cost.
3. Instead of ordering a large side and drink order medium sizes.

Success Measures



Goal

Reduce my daily average restaurant expenditures by 35% or said differently reduce my annual restaurant expenditures from $8,221.05 to $5,343.68.

Operational definition

“Restaurants” is fast food, fast casual, food truck, and waiter/waitress restaurants. Delivery costs, although not food, is still part of the cost factor. Using my own gas and time is **NOT** part of the cost factor. Output will be measured in dollars, which is continuous data.

Baseline

After 14 months (426 days) of gathering data from bank statements, I spent an average of $22.56 on restaurant expenses.

DPMO

Defect Opportunities = 1
Number of Days = 426
Total Possible Defects Per Day (DxU) = 426
Total Actual Defects = 227
The Defect Rate: A/DU= 227/426 = 53%
Defect Per Million Opportunities (DPMO) = 532,864

SQL: 1.4

Data Measurement Plan

Performance Measure	Data Source and Location	How Will Data Be Collected?	Type of Data	Who Will Collect Data?	When Will Data Be Collected	Target Sample Size
Total restaurant spend per month	Capital One Credit Card (online) Citi Bank Credit Card (online) Apple Credit Card (online)	An application called Personal Capital. This plugs into my accounts and give me a csv file.	Continuous	Daniel Caley	February 28th 2021	12 months worth of data
How Many times did I eat at a sit down restaurant rather than a fast food restaurant	Capital One Credit Card (online) Citi Bank Credit Card (online) Apple Credit Card (online)	An application called Personal Capital. This plugs into my accounts and give me a csv file. I will review each purchase manually and identify which restaurants are sit down.	Discrete	Daniel Caley	February 28th 2021	12 months worth of data
How often do I get a full meal which qualifies as an entrée, side, and a drink. For restaurants with larger portion sizes this will count as an entrée and a side.	Personally monitoring	Via Excel Spreadsheet.	Discrete	Daniel Caley	Daily	15 days worth of data
How often do I get large sizes of an entrée, side, and a drink. Restaurants with larger portion size count.	Personally monitoring	Via Excel Spreadsheet.	Discrete	Daniel Caley	Daily	15 days worth of data
How many weeks did I go over 40 hours (Y/N).	Company Workday (online)	A csv output, with (Y/N) by week.	Discrete	Daniel Caley	February 28th 2021	4 months of worth of data
What day of the week the expense occurred on. Weekend vs. Weekday.	Capital One Credit Card (online) Citi Bank Credit Card (online) Apple Credit Card	An application called Personal Capital. This plugs into my accounts and give me a csv file. Each day will have a flag that says weekday vs weekend.	Discrete	Daniel Caley	February 28th 2021	12 months worth of data

Data Collection Method & Sample Size

90%

Both continuous and discrete data were collected through a banking application or by logging data. For the continuous data I wanted to be 90% confident in order to avoid drawing the wrong conclusion.

The continuous data was collected by an application called Personal Capital which plugs into my bank account and then pulls my expenses onto the platform. For the continuous data I had a sample size over 30. For the discrete data I had a total of 5 performance measures. All but 2 I was able to get a sample size over 30. This was due to only having 14 days, from 2/3 – 2/17, for the measuring phase of the project.

Sample Size - Continuous

I will need at least 346 days of sample to be 90% confident that the sample mean will be within $2.50 of daily restaurant expenditures.

