QUALITY MANAGEMENT IN HIGHER EDUCATION ADMISSION SYSTEM

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ABSTRACT
The industry of higher education institutions such as colleges and universities are highly competitive amongst themselves for the best students, professors, researchers, industry partners, and athletic programs. Charged with attracting top quality clientele who will not only attend the institution, but help the university reach its objectives and goals, the marketing department becomes paramount to the organization’s success.
For many years higher institution attendance has increased across the board. As more technical colleges and alternative career paths with specialized training become more appealing, statistical analysis indicates that higher institution attendance numbers are decreasing. If this trend continues, colleges and universities will be forced to become more competitive to entice high quality clientele to attend their organization. The importance of marketing the institution will become critical to ensure the continued success of the organization.
Higher education institutions can target ideal candidates for their university’s programs through the use of statistical analysis techniques such as lead scoring, time series control, continuous improvement, and quality management tracking. Considered quality leads, ideal candidates possess a high likelihood of attending the university and garnering greater returns for the university through academic or athletic achievement.

Introduction

The marketing group of an organization is responsible for generating interest in the products and services the corporation offers which translates into increases in the corporation’s sales and profits. This can occur through advertising campaigns, the study of industry trends, and the analysis of market competition. The marketing strategy of an organization is based on a variety of factors including internal and external data. Internal data is comprised of product/service metrics, while external data encompasses sales and profits of industry competition. The internal and external data consumed by the marketing department is often the same data generated and used for industrial engineering concepts, such as quality management. This case study will demonstrate that by incorporating quality management techniques and processes into an organization’s marketing department, the marketing department will experience an increase in return on marketing capital.

Higher educational organizations, primarily colleges and universities, are extremely competitive in every aspect from academic prowess to athletic prestige. In order to provide the highest quality of service to customers and increase institutional prowess, these organizations are constantly searching for high caliber clientele including students, professors, coaches, and researchers. The more prestigious and sought after the university is, the higher the demand is for its services from prospective students, industry, and research groups. These organizations’ marketing departments play a crucial role in attracting desired clientele. The marketing group must consider how they will use the abundance of available data on potential university clientele to determine and target quality leads. Quality leads have a high likelihood of attending the institution and will assist the university in its goal of increasing their prestige and prowess. By increasing prestige and prowess, the university will attract more quality leads and the process will come full circle.

Most higher education institutions offer diverse services ranging from art and communication to engineering and healthcare. In parallel with these diverse service offerings, the various service groups (departments) have differing definitions of ideal clientele. An ideal candidate for a university’s nursing program can potentially differ from the ideal candidate for the university’s basketball team. It is the marketing department’s responsibility to cater the university to the ideal candidates of each group using the budget and information they have available. Quality management techniques, tools, and processes facilitate the marketing department’s process to identify and target the ideal clientele. Utilizing these tools, the marketing department is able to cater their products and services to quality lead. By focusing on quality leads, the marketing department can increase the attendance of high caliber clientele that attend the university while simultaneously reducing resource expenses on marketing to unlikely or undesired candidates.

One of the ways in which universities can identify and increase the number of quality leads is by utilizing statistical analysis tools such as Lead Scoring and Time Series control to analyze data trends of prospective clientele and existing clientele. Through the use of these tools, the marketing department is capable of identifying unique trends relating to an individual discipline in ideal clientele and therefore can identify common characteristics of quality leads across various disciplines. This data can be used to forecast new marketing strategies, plan for strategy implementation, and develop decision matrixes on likely outcomes.

The marketing department can analyze the resulting statistical tools data, so long as the processes used to identify and develop marketing material is flexible enough relative to the analyzed data trends. By implementing a corporate culture of continuous improvement, the marketing department is able to incorporate real time data and feedback from the organization into its marketing strategy. Continuous improvement as a marketing strategy gives an advantage over competitor higher education institutions by empowering the marketing department to react swiftly to failed marketing strategies. It also can provide justification for embracing successful marketing approaches.

For tracking the statistical data trends, high quality prospective clients (leads), and continuously improving processes, a quality management system must be incorporated into the marketing department. This enables additional data analysis and statistic tools to be implemented for analysis and development of marketing material.

To date the advantages of implementing quality management into a higher educational institution's marketing department remain focused on the benefits of effectively seeking and attracting quality clientele. Additionally, the marketing department profits from implementing quality management practices derived from the data analysis of ideal clientele. The marketing department can then provide information to the university on the products and services that interest the university's ideal clientele. For example, the data collected on ideal computer science clientele has identified that having courses available online is an imperative factor for students when choosing which university to attend. From the data analysis, the university can choose to offer more online computer science courses. Based on the data collected, this decision will directly impact the number of ideal computer science students who are interested in and will ultimately attend the university.

Literature Review

Quality management is essential for every department in an organization. Most popular quality concepts are seen with production and process improvements. The marketing strategy analysis remains prominent for any organization or institution in the recent decades with TQM (Total Quality Management) in practice. Many organizations spend large amounts of their budget on advertisements. In 2014 the total revenue of advertisements was around $50 billion, per Internet Advertisement Bureau (IAB 2015). With such a budget for the all institutions across industry, the number of leads that are converted to potential customers remains a pressing issue. ROI (return on investment) remains low for this kind of marketing strategy spending. As the quality management tools can be deployed for any department in the organization, we must apply the quality and statistical tools to optimize the marketing expenditure to experience a better ROI in terms of customer attraction success rate. This can result in enabling continuous improvement in the processes used by educational institutions.

All departments in the organization must work together to achieve TQM within the organization. The customer service related groups/departments are a cross functional management of quality, service and marketing. So long as the service satisfies the customer, the organization can expect to see an increase in their customer base. In order analyze customer satisfaction, the data available to the customer service groups must be accurate. The Automatic Identification and Data Capturing (AIDC) method of implementation has improved data capturing by reducing errors in the marketing field (Alan 2006). Service quality management is an imperative factor for customer management, so the marketing department must own the responsibility of connecting the internal and external customers of organization says Payne et al (Payne 1991). Payne also states that role of quality has widened, which can translate to a change in the marketing department's roles from traditional views.

In the age of internet, there are various factors associated to convert a lead into a customer. These factors are established by the university marketing agency to ensure successful advertisement. Total Quality helps in regulating and aligning marketing to organization goals. TQM and marketing integration is a relatively new concept to benchmark processes for successful TQM implementation in any organization. The scope of TQM has been greatly identified with little development which can be used to integrate the process (Longbottom 2000).
One of the trending marketing techniques is B2B (Business to Business), where the strategy is obtaining leads and converting those leads into customers which can be shared with partner or ally organizations. Most organizations in the manufacturing and service sector have adopted some form of these techniques. Per the 2013 educational marketing groups (EMG 2013) report, the total amount paid for advertisement from educational institutions was approximately $1.4 billion in the United States. If and when unsatisfied with their class performance, or their predicted grade and likelihood of success of the pedagogical innovation, students in the post-innovation group were directed to either self-regulate their class engagement, and/or seek the intervention of the instructor for remedies to facilitate their success (Rahal, A., & Zainuba, M. 2016). With excessive resources exhausted strictly on advertising, marketing strategists feel the quality or ROI on marketing expenses is lower than in previous years. Recent cost cutting measures have also affected the marketing departments, resulting in requirements to spend less while organizational management is demanding higher quality leads with the reduced budget available.

