SOUTHWEST COLLEGE

Projecting SWC Growth opportunities.

The information in this document is to assist Southwest college forecast future applications in order to establish potential revenue. How often specifics marketing should be used and project the duration of reorganizing the university departments

Southwest college

PROJECTING SWC GROWTH OPPORTUNITIES.

CONCERNS AND REQUESTS OF SWC.

SWC has supplied data to identify three areas of focus for the university. First is the breakdown of applicants versus actual attending students. SWC has asked that three different methods to predict next year applications and two ways to determine which method is best for them to use. Secondly SWC has concern about their marketing and wanting to know what the best marketing strategy for the college is. Lastly SWC is looking to reorganize and needs to know, based on the data provided, what the project visually undergoes and the probability the project will be completed within the 57 weeks.

Applying student's vs Actual attendance.

Utilizing the data provided for the last eleven years of applications we looked at different forecasting models that would be best suited to deliver the best information. The three methods were moving average, Exponential smoothing, and linear trend projection which uses regression analysis that was shown and advised on during our last venture. At the request of the VP we will cover these three methods and advise on which will be the best forecasting program going forward.

After inputting the data supplied by SWC to three separate methods the following results were forecasted. As you can see forecasting is not a guarantee but can provide the best estimation based on the data provided.

Moving Average	Exponential Smoothing	Linear Trend Projection Method
1193	979	1233

Per the results it can be noted the application estimations are within close proximity of each other and that each method will allow a proper forecasting estimation for SWC. The following information will explain each method and discuss how these estimations were predicted. Then provide a recommendation to which method may be the best for the school to utilize going forward.

Moving Average Forecasting

This method of forecasting method uses the average of the most recent data values in the time series as the forecast for the next period. Since the information is up to date and we can utilize prior years and applications received during this time to establish a trend. While looking over the information we opted use a moving average of 3 years and 4 years to establish trend. It was noticed about every three years there is a drop in applications. Using a 3 year and 4 year moving average will help catch this information and provide a potential forecast going forward. A positive for moving average is can be updated every year with the actual number of applications received to forecast for the following year.

Moving Average											
year	applications	3 Year MOVING AVG	4 Year MOVING AVG	ERROR	|err|	ERROR2	ERR%	ERROR	|eRR|	ERR2	ERR%
2009	803	X	X								X
2010	877	X	X								X
2011	942	X	X								X
2012	863	874	X								X
2013	937	894	871	43	2	3	0.20	66	4.40	19	0.51
2014	1054	914	905	140	5	25	0.55	149	4.40	19	0.49
2015	922	951	949	-29	4	14	0.39	-27	3.00	9	0.32
2016	976	971	944	5	1	2	0.13	32	1.00	1	0.11
2017	1103	984	972	119	4	14	0.38	131	3.00	9	0.31
2018	1351	1000	1014	351	2	3	0.17	337	2.00	4	0.20
2019	907	1143	1088	-236	7	46	0.59	-181	5.60	31	0.51
2020	1322	1120	1084	202	4	18	0.38	238	3.60	13	0.33
		1193	1171								
					3.53	15.55	0.35		3.38	13.26	0.35
					maD	MSE	MAPE		mad	mse	Mape

Looking over the information in the graph above it can be determined there will be a decrease in applications during the 2021 where the three-year average is estimating around 1193 and the four-year average estimation is around 1171. Since we have established potential estimated forecast, we then need to ensure the accuracy of the information by utilizing Mean absolute deviation (MAD), Mean square error (MSE), Mean absolute square error (MAPE) to find out any errors that may occur. Per the calculation the forecast has a MAPE of 0.35 for both 3-year and 4-year monthly average. A MAD of 3.53 for the third year and 3.38 for the fourth year moving average. The MSE of 15.55 for third year and 13.26 for fourth year. Based on the information discussed there is a 35% chance the forecast may be off. Though it is able to provide an estimation moving average may not be beneficial for the SWC to utilize.

Exponential smoothing method

The second method using the same moving average but will incorporate exponential smoothing. This method is used often in time series data and since we are using yearly numbers it will provide another method to see what outcome may occur. The overview of this method is past observations are weighted less where the first method weighs previous years equally. As stated for the previous method this can be updated yearly and provide an estimated forecast for future outcomes. The smoothing application associated with this method will decrease past weighting and provide better information.