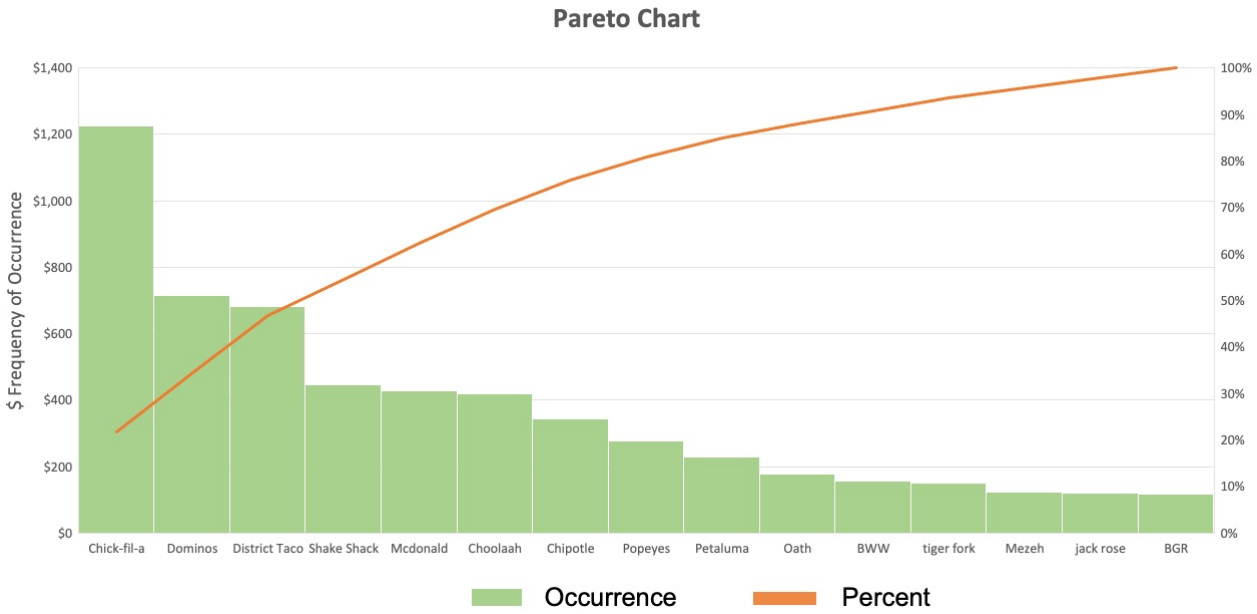
$$n = \left(\frac{z^* \hat{\sigma}}{E}\right)^2 = \left(\frac{1.645 * 28.26}{2.50}\right)^2 = 346$$

Measurement Error

The Personal Capital app or myself mis-labeling an expenditure as restaurant or not restaurant can lead to a measurement error. I do my best to transform the data when needed but there is the possibility of errors. To minimize these errors I could have reviewed all my transactions not just restaurants.

Pareto Chart

Measure



15 out of 181 Restaurants Represent 68% of My Expenses

The pareto chart was valuable in identifying the restaurants that contributed the most to expenditures. Therefore, these restaurants should be where I spend the most time improving.

The top 15 restaurants made up 68% of my restaurant expenses. Said differently 8% of the total restaurants made up 68% of my expenses.

Of the top 15 Chick-fil-a, District Taco, Dominos, Shake Shack, and McDonalds seem to be the focus. Even though Chick-fil-a could be the sole focus the top 5 could yield a lot of benefit when improved.

In order to truly identify the x variables that may be contributing to the root of the problem I created a histogram of the top 5 restaurants to identify the frequency of visits.

Of the top 5 the average amount spent is the following:

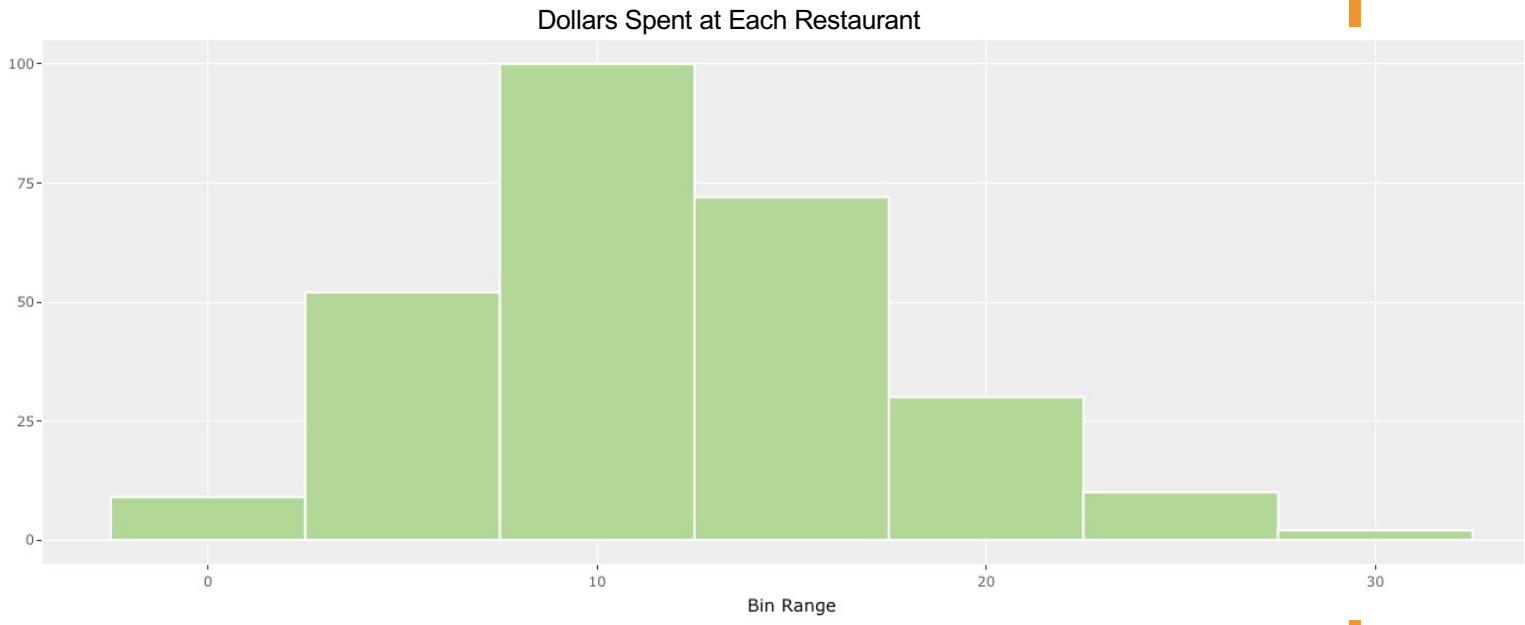
1. Chick-fil-a: $11.43
2. Dominos: $12.25
3. District Taco: $37.61
4. Shake Shack: $6.37
5. McDonalds: $15.41