To identify the moment of truth, Payne (1991) suggests the use of quality tools like fishbone and flowcharts. The data for the lead quality management is collected from various sources to analyze the trend of lead quality for higher education enrollment. This analysis provides the means to check on how the marketing department can improve enrollment numbers. American Football remains a prominent advertising arena, as approximately 100 million people watch football on television regularly (Barbara 2014). Barbara 2014 shows an increase of 42% in enrollment applications for a university located in Texas following the weekly football match due to advertising during the game. With social media advertising and other means of advertisement, reports state that there are no best practices evaluated for maximizing revenue of educational institution through ROI from marketing in social media (CASE 2010).

“Get to know the next and final customer” is an essential principle for TQM (Schonberger 1992). This is an important strategy for customer satisfaction which assists in identifying a potential target. Identifying the potential customer remains challenging even with arrival of The Internet of Things. Tools like Google Analytics and internet marketing are great sources which can be used to identify and target potential customers. Google Analytics and other analytics services are reliable sources of information for analyzing the customer click usage pattern to identify the CPC (Cost Per Click) analysis for research purposes (Nakatani 2011 and Hsinchun 2012).

The total quality process can be used to operationalize marketing using tools like QFD. QFD focuses on both the needs determination and organization wide commitment to achieve the organization’s mission and vision (O'neal 1992). Universities support causes in view of social responsibility, which are also seen as strategy of marketing the university called Cause Related Marketing (CRM). A balanced score card is used to evaluate the performance measurement (Ming 2007). Although there have been many important academic advancements in the area of performance measurement systems, many practitioners and researchers still report encountering significant challenges during practical applications (Keathley-Herring 2017).

Previous research on the Search Engine Marketing (SEM) has studied the cost analysis of quality improvements in SEM. Abou et al, have determined that quality improvements costs 4.7% more cost as per CPC (Abou et al, 2012). Their research also analyzed the mechanism for pricing strategy by evaluating Google AdWords. The study concluded that Quality Score (QS) of an ad plays a major role, along with other factors for pricing strategy and found that the higher the QS, the lower the costs needed. It also yielded a better position in webpages meaning increased traffic and visibility for those advertisements. As per Google, a lower quality score of 1/10 increases the pricing by 400% and a score of 10/10 decreases the price up to 60%. However, the quality score (QS) algorithm is kept secret by Google.

The forecast trends can be conducted through use of the Autoregressive Integrated Moving Average (ARIMA) forecasting model to predict the admissions and SEM trends. This forecast can be utilized to decide on the marketing investments in the future. The ARIMA model can also be used to predict quality of products or services (Onado 1991). For the performance measure of marketing, ROI, this method is the best in qualitative terms. The implementation of quality management principles can increase the ROI of product or service.

Educational marketing is an essential tool for managing change (Bonnie 1998). In his article, Bonnie mentions five steps to integrate marketing to respond to the changing trends which allows businesses to remain competitive. This article focuses more on Total Quality concepts by enhancing accountability for every resource in the organization. Bonnie also states the educational institutions focus on five concepts which are as follows: competition through mission, mission recognition, research market place, accountability and role for everyone, and managing with strategic objective. The efforts of TQM and marketing management can be used in conjunction to create Customer Value (Mahmood 2015). The study demonstrates the relationship between management and its effect on Customer value. The article also shows that TQM practices are essential in providing grounds for marketing plans, policies, and strategies. This helps align the marketing management with TQM to focus on valuable and potential customers.

Our project aims to incorporate these strategies for the marketing department in higher educational institutions like universities and colleges to regulate the marketing expenditure and to incorporate Total Quality in marketing. The cost reduction for the existing models paired with previous research and implementation of statistical tools can be used to predict the future points of the advertising leads. Additionally, this data can be used to determine CPC trends in order to optimize the marketing quality of educational institutions for higher returns through admissions.

Research Methods

Based on recent general public research performed for this case study, the following trends in Figure 1 below were forecasted in the education system as the average growth rate of University attendance will have a significant impact on student enrollment after 2014.

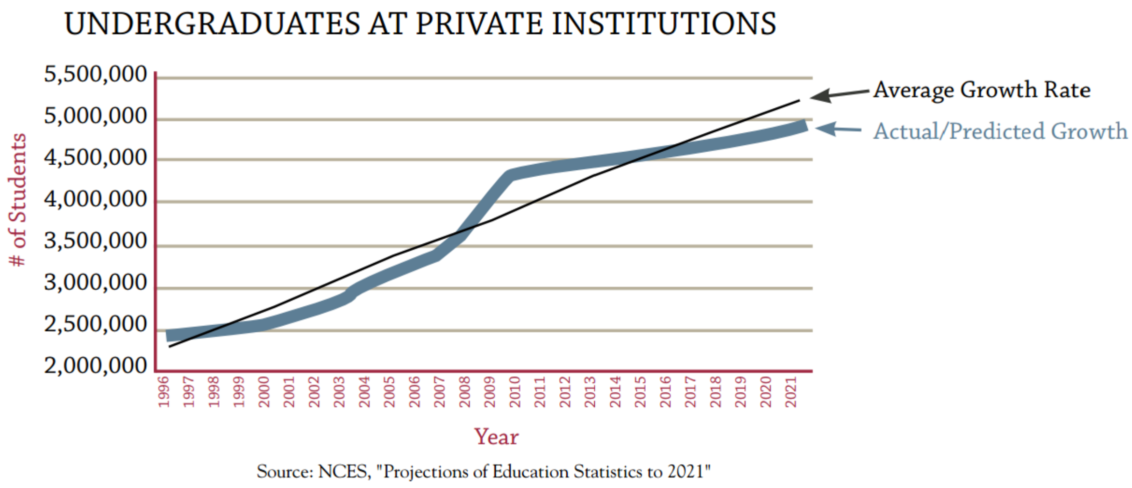

Figure 1:Enrollment Prediction Trend

The data trend forecasts that private university enrollment rate will continue to decline during the upcoming years. Private colleges have enjoyed a 38% increase in enrollment in last 8 years; however, the predicted rate for the next 8 years shows a 10% increase in registration. Additionally, recent findings identified that current college students demographics show that 60% of all attendees are under the age of 25, but that percentage is anticipated to decline 3% to 57% by 2021. A declining trend can also be found in high school graduates applying or attending private universities in the US, except for 18 states located in the Southern United States. Analysis predicts that within 5 years, by 2019, most of these high school graduates will choose to attend a college within 100 miles of wherever they call home. This carries bad news for colleges who depend on students attending out of state, as net tuition revenue goals may now be more difficult to reach especially for institutions with a smaller local population.