	A	1-A				
	0.1	0.9				
	AT	FT		mae	mse	mape
WEEK	SALES	FORECAST	ERR	|err|	EER2	mape
2009	803	X	X		X	
2010	877	803	74	4.00	16.00	0.46
2011	942	810	132	1.60	2.56	0.17
2012	863	824	39	5.44	29.59	0.63
2013	937	828	109	0.10	0.01	0.01
2014	1054	838	216	2.09	4.38	0.20
2015	922	860	62	2.12	4.48	0.23
2016	976	866	110	0.10	0.01	0.01
2017	1103	877	226	3.91	15.32	0.35
2018	1351	900	451	1.52	2.32	0.11
2019	907	945	-38	3.63	13.18	0.40
2020	1322	941	381	3.73	13.94	0.28
2021		979	160	2.57	9.25	0.26

Per the information above the estimated forecast is showing a lower number of applicants as well for 2021 at 979 applicants but the information is now showing a 26% chance of being off. Between these two models the Exponential smoothing shows a better chance of being accurate that would allow proper budgeting and estimation of incoming revenue for the university. Overall, both can provide an opportunity of forecasting incoming students/revenue

Linear trend projection method

This method utilizes regression models to establish forecasting. Regression was used during our last cooperation in identifying higher salaries for students after graduations and the factors involved. Since you are already familiar with this form of calculations it will be the method of recommendation to use going forward. Based on the data here is forecasted regression data for 2021

year	applications
2009	803
2010	877
2011	942
2012	863
2013	937
2014	1054
2015	922
2016	976
2017	1103
2018	1351
2019	907
2020	1322
2021	1233

SUMMARY OUTPUT

Regression Statistics

Multiple R	0.72
R Square	0.52
Adjusted R Square	0.48
Standard Error	126.38
Observations	12.00

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1.00	175770.51	175770.51	11.01	0.01
Residual	10.00	159717.74	15971.77		
Total	11.00	335488.25			

	Coefficients	*standard Erro*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*pper 95.0%*
Intercept	-69622.49	21290.04	-3.27	0.01	-117059.66	-22185.33	-117059.66	-22185.33
year	35.06	10.57	3.32	0.01	11.51	58.61	11.51	58.61

Based on the P-value as seen above it is lower than 0.5 and can be determined that the information show a correspondence and present an opportunity to predict a strong estimation of applicants for the next year. How regression determines the forecast is by the calculation of coefficients.

$$Y=35.06(2021) +-69622.49$$

$$Y=1233$$

Per the regression model analysis and forecasting it is determined that 1233 applicants is the estimated amount for the coming year.

Going forward it is recommended to utilize linear trend projection because it is the best way to predict applications for the coming years because it is using data of previous years and applications. Also the data provided shows a trend where there is growth every two to three years and then a drop. By using this method, it will continue showing a trend line and if there is a deviation then SWC can make changes immediately for future applications.

How to increase applications

SWC has a concern about attracting students and want to make sure that the three current marketing streams and wants to maintain a broad presence using the three forms of recruiting which are online advertisements, direct mailers, and in person recruitments.

Based on the estimates of SWC:

Type of marketing	Estimated number of applications	Cost of marketing
Online Ads	50	850.00 per ad
Mailers	30	600.00 each
In person recruiting	12	300.00 per event

As stated by SWC the goal is to hold a minimum of 3 of each form of recruiting. For the in-person event there is a limited amount of personnel that can be used. SWC also requests at least half of the budget is used in online advertisements. The current budget is set at 7,000 but there is a question of what would be the best plan with a 2,000 increase of the budget to 9,000.

Establishing the variables and parameters we were able to create a way to determine how often marketing can occur and created an excel for SWC to use going forward. Based on our calculations 5 Online ads can occur with 3 mailer events and 3 in person events with a budget of 7,000.

Marketing Streams	Online Ads	Mailers	in person Events			
variables	A	B	C			
values	5.06	3	3			
coefficient	50	30	12			
Applications	379					
				Amounts	greater/less	
Budget	850	600	300	7000	<=	7000
5 in person events	0	0	1	3	<=	5
Minimum 3 online ads	1	0	0	5.06	>=	3
Minimum 3 Mailers	0	1	0	3	>=	3
Minimum 3 in person events	0	0	1	3	>=	3
Half Budget used for online ads	0.5	-0.5	-0.5	-0.47	>=	0

If the budget was increased to 9,000 for marketing, and half of the budget going to online advertisements the breakdown would be as follows.