Histogram

Measure

Out of the top 5 restaurants I wanted to see how much money I was spending per visit. The histogram below shows that the highest frequency is between $10 and $15 with many other bins to the right at $20 and $25. In order to improve my process, I should aim to bring spending down in the bins above $10.

On average I spend over $10 each day.



Chi – Square Test

Analyze

When reflecting on the data, I hypothesized that I was spending more money on the weekdays due to being busy at work, than on the weekends.

	>= $22.50 Restaurant Expense	< $22.50 Restaurant Expense	Totals
Not Weekend	110	194	304
Weekend	40	82	122
Total	150	276	426

	f (Observed)	F (Expected)	(f-F)^2 / F
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Weekend / >= $22.50 Expense	40	42.96	0.20
Weekend / < $22.50 Expense	82	79.04	0.11
Total	426	426	**0.44** <-- chi-square

Calculate degrees of freedom:

df = (r - 1) * (c - 1) = (2 -1) * (2 - 1) = 1

p-value = 0.51

Alpha = 0.10

Hypothesis Statement

Does the amount I spend on restaurants have a relationship with weekend vs weekday.

Ho: Restaurant Expenditures and weekend vs weekday are independent.

Ha: Restaurant Expenditures and weekend vs weekday are not independent.

Results

P- Value (0.51) is more than alpha (0.10), fail to reject Ho.

Evidence

There is evidence that the amount I spend at a restaurant and the day falling on a weekend vs weekday are independent. There is no relationship.

Hypothesis Test

Analyze

Two Sample Hypothesis Test
Z-test upper 1 tail test
Ho = Avg. Restaurant Expenditures <= Avg. Restaurant Expenditure Post Process Change
Ha = Avg. Restaurant Expenditures > Avg. Restaurant Expenditure Post Process Change
Ho = U1 <= U2
Ha = U1 > U2
Z = 2.43
P-value = 0.007 so p = 0.007 < 0.10 therefore reject the null hypothesis

I can, with 90% confidence, reject the null hypothesis. Therefore, Avg Restaurant Expenditure before new process is greater than after my process change.

Next step is to now control this process and make sure to continue this success further.

Improve

Y

After reviewing the gathered data, I found the restaurants I spend the most time and money at. I was also able to rule out the possibility that the weekdays and weekends had a factor in spending more money.

Specifically, I found multiple restaurants that if I cut out entirely, reduce my frequency. An additional solution is to buy medium size drink/sides to help meet my goal.

The restaurants to **cut** were Dominos and Shake Shack. Domino's is more than 3 times higher than Chick-fil-a, the most popular restaurant in my list. Shake Shack cost 35% higher than Chick-fil-a.