A survey carried in 2014 by the chief academic officers at both public -The American Association of State Colleges and Universities, and private -The Council of Independent Colleges institutions found that, diverse online programs are not offered in a majority of universities notwithstanding a rising demand for online courses by new students. To highlight this point and shown in Table 1, the study affirms that 81% of public college and 87% of private colleges do not offer online computer science program, which is the 3rd most-desired program by students according to the study.

Fields of Study	AASCU	CIC
Psychology/counseling	84	71
STEM	81	92
Computer science	81	87
Social sciences	70	88
Liberal arts/humanities	71	83
Criminal justice/paralegal studies	71	72
Business	45	34
Education	43	48
Health professions	38	5

Table 1: Percentage of Programs Not Offered Online at Either the Graduate or Undergraduate Level

For educational institutions which offer both undergraduate and graduate degree, institutions would ideally like to keep enrollment rate up and respond accordingly to this trend by offering more in demand online courses to curb the declining trend in application rates. According to Leads recorded data from 2000 seen in Figure 2 below, we can observe that yearly leads have significantly increased in last fourteen years, particularly from 2007 to 2012. The highest leads score of 852,810 was achieved in 2012. However, this number declined from 852,810 to 717,080 in 2013. As you can see from this figure, there is a big jump starting from 2007, which is the year our case study institute launched internet marketing campaign on applications.

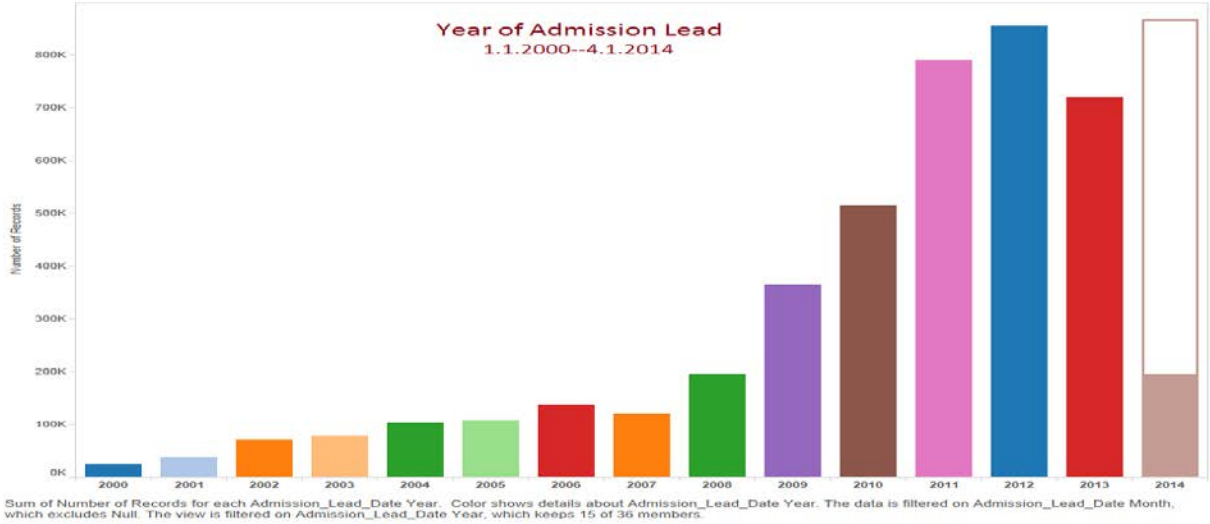

Figure 2: Student Lead Statistics

Figure 3 below depicts the web traffic record from Google Analytic dated January 2009 through Apr 2014. Yellow dots demonstrate a full traffic record including both organic and paid landing page visits, while the blue line illustrates only paid landing page visit. Based on the five year data displayed in Figure 3, analysis estimated an increased trend for both instances of visits. However this trend cannot be considered accurate as it relies heavily on data which may or may not directly correlate to marketing leads. The data shows that website traffic has experienced a dropoff beginning in October of 2012.

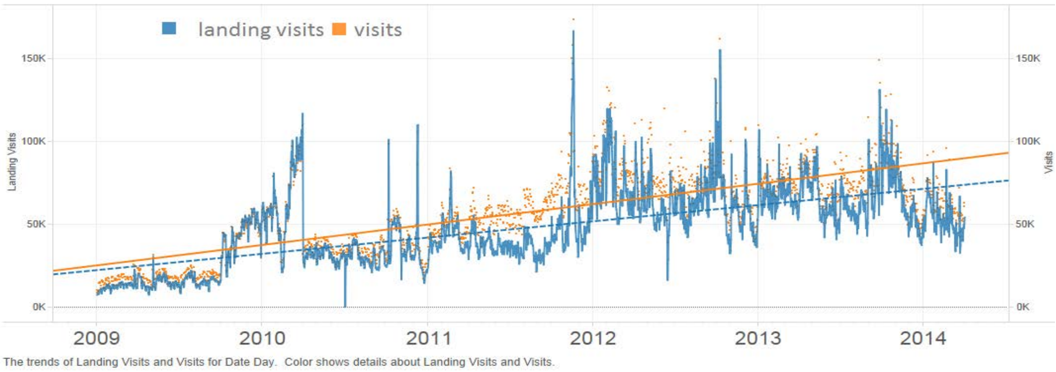

Figure 3: Website Traffic Trends: Sponsored and Unsponsored

Statistically analysis shows that the application enrollment rate is however significantly correlated to a potential students' website visit, and the institutions website can be a very powerful tool for marketing and identifying quality leads. In this study we to use statistical analysis and quality improvement methods to determine how the marketing department can keep the trend from decreasing in following coming years and how to address any issues in the marketing department that are preventing continuous improvement. All analysis in this study is based on real data collected by the authors on a time basis.

Visit Trend

Figure 4 below shows the website visits compared between 2012 and 2013. As both "website visits" and "number of leads" saw a drop-off in 2013, we must determine what changed, why, and ultimately forecast the new 2014 leads trend. Data from April 1st, 2012 to March 31st, 2013 are represented by a blue line, and data from April 1st, 2013 to March 31st, 2014, are represented by a green line. The graph is analyzed and the following trends were discovered.