Marketing Streams	Online Ads	Mailers	in person Events			
variables	A	B	C			
values	7.41	3	3			
coefficient	50	30	12			
Applications	497					
				Amounts	greater/less	
Budget	850	600	300	9000	<=	9000
5 in person events	0	0	1	3	<=	5
Minimum 3 online ads	1	0	0	7.41	>=	3
Minimum 3 Mailers	0	1	0	3	>=	3
Minimum 3 in person events	0	0	1	3	>=	3
Half Budget used for online ads	0.5	-0.5	-0.5	0.71	>=	0

With the increase of the budget to 9000 and increasing online ads SWC will see a potential increase of applications by 118 potential students. We would also recommend SWC look into possibly adjusting their limit of three for all categories and possibly consider, if there are any future deviations in trend, to look into increase marketing in online adds then mailers or in person events.

The VP of SWC requested an excel file to solve the problem going forward. The two graphs are PDF pictures of the same excel file to solve the problem. To help SWC a step-by-step walkthrough will be provided at the end of the report so SWC will have a way to estimate applications and what if scenarios if they change their marketing goals. SWC will need to utilize Solver through excel which will help predict these options.

How to utilize excel solver.

As shown above setup your table as follows

	A	B	C	D	E	F	G
1	Marketing Streams	Online Ads	Mailers	in person Events			
2	variables	A	B	C			
3	values						
4	coefficient	50	30	12			
5	Applications		0				
6					Amounts	greater/less	
7	Budget	850	600	300		<=	9000
8	5 in person events	0	0	1		<=	5
9	Minimum 3 online ads	1	0	0		>=	3
10	Minimum 3 Mailers	0	1	0		>=	3
11	nimum 3 in person eve	0	0	1		>=	3
12	Budget used for online	0.5	-0.5	-0.5		>=	0

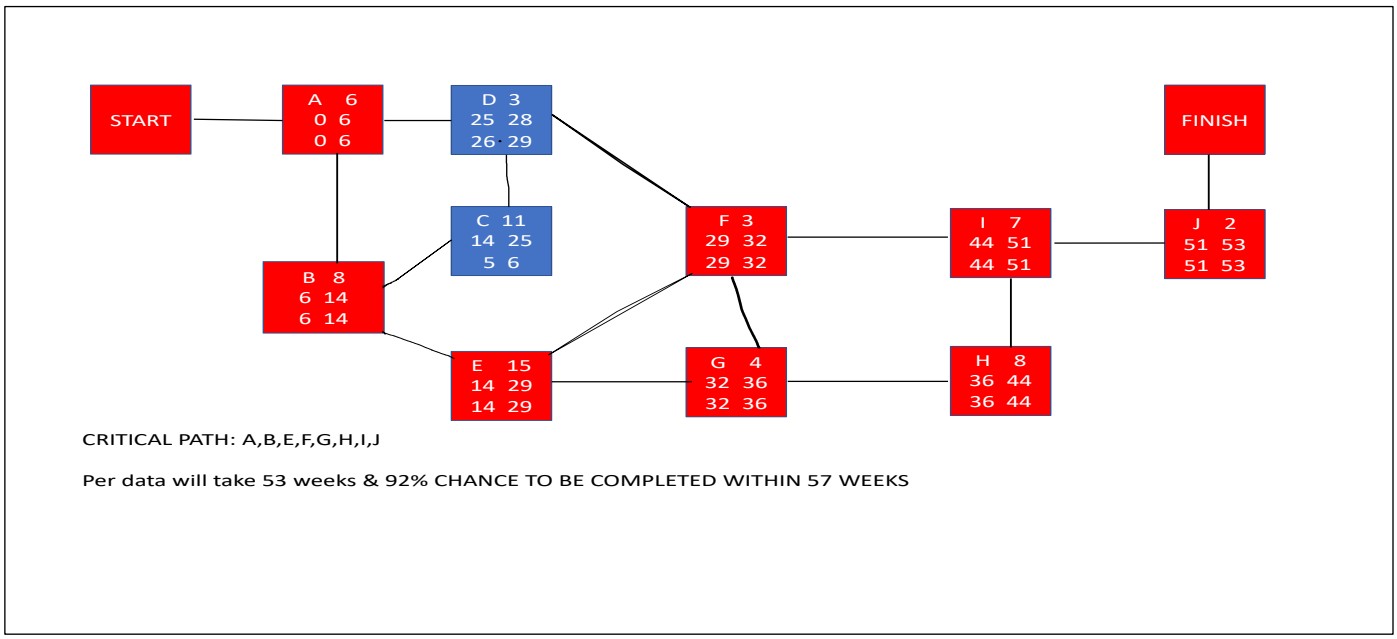
Now the information is entered choose analytic solver and enter the following information:

1. Objective: $B$5
2. Variables: $B$3:$D$4
3. Constraints: $E$9:$E$12>=$G$9:$G$12
4. Constraints: $E$7:$E$8<=$G$7:$G$8
5. Choose Standard LP/Quadratic
6. Click Solve.

Going forward coefficients, budgets and the items in cell column G can be adjusted to desired amounts. After changes occur go to solver and choose “Solve”. The information will be updated using the new data inputs that will allow SWC.

Reorganizing Departments

SWC is ready to kick off reorganizing departments to make the college optimal for staff and students. The President is concerned on the amount of time the project will take and wanting to know if the project will be completed within 57 weeks. SWC has supplied the data and we will use Pert/CPM to provide time of completion. Based on the information and timeline here is a visual representation of the timeline with start time and finish times throughout the project.



To provide more information on the critical path here is an excel with the data and how the information was processed to provide the 53-week nominal period.

Data	Immediate	optimistic	Most likely	Pessimistic
Activity	Predecessors	(weeks)	(weeks)	(weeks)
A	--	4	6	9
B	A	5	8	13
C	B	6	11	16
D	A,C	1	3	5
E	B	10	15	20
F	D,E	2	3	5
G	E,F	3	4	6
H	G	6	8	10
I	F,H	4	7	12
J	I	1	2	3

ACTIVITY	time	Predecessors	ACTIVITY	EARLY START	EARLY FINISH	LATE START	LATE FINISH	SLACK	MEAN	STANDARD DEVIATION	VARIANCE
A	6		A	0	6	0	6	no	6	0.83	0.694
B	8	A	B	6	14	6	14	no	8	1.33	1.778
C	11	B	C	14	25	15	26	yes	11	1.67	
D	3	A,C	D	25	28	26	29	yes	3	0.67	
E	15	B	E	14	29	14	29	no	16	1.67	2.778
F	3	D,E	F	29	32	29	32	no	3	0.50	0.250
G	4	E,F	G	32	36	32	36	no	4	0.50	0.250
H	8	G	H	36	44	36	44	no	8	0.67	0.444
I	7	F,H	I	44	51	44	51	no	7	1.33	1.778
J	2	I	J	51	53	51	53	no	2	0.33	0.111
			Estimated time of completion		53					sum of variance	8.083
			Goal to be completed by		57					square root	2.84
			estimated time minus goal		4					ZSCORE	1.41
										ZTABLE	0.9207
									% completed within 57 weeks		**92%**

As can be seen in the Graph above the information provides a walk-through of start time and finish time for early and late starts and finish. As can be seen for A, B, E, F, G, H, I, J the early start and finish minus the late start and finish equal 0 meaning no slack during these events. C and D show there will be slack since both start and finish times do not subtract from each other. Now that we established the critical path, we then determine the probability of completion by using the following calculation:

(Optimistic time - Pessimistic time)/6 = Standard deviation

Then determine the variance by using the Standard Deviation squared.

Sum the standard deviation then square root the result.

Then use the result of estimated time minus goal divided by the square rooted variance.

This will provide a Z-score to find the Z-table Result.

Conclusion

Going forward SWC should utilize linear projection trend for forecasting applications. Since there is an understanding of regression this will allow for easier transition in breaking apart the information and will allow SWC to spot negative trends and make adjustments for the following year and not miss on potential applications.

Also, to increase applications we recommend to SWC to increase their budget to $9,000 and place 7 online ads, 3 mailer events and 3 in-person events. This could provide an increase application of 120 more applicants and which potentially increased actual attendance which will generate revenue. So SWC can

Finally, the concern of completing the reorganization of departments within SWC has a 92% chance of success being completed under the 57-week deadline and should not have concerns.