Another method is to **swap** out some of the Chick-Fil-A orders with McDonalds orders. This would reduce my expenses by 45% every time I go to Chick-fil-a

SQL & Statistical Analysis

Improve -Before & After

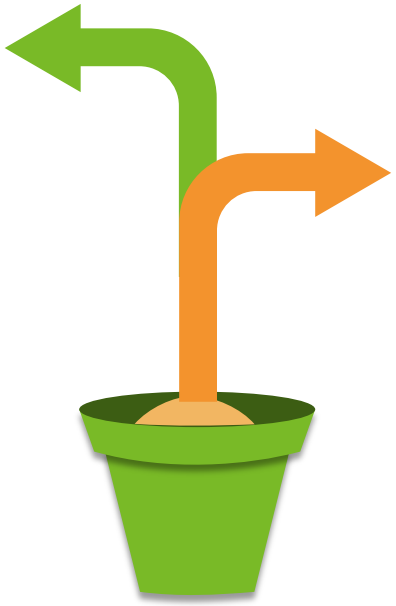
Before

DPMO & SQL

Defect Opportunities = 1
Number of Days = 426
Total Possible Defects Per Day (DxU) = 426
Total Actual Defects = 227
The Defect Rate: A/DU= 227/426 = 53%
Defect Per Million Opportunities (DPMO) = 532,864

SQL: 1.4

Before	
Mean	22.56
Standard Error	1.37
Median	16.88
Mode	-
Standard Deviation	28.26
Sample Variance	798.83
Kurtosis	30.14
Skewness	4.29
Range	289.15
Minimum	-
Maximum	289.15
Sum	9,611.57
Count	426.00



After

DPMO & SQL

Defect Opportunities = 1
Number of Days = 16
Total Possible Defects Per Day (DxU) = 16
Total Actual Defects = 7
The Defect Rate: A/DU= 7/16 = 44%
Defect Per Million Opportunities (DPMO) = 437,500

SQL: 1.7

After	
Mean	15.31
Standard Error	2.65
Median	13.22
Mode	6.36
Standard Deviation	10.59
Sample Variance	112.06
Kurtosis	0.71
Skewness	0.99
Range	40.05
Minimum	-
Maximum	40.05
Sum	244.94
Count	16.00

Defect rate decreased from 53% to 44% therefore SQL increased from 1.4 to 1.7

By simply swaping some Chick-fil-a for McDonalds, dropping Domino's and Shake Shack, and reducing the portion sizes to medium help improve the process. Although a 1.4 to 1.7 SQL isn't the best, improvement still occurred. The question remains though, did I reduce the average restaurant expense?

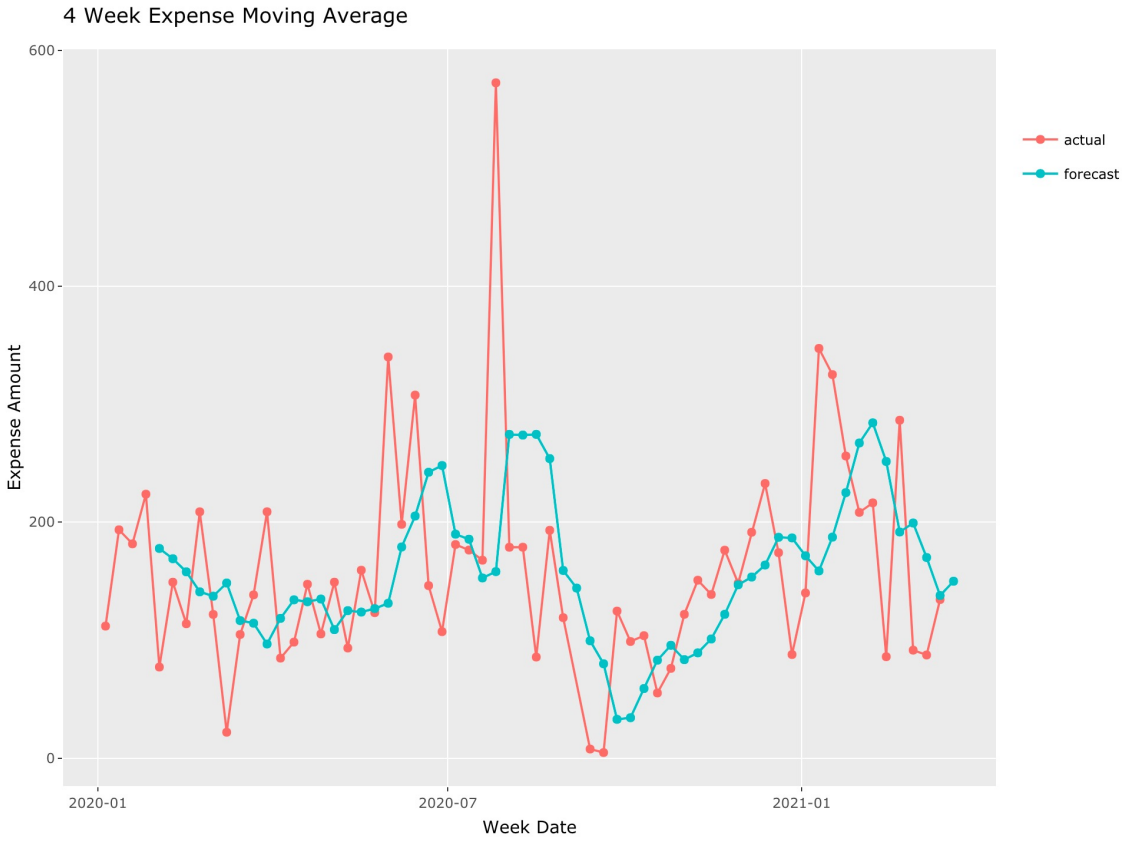
When looking at the average I did reduce my expenditures by more than 35% to 47%