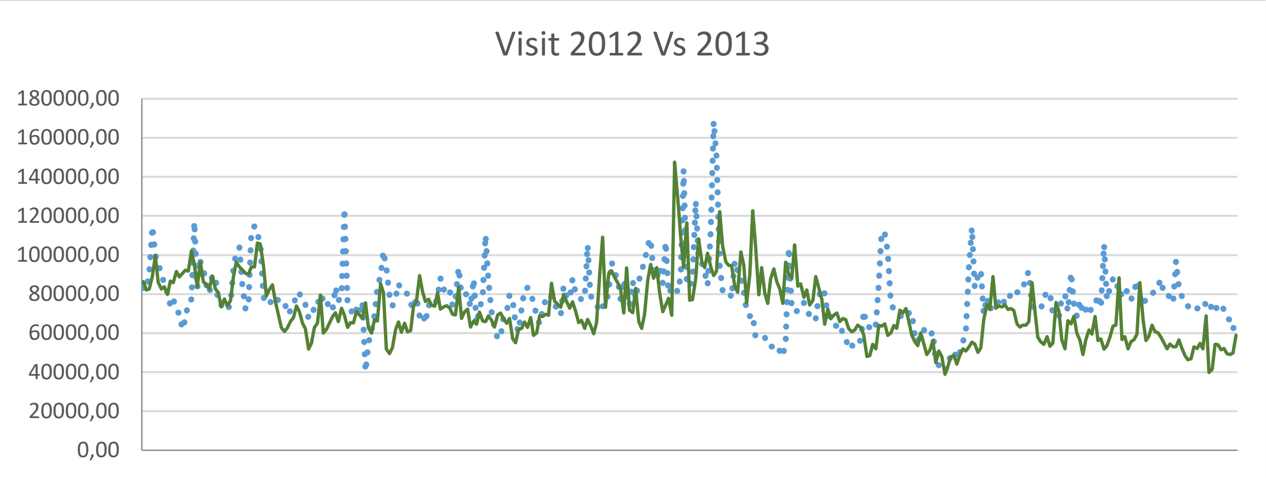

Figure 4: Website Visit 2012 Vs 2013

Comparing the website generated lead difference between 2012 and 2013 and investigating if that related to the rate of decline. The leads trend seen in those twenty-four months are displayed in Table 2, below. The overall structure of each trend fluctuates in a weekly cyclical manner. The admitted leads trends chart, shown in Table 3 below, displays the same cycle as seen in Table 2. From comparing Table 2 and Table 3, we are able to conclude that the average leads of 2013 are significant lower than 2012, with a sig level <<< 0.05.

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	V2012	2027.6658	365	411.35304	21.53120
	V2013	1777.2767	365	379.19611	19.84803

Table 2: 2012 vs 2013 Paired Samples Correlations of Website Traffic Visits

		N	Correlation	Sig.
Pair 1	V2012 & V2013	365	.357	.000

Table 3: Stat test of 2012 vs 2013 Admitted Leads Data

Table 2 differs from Table 3 in one key regard. Beginning in January 2014, the leads of the 1st quarter of 2014 have maintained the records seen in the 1st quarter of 2013. It is imperative to keep in mind that data from 2013 shows that the number of unique web visits has decreased, which explains the increase seen in CPC over the last three months. However the admitted leads on Table 3 depict no change. Our curiosity was peaked when it was discovered that the data showed lower admitted leads rate (Table 3) when the overall leads number increased (Table 2).

In order to develop deeper understanding of the previous data our study analyzed a time series forecast of the 2014 leads trend. The first step in analyzing the data was to build an ARIMA model based on previous 2 data sets, which consisted of the leads trends for the spring of 2012 and the spring of 2013 and is shown in Table 4 below. Utilizing this second quarter data provided the opportunity to forecast the yearly trends based on 2012 and 2013. The obtained value was then compared to true value and shown in Figure 8.

Model Description

			Model Type
Model ID	Spring2012	Model_1	ARIMA(2,0,7)
	Spring2013	Model_2	ARIMA(2,0,7)

Table 4: Time Series Analysis Model Description

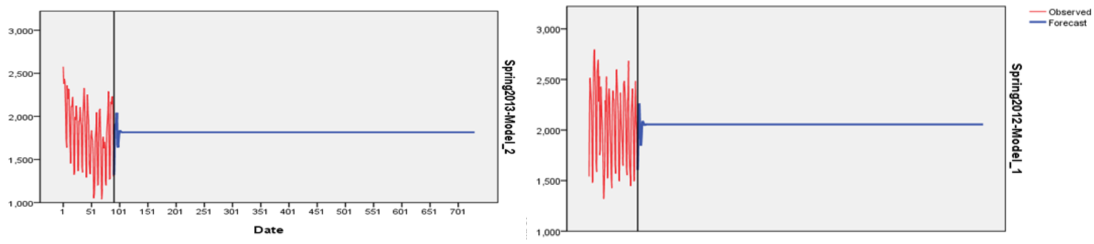

Figure 5: Time serious prediction

Model Statistics

Model	Number of Predictors	Model Fit statistics	Ljung-Box Q(18)			Number of Outliers
		Stationary R-squared	Statistics	DF	Sig.	
Spring2012-Model_1	0	.512	36.207	15	.002	0
Spring2013-Model_2	0	.649	39.796	15	.000	0

Table 5: Model Fitting

In Figure 5, the blue line represents the forecasting value. By comparing the forecasted value to the real number, we can see that the forecasted leads of 2012 are greater than those forecasted originally back in 2000. The true number is 2027 in the year 2012 and the forecasted leads of 2013 was around 1800, while the true value for 2013 was actually 1777. From Table 5 above we are able to verify that our forecasting values are highly reliable. With both the sig levels <<< 0.05 (5%), we can conclude that our ARIMA model in Table 4 is highly sensitive and well supported. Now that we have verified the accuracy of our model, we will use this model in parallel with data derived from the first quarter of 2014 leads in order to predict the yearly trend of 2014 website visits.

Model Description

			Model Type
Model ID	1st Qt 2014	Model_1	ARIMA(1,0,14)

Table 6: Time Series Analysis Model Description for Q1 2014

Model Statistics

Model	Number of Predictors	Model Fit statistics	Ljung-Box Q(18)			Number of Outliers
		Stationary R-squared	Statistics	DF	Sig.	
Winter2014-Model_1	0	.560	27.255	15	.027	0

Table 7: ARIMA Model forecast of 2014 Based on Q1 2014 Model

The results of Table 7 indicate that the average leads of 2014 will be around 1900 after running the model shown in Table 6. It is imperative to note that the Sig level is 0.027, which means this result was less sensitive compared to previous results. The above analysis is focused only on Leads. By involving a second factor, internet traffic, we can conduct further analysis. We will introduce the idea of leads per 100 website visits, which we will called LPV(Leads per 100 visit) which is demonstrated by Figure 6. A high LPV rate means there is a high converging rate.

$$\text{LPV} = 100\left(\frac{Lead}{Traffic}\right)$$

Figure 6: Lead per visit equation

Comparing the previous two years LPV we observe that starting in September 2013, LPV significantly increased. We can also conclude that the LPV of winter 2014 was significantly higher than winter 2013. Figure 6 plots this data, with the orange line portraying data collected April 1st , 2013 through March 31st , 2014 and the blue line represents data collected April 1st , 2012 through March 31st , 2013. We also conduct four statistical tests of the eight quarter LVP records. From the statistical analysis we can conclude that LVP of 1st quarter of 2014 was significant higher than other seven quarter's LVPs. Following Figure 6 displaces the difference between leads total of year 2012 and 2013, compared at the same time. Figure 7 plots the LPV values between 2012 and 2013 with

2012 plotted in green and 2013 plotted in blue, and shows the relationship between LPV correlates to the admitted leads based on traffic visits.

