RUNNING HEAD: Process Improvement Plan

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Process Improvement Plan

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Introduction

In Week one, I made a dinner at home and monitored how much time it took to finish it. I determined that it would take less time to make a dinner together (43 minutes), rather than one person making it (55 minutes).

Over each night, we teamed up to make dinner decisions. We wanted to make dinner in a less period of time. Dinner times were taken for preparation times, not eating or clean up times. When we ate out, we determined preparation time from the time we ordered food until the time we got food at our table.

	Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Type of dinner
Mon	13	25	20	18	32	25	Eating out
Tues	16	20	20	22	21	15	Very quick meal
Weds	22	25	28	27	30	25	Light meal
Thurs	25	28	26	28	18	22	Light meal
Fri	45	30	34	37	25	24	Regular meal
Sat	15	25	20	22	17	25	Eating out
Sun	55	40	50	53	43	38	Family gathering dinner

Statistical Process Control

Statistical process control is the method of using statistical charts such as the one above to monitor quality and quantity in the product process, or as in our case, the dinner making process. If our dinner preparation times were a business process, we would use statistical process control to determine quality assurance insuring the job is being performed correctly. If a time period took too long, we would use statistic process control procedures to help us analyze and improve the times.

Control limits explained

A very useful tool is the control chart which lets a manager see when an unusual event happens has the effect of taking the variation out of statistical control. We determine the standard deviation each week to establish the upper and lower limit levels of acceptance.

We found that each week had its own variations, yet breaking down the time each week only gives us the data for that week in particular. If something out of the ordinary happened in a specific week, such as a broken leg or final exam, and factor that week out of the entire average. Another observation in this sampling is Sunday night dinner. Because guests are present, this meal takes longer than usual to prepare and does not reflect the other six days of the week. Unusual situations, such as holidays or seasonal differences need to be taken into consideration using data because it can skew the usual standard deviation and control limits.

The mean time overall to make a meal over six weeks is 27 minutes. The standard deviation minutes over each meal time for 6 weeks is 10 minutes, which means the upper control limit would be 37 minutes, and lower control would be 17 minutes. To be compliant with our wishes to spend less time making dinner every night, we need to monitor time for 27 minutes and not go over 37 minutes in preparation. The lower control limit is put in place for the cooks to understand that if they make a dinner in 17 minutes that is on average, the least amount of time they need to take and still be within an acceptable range.

The upper control limit is designed to help the person making dinner know that if it takes over ten minutes to make a meal than the average, they are over the control limit and are spending more time than usual to make the dinner.

Calculations and data used to determine control limits

Time Dinner Ready
In Minutes

	week 1	week 2	week 3	week 4	week 5	week 6	
M	13	25	20	18	32	25	eating out regularly
T	16	20	20	22	21	15	school night very quick meal
W	22	25	28	27	30	25	light meal
T	25	28	26	28	18	22	light meal
F	45	30	34	37	25	24	home cooked
S	15	25	20	22	17	25	eating out regularly
S	55	40	50	53	43	38	Sunday night family dinner

Week by week breakdown

	week 1			Mu	Mean	Mu-Mean	$(Mu-Mean)^2$		
M	13			13	27.29	-14.29	204.08		
T	16			16	27.29	-11.29	127.37		
W	22			22	27.29	-5.29	27.94		
T	25			25	27.29	-2.29	5.22		
F	45			45	27.29	17.71	313.80		
S	15			15	27.29	-12.29	150.94		
S	55			55	27.29	27.71	768.08		
total	**191**	**27.29**	**mean**			0.00	**1597.43**	**total**	
							228.20	**average**	
							15.11	**standard deviation**	**15 minutes**

Total dinners

$(Mu-Mean)^2$	Wk 1
204.08	Mon
127.37	Tues
27.94	Wed
5.22	Thurs
313.80	Fri
150.94	Sat
768.08	Sun

	week 2			Mu	Mean	Mu-Mean	$(Mu-Mean)^2$		
M	25			25	27.57	-2.57	6.61		
T	20			20	27.57	-7.57	57.33		
W	25			25	27.57	-2.57	6.61		
T	28			28	27.57	0.43	0.18		
F	30			30	27.57	2.43	5.90		
S	25			25	27.57	-2.57	6.61		
S	40			40	27.57	12.43	154.47		
total	**193**	**27.57**	**mean**			0.00	**237.71**	**total**	
							33.96	**average**	
							5.83	**standard deviation**	**6 minutes**