This is quite a remarkable feet was still a quite remarkable reduction. Another take away is that the standard deviation reduced greatly from 28 to 10.59. What this provides is that the variability in the expenses has dropped.

Time Series

Improve

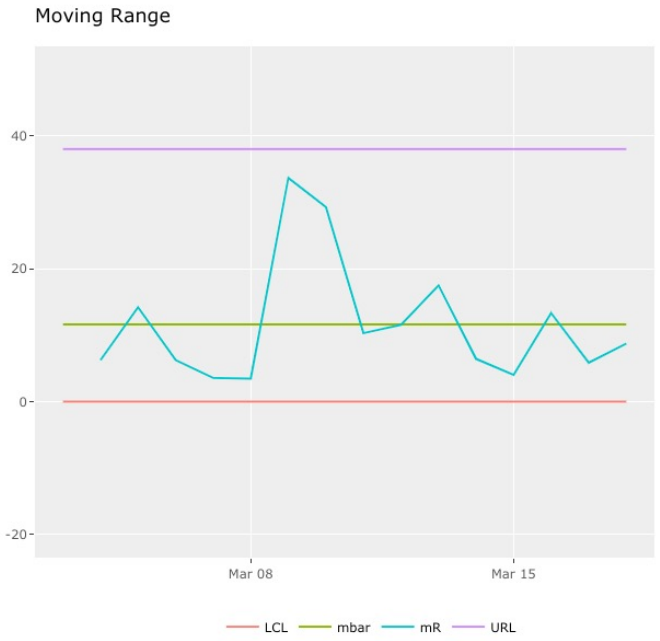
- Bringing expenses down by 47% over the last 15 days, I saved $3,540.
- This would bring my expenses from $8,234.40 to $4,693.78.
- This is a significant improvement but, without continued implementation of the new processes, this could be under question
- The time series to the right shows a 4 week expense moving average. Expenses do seem to tick back up in the forecast.

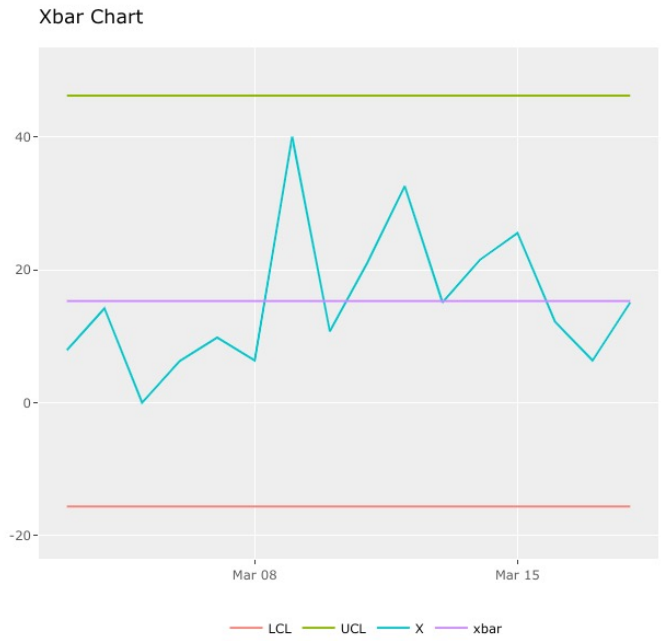


Controlling the Process

The moving range chart showed that the new process is working and the performance is sustainable. The Xbar chart show that the process is consistent and stable. There were no patterns observed and neither the mR nor the x moved outside of their respective URL/UCL and LCL bands.

Process Control Charts





Conclusion

Process Improvement Project

Reducing Restaurant Expenditures

- SQL increased from 1.4 to 1.7, which did indicate a process improvement.
- The IMR chart showed that the new processes is consistent and stable.
- Continued testing is still recommended because I only had 2 weeks to qualify if the new processes was working properly. My recommendation is to take samples for at least 6 months because seasonality factors could be at play.