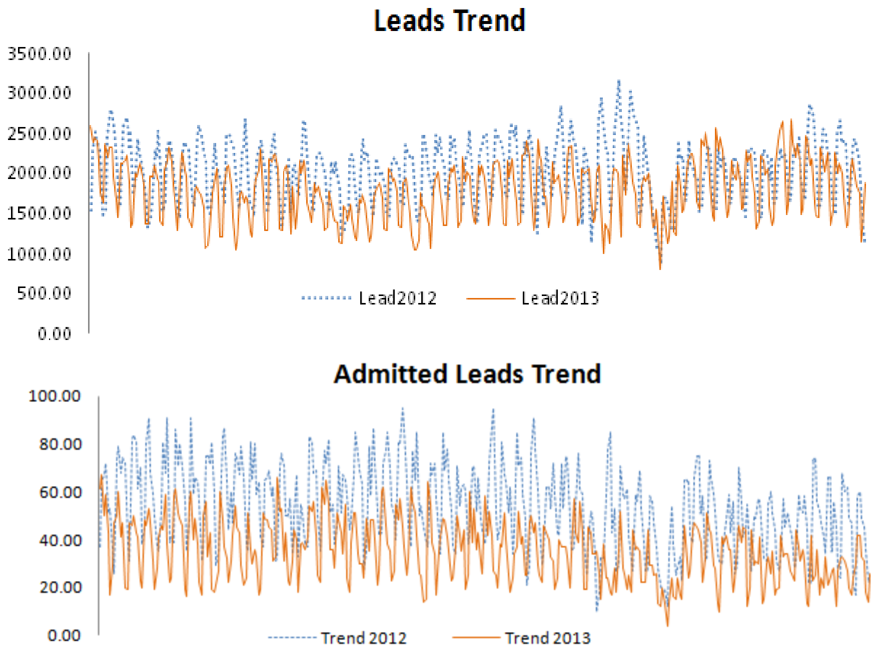

Figure 6: Lead Comparison 2012 vs 2013 Admitted Leads vs Total Leads

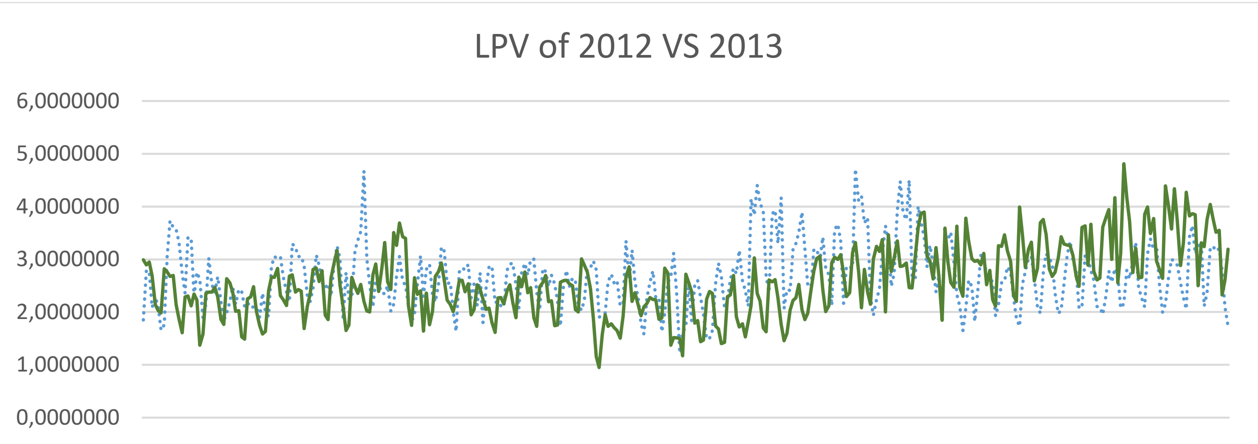

Figure 7: LPV 2012 vs 2013

From the analysis below we can see that the LVP of January through March 2014 is significantly higher than others.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	LVPSP2012	2.5793	91	.53664	.05625
	LVPSP2013	2.3814	91	.48804	.05116
Pair 2	LVPSU2012	2.4604	92	.43255	.04510
	LVPSU2013	2.1890	92	.43897	.04577
Pair 3	LVPFA2012	3.0014	92	.74665	.07784
	LVPFA2013	2.4892	92	.60713	.06330
Pair 4	LVPWI2013	2.6120	90	.47501	.05007
	LVPWI2014	3.2437	90	.57527	.06064

Table 8: LVP Analysis Across Quarter Year between 2012 and 2013

From the *LVP analysis* we observe that the predicting results of 2013 were determined by matching the true LVP value of 2.6120 for the entire year. The significant level of this model is <0.05. Based on this result, we conclude that our model is reliable and there exist a high probability that the predicted value of LPV in 2014 converges around 3.3. These predications of 2014's LPV based on 2013's LPV values is show in Figure 8 below.

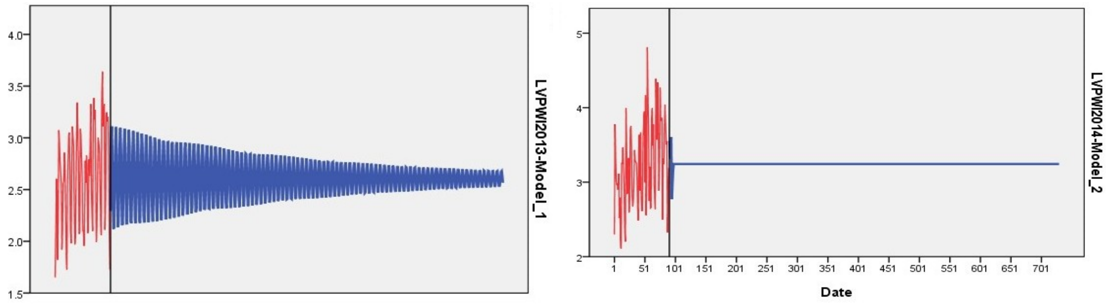

Figure 8: Time Seris Prediction of 2014 LPV

The results demonstrate that the LVP rate increased since Sep 2013, especially during the 1st quarter of 2014. These results match what was observed during the 1st quarter of 2014. If CPC and traffic remain constant, a high LVP rate could generate increased income and the ROI for the marketing department would increase. However, we must remain mindful of the fact that cost per click has seen a steady increase the past two years and that the web visit traffic is gradually slowing, especially compared to recent years. This data serves as justification for the marketing department of the institution to focus on ways to increase web site traffic to the university. Table 9 below is a paired samples test showing comparison of the 2013 actual LPV and the forecasted LPV for the rest of 2014 if an increase in site traffic is seen.