$(Mu-Mean)^2$	Wk 2
6.61	Mon
57.33	Tues
6.61	Wed
0.18	Thurs
5.90	Fri
6.61	Sat
154.47	Sun

	week 3			Mu	Mean	Mu-Mean	$(Mu-Mean)^2$		
M	20			20	28.29	-8.29	68.65		
T	20			20	28.29	-8.29	68.65		
W	28			28	28.29	-0.29	0.08		
T	26			26	28.29	-2.29	5.22		
F	34			34	28.29	5.71	32.65		
S	20			20	28.29	-8.29	68.65		
S	50			50	28.29	21.71	471.51		
total	**198**	**28.29**	**mean**			0.00	**715.43**	**total**	
							102.20	**average**	

$(Mu-Mean)^2$	Wk 3
68.65	Mon
68.65	Tues
0.08	Wed
5.22	Thurs
32.65	Fri
68.65	Sat
471.51	Sun

10.11	**standard deviation**	**10 minutes**

	week 4			Mu	Mean	Mu-Mean	$(Mu-Mean)^2$			$(Mu-Mean)^2$	Wk 4
M	18			18	29.57	-11.57	133.90			133.90	Mon
T	22			22	29.57	-7.57	57.33			57.33	Tues
W	27			27	29.57	-2.57	6.61			6.61	Wed
T	28			28	29.57	-1.57	2.47			2.47	Thurs
F	37			37	29.57	7.43	55.18			55.18	Fri
S	22			22	29.57	-7.57	57.33			57.33	Sat
S	53			53	29.57	23.43	548.90			548.90	Sun
total	**207**	**29.57**	**mean**			0.00	**861.71**	**total**			
							123.10	**average**			
							11.10	**standard deviation**	**11 minutes**		

	week 5			Mu	Mean	Mu-Mean	$(Mu-Mean)^2$			$(Mu-Mean)^2$	Wk 5
M	32			32	26.57	5.43	29.47			29.47	Mon
T	21			21	26.57	-5.57	31.04			31.04	Tues
W	30			30	26.57	3.43	11.76			11.76	Wed
T	18			18	26.57	-8.57	73.47			73.47	Thurs
F	25			25	26.57	-1.57	2.47			2.47	Fri
S	17			17	26.57	-9.57	91.61			91.61	Sat
S	43			43	26.57	16.43	269.90			269.90	Sun
total	**186**	**26.57**	**mean**			-0.00001	**509.71**	**total**			
							72.82	**average**			
							8.53	**standard deviation**	**9 minutes**		

	week 6			Mu	Mean	Mu-Mean	$(Mu-Mean)^2$			$(Mu-Mean)^2$	Wk 6
M	25			25	24.86	0.14	0.02			0.02	Mon
T	15			15	24.86	-9.86	97.16			97.16	Tues
W	25			25	24.86	0.14	0.02			0.02	Wed
T	22			22	24.86	-2.86	8.16			8.16	Thurs
F	24			24	24.86	-0.86	0.73			0.73	Fri
S	25			25	24.86	0.14	0.02			0.02	Sat
S	38			38	24.86	13.14	172.73			172.73	Sun
total	**174**	**24.86**	**mean**			0.00002	**278.86**	**total**			
							39.84	**average**		4200.86	total
							6.31	**standard deviation**	**6 1/2 minutes**	100.02	average
										10.00	**standard deviation**

1149	total minutes cooking
27.36	mean minutes cooking
27 minutes	overall average time to make a meal
37 minutes	**Upper control**
17 minutes	**Lower control**

Because Sunday is a large family dinner unlike the rest of the week, we may want to remove this statistic from the overall total. If do not include Sunday in the statistics for the week, we have very different upper and lower control limits.