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	LVPSP2012 – LVPSP2013	.19792	.65736	.06891	.06102	.33482	2.872	90	.005
Pair 2	LVPSU2012 – LVPSU2013	.27145	.54175	.05648	.15926	.38364	4.806	91	.000
Pair 3	LVPFA2012 – LVPFA2013	.51215	.82458	.08597	.34138	.68291	5.957	91	.000
Pair 4	LVPWI2013 – LVPWI2014	-.63171	.67524	.07118	-.77313	-.49028	-8.875	89	.000

Table 9: LPV Paired Samples Comparison based on Model predictions with constant site traffic

The LVP of 2014 was predicted via time series model show in Table 9 above. We built another model shown in Table 10 with existing data sets for the LVP of 1st quarter of 2013 and LVP of 1st quarter of 2014 just for the first quarter of 2014 to understand traffic values effect on the model. Table 11 shows the comparison of the model and with a sig level of .027 for 2014 reflects that the model has some slight variance in forecast values based on what was seen in the first Quarter of 2014.

Model Description

			Model Type
Model ID	LVP1qt2013	Model_1	ARIMA(2,0,3)
	LVP1qt2014	Model_2	ARIMA(0,0,7)

Table 10: LVP 2013 Q1 vs 2014 Q1

Model Statistics

Model	Number of Predictors	Model Fit statistics	Ljung-Box Q(18)			Number of Outliers
		Stationary R-squared	Statistics	DF	Sig.	
LVP1qt2013-Model_1	0	.560	25.499	14	.030	0
LVP1qt2014-Model_2	0	.213	29.952	17	.027	0

Table 11: Statistical 2013 vs 2014

Cost Trend

Cost per click is another indication of how web site visits impact the marketing departments return on investment. The higher the CPC value the less revenue the organization receives upon click. Comparing the CPC trend between 2012 and 2013, we see a significantly higher CPC of 2013 compare to 2012. Using this information combined with the LPV analysis the marketing department can focus on strategies to decrease the CPC moving into 2014 which is needed based on the projected application rates in the upcoming years.

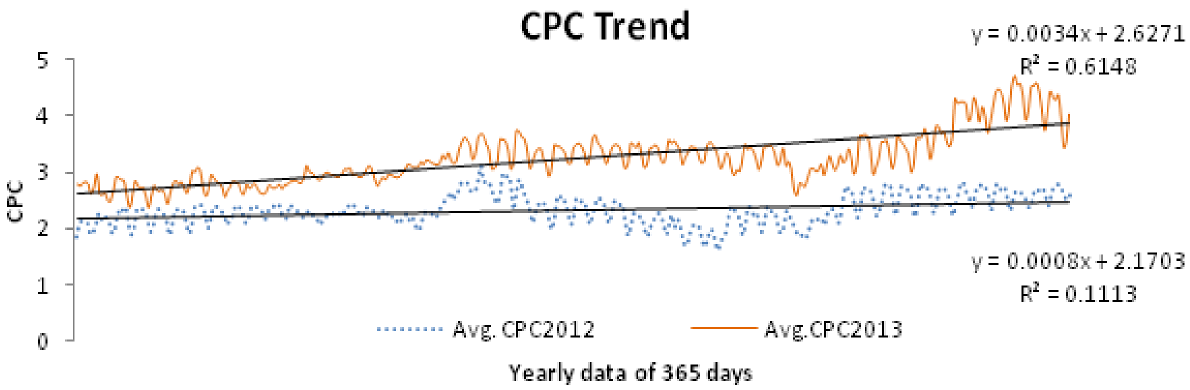

Figure 9: Cost Per Click Analysis 2012 and 2013

Another metric to investigate is the return of investment, which for marketing just like all other departments, is always looking for ways to get more and spend less in doing so. If we can decrease the cost per click in 2014 and beyond and increase the performance of the website, individual page visits, the marketing department should see a significant increase in revenue being generated, be able to improve the application rate total, and improve the lead quality. To determine whether the ROI on leads is better than that seen in previous years, such as 2012, we will analyze ROI trend showing in figure 10, although we must keep in mind that the number calculated in our model is the exact lead number, and therefore not accumulated.

We will limit our definition of ROI for the marketing department to the daily admitted active leads numbers (students whose status is still active) / (daily CPC * daily traffic). A simple way to define ROI is our quality return divided by investment. If the ROI rate is increasing, this means we will achieve a better return. If the ROI rate is decreasing, this means that our investment was not worth the capital. The ROI trend in Figure 10 used same data as our previous charts. Figure 6 above uses an orange line to represent the data points from April 1st, 2013 through March 31st,2014. The blue line represents the data points from April 1st, 2012 through March 31st, 2013. From Figure 10 we concluded that the ROI of 2012 is decreasing and the ROI of 2013 is increasing. More specifically, ROI declined starting in October 2012 and showed increasing trends beginning in September 2013.

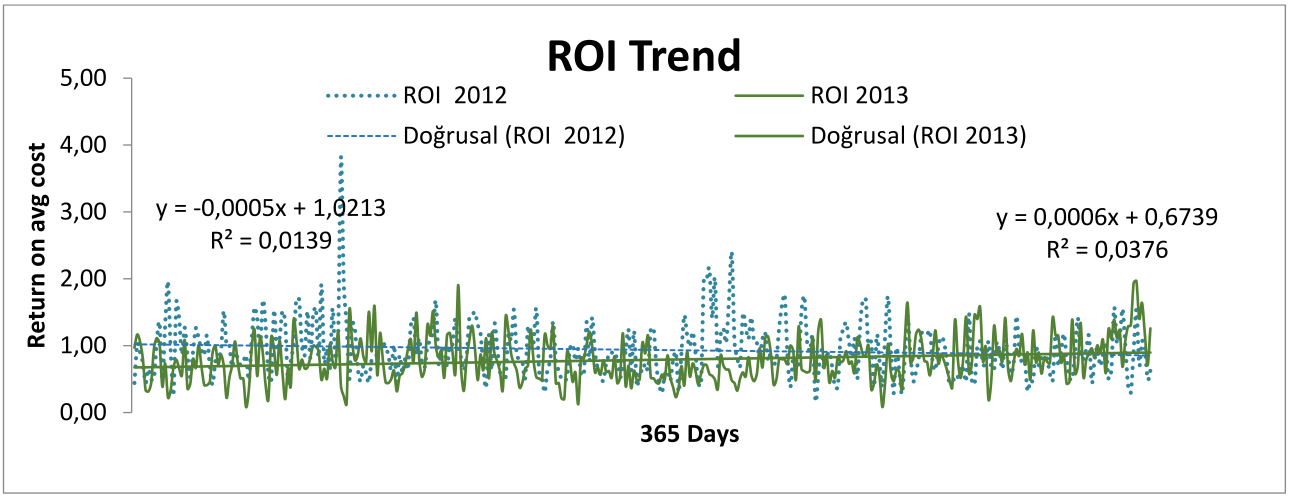

Figure 10: ROI trend across 2012 and 2013

How to Improve ROI

In order to solve this problem the marketing department would like to lower the CPC value they are seeing at present day. As we have seen, the site visit is significantly related to the admission record, and that site visits also significantly relate to the website speed --In this case the website speed comes up to be a very important factor. One way to decrease CPC easily is to increase the performance (speed up) the website. Web and Mobile performance is not just an IT issue, it also affects the marketing and lead generation for the entire university. Slower IT infrastructure that is seen or experiences by potential leads will result in increased page abandonment, loss of revenue and etc [Compuware Tech]. Poor web performance will push potential customers to look to alternate service providers (competitors) which in this case study are other universities. From figure 11 below we understand that the visit loss is quite related to loading time, also related to revenue loss.