	week 1	$(Mu-Mean)^2$	
M	13	204.08	Mon
T	16	127.37	Tues
W	22	27.94	Wed
T	25	5.22	Thurs
F	45	313.80	Fri
S	15	150.94	Sat
	136	829.35	

	week 2	$(Mu-Mean)^2$	
M	25	6.61	Mon
T	20	57.33	Tues
W	25	6.61	Wed
T	28	0.18	Thurs
F	30	5.90	Fri
S	25	6.61	Sat
	153	83.24	

	week 3	$(Mu-Mean)^2$	
M	20	68.65	Mon
T	20	68.65	Tues
W	28	0.08	Wed
T	26	5.22	Thurs
F	34	32.65	Fri
S	20	68.65	Sat
	148	243.92	

	week 4	$(Mu-Mean)^2$	
M	18	133.90	Mon
T	22	57.33	Tues
W	27	6.61	Wed
T	28	2.47	Thurs
F	37	55.18	Fri
S	22	57.33	Sat
	154	312.82	

	week 5	$(Mu-Mean)^2$	
M	32	29.47	Mon
T	21	31.04	Tues
W	30	11.76	Wed
T	18	73.47	Thurs
F	25	2.47	Fri
S	17	91.61	Sat
	143	239.82	

	week 6	$(Mu-Mean)^2$	
M	25	0.02	Mon
T	15	97.16	Tues
W	25	0.02	Wed
T	22	8.16	Thurs
F	24	0.73	Fri
S	25	0.02	Sat
	136	106.12	

870	1815.26	total
24.17	51.86	average
	7.20	standard deviation

	total minutes
870=	cooking
	mean minutes
24 =	cooking
31 minutes	Upper Control
17 minutes	Lower Control

The total minutes cooking from Monday through Saturday are 870 minutes. Divided by 36 dinners is 24 minutes. The standard deviation is seven minutes, which means the upper control would be 31 minutes and the lower control is 17 minutes. This data is different than when we factor Sunday night dinners into the entire equation. Sometimes in business, we need to remove an exception from the regular manner in doing business; an "out-of-control event" because it greatly skews the average times along with upper and lower control limits.

Confidence intervals and usefulness based on data points

Confidence intervals are used to estimate population parameters and give the estimated range being calculated of all dinners using the sample data we collected over 6 weeks time period (42 dinners). We want to estimate a find 95% confidence interval of all dinners we will ever make. We measured the time it took to make dinner and found the sample mean is exactly 27.40 minutes and the standard deviation is 10 minutes.

A 95% confidence interval covers 95% of the normal curve, so the probability of observing a value outside of this area is less than 0.05 and the area in each tail is equal to 0.05/2 = 0.025. A 95% confidence interval for the standard normal distribution is the interval (-1.96, 1.96), since 95% of the area under the curve falls within this interval. We also need to find he standard deviation / square root of the sample mean. (10/sqrt 27 = 1.92)

In our data, the sample mean is 27.40 minutes with a standard deviation of 10 minutes which is the standard error of the mean. The critical value for 95% confidence interval is 1.96. A 95% confidence interval is 27.40 – (1.96*10), 27.40 + (1.96*10) or 27.40-19.60, 27.40+19.60 = 7.80, 47 minutes. The 95% confidence level shows that any time between 7.8 minutes and 46.4 minutes will fall between 95% of the normal bell curve. Because the sample size is so small, it is difficult to get a tight confidence interval. If the sample size was higher, the confidence interval would be a tighter time line, closer to the upper and lower control limits calculated earlier.

Conclusion

In business, controls are usually put in place to set expectations for business process flow. Managers use specific data calculations to come to difference control decisions. Using statistical process control in business helps managers analyze and improve on processes to ensure quality. Control limits then are put in place so a business manager can investigate if a process goes outside the regular limits. Using the mean and standard deviation, one can find the upper and lower control limits; mean + standard deviation for upper control limit, and mean – standard deviation for lower control limits. A manager can use a confidence interval to decide on adequate time parameters, but only if the sample size is large enough to get a control limit one can properly use.

Reference

Chase, R. B., Jacobs, F. R., & Aquilano, N. J. (2006) *Operations management for competitive advantage (11th ed)*. New York: McGraw Hill/Irwin.