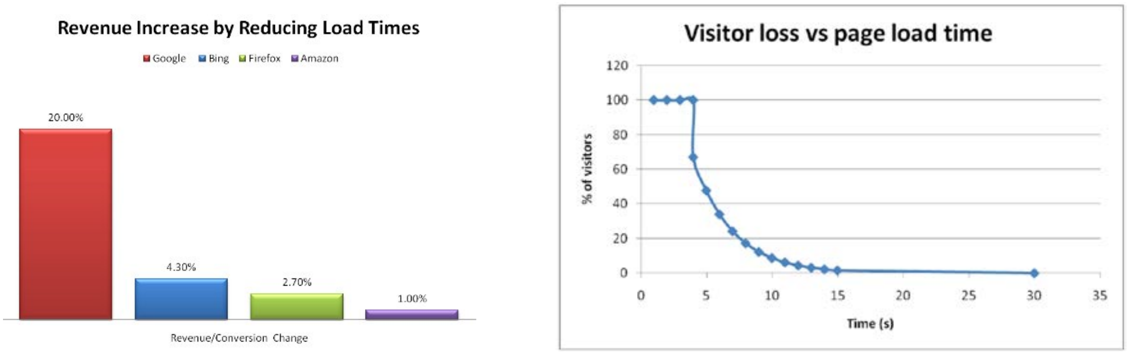

Figure 11: Revenue lost based on Web page load time

Based on real time speed tests which were generated on May 10th 2015, Only New York, Dulles, and Miami have a loading speed lower than 10 seconds and basically those all located in east coast. The statistics in Figure 12 is from google analytics.

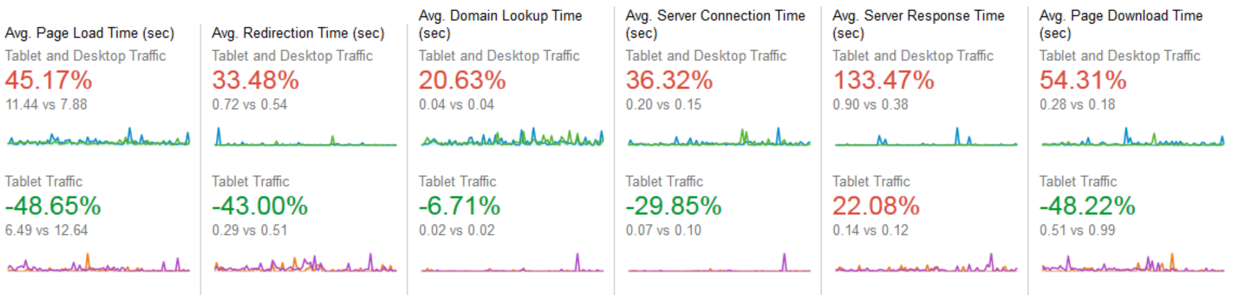

Figure 12: Web Page and Speed Tests impact on Web and Mobile Traffic

For locations like California, Denver and Oregon, average page load time is around 15 seconds, which is basically west coast and Midwest. For international location, average loading time is approximately 23 second. Going back to our previous research results in Figure 11, if the loading speed average is more than 10 seconds, the marketing department is going to lose 90% of its visitors. This could be one of the reasons why most of the universities leads are observed to be coming from east coast instead of west coast and international location. Additionally the marketing campaign's cost is also strongly related to site speed. The faster speed the university has, the less money is lost in marketing.

In the case we may now indicated, the most effective way to improve our web visits , university applications, and marketing departments ROI is to increase the performance (Speed) of the website. Additional math models could be used to prove this hypothesis. According to real data provide by Google analytics dated between March 2014-March 2015, the statistical analysis results of the universities cost per click is shown in Figure's 13 and 14 below.

Regression Statistics: Model 5 for Cost_per_Click (1 variable, n=51)

	R-Squared	Adj.RSqr	Std.Err.Reg.	# Cases	# Missing	t(2.50%,49)	Conf. level
	0.133	0.115	0.459	51	0	2.010	95.0%

Summary Table: Model 5 for Cost_per_Click (1 variable, n=51)

Variable	Coefficient	Std.Err.	t-Stat.	P-value	Lower95%	Upper95%
Intercept	2.576	0.401	6.426	0.000	1.770	3.382
Avg._Page_Load_Time__sec	0.125	0.046	2.739	0.009	0.033	0.216

Figure 13: Google Analytics Cost per Click Statistical Analysis

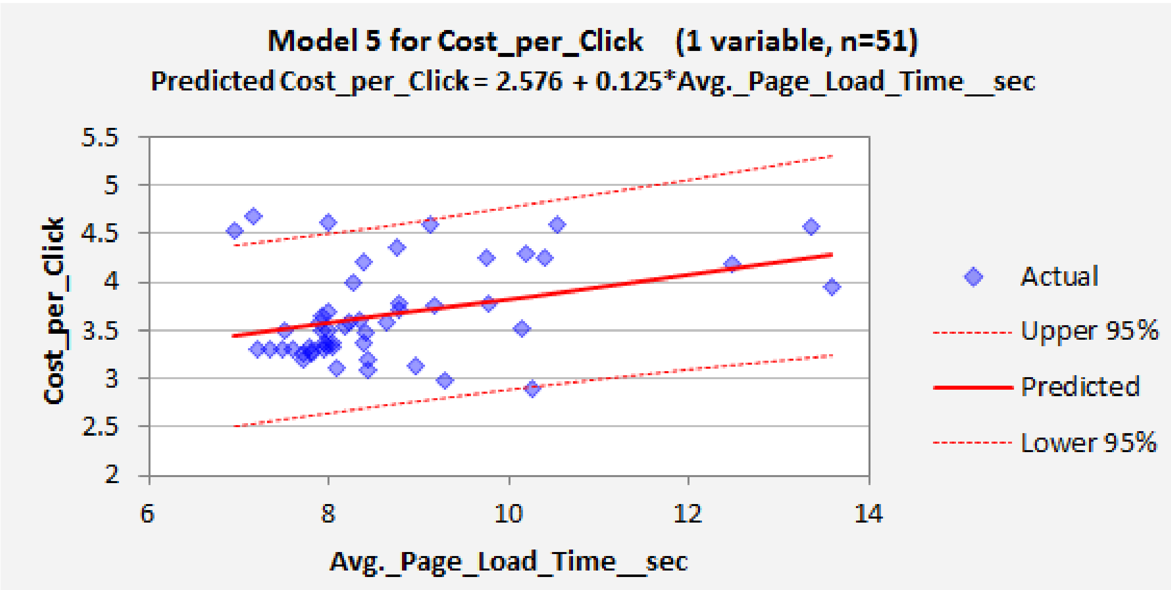

Figure 14: Google Analytics Cost per Click Statistical Model

Results

As is seen from the CPC analysis above, the CPC is strongly related to the Average web page loading time (P=0.009<<0.05), this means for every 1 second Average page loading time speed increase, the marketing department could lower 0.125 dollar of future average CPC investment. Over the last 52 weeks, the average CPC $ 3.60357, Total Clicks is 4,720,768, with Total cost to the marketing department of $17,011,620. Moving forward looking into 2015 from the beginning, CPC increased from 3.2 to almost 4 -4.5, and number of clicks stuck to the decreasing trend, while the Total Cost is keeping the same trend as was seen in previous years. Total number of clicks on the university webpage, cost spent by the marketing department and cost per click over the 52 weeks analyzed in 2015 are shown below in figures 15, 16, and 17 respectively.

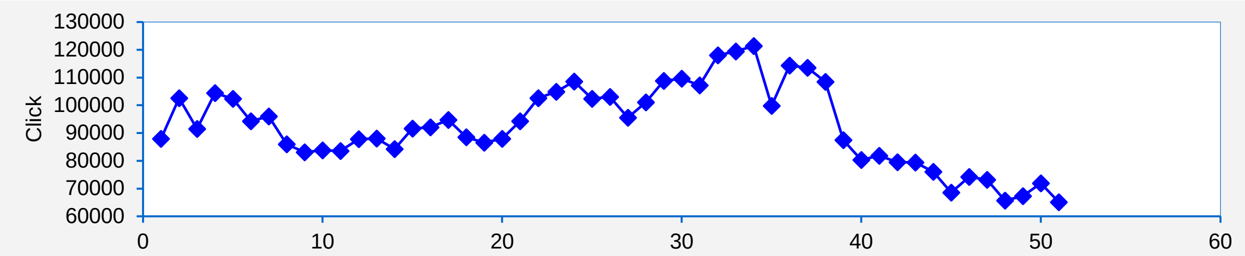

Figure 15: Total number of clicks on University website in 2015 by week

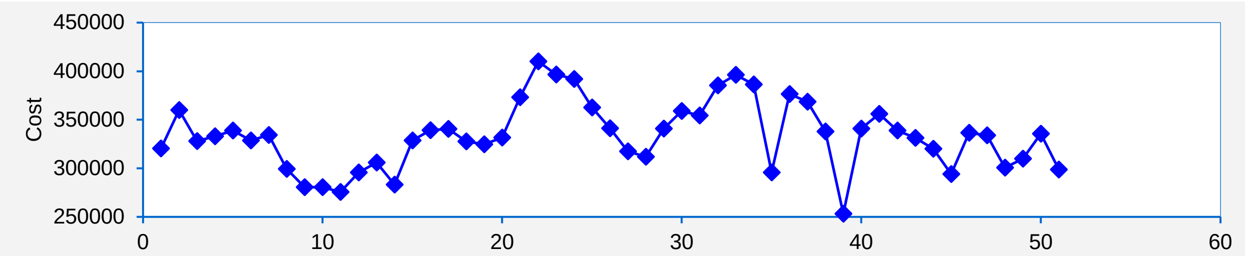

Figure 16: Total Cost by University Marketing in 2015

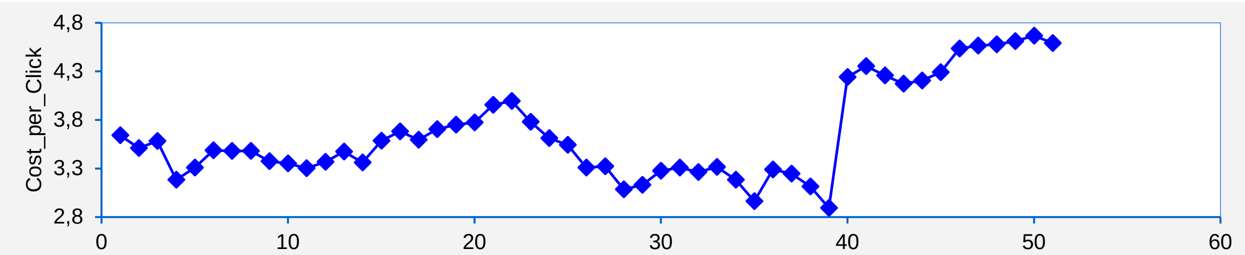

Figure 17: Cost per Click across 2015

Because CPC = Cost / Click , in this case if we set CPC equal to Average page loading time and keep the cost constant, we have 2.576 + 0.125 AVGSPEED= Cost/ Clicks. Assuming weekly cost equals to $360,000 dollars, Click changing trend will be predict as shown below in figure 18.

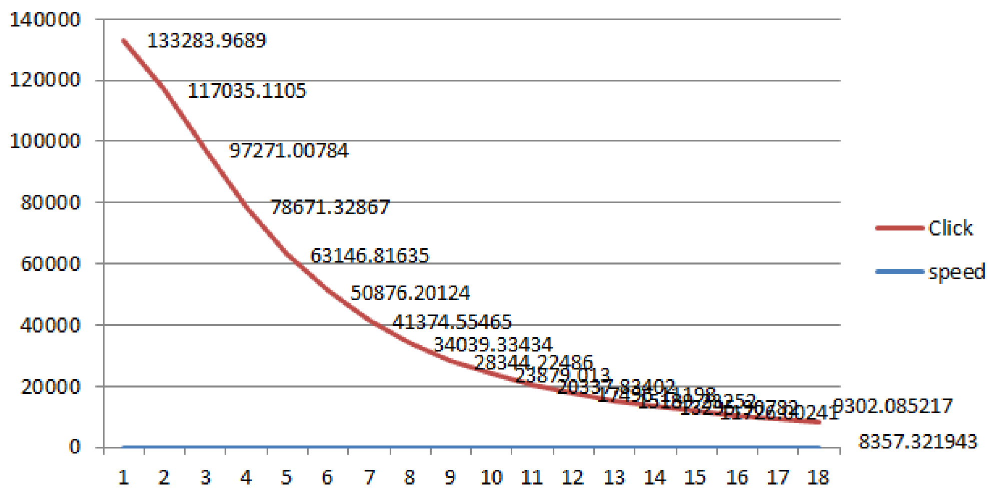

Figure 18: Click changing trend based on constant cost

If the performance of the website can be increased so that the average loading time decreases from 10 seconds to 5 seconds, the forecasted Clicks/Visit will increase from 23879 to 63146, because every one second decrease can lead to approximately d 10,000 additional clicks, under the same amount of campaign cost, which also help the marketing department improve their ROI.

Conclusion

Stepping back from the detailed analysis we see that by using certain quality management techniques such as statistical analysis the marketing department studied in this case study was able to identify target goals for its metrics and hypothesize solutions to reach its goals. During this case study statistical analysis was extremely important to gaining insight into potential problems forthcoming by looking into the trends for university admission application rates and overall university attendance rates for the Country both of which were predicted to remain in decline in the upcoming 5 years. Once these issues were identified, quality management techniques such as root cause analysis and the five why's techniques were used to brainstorm solutions to combat the declining admission rate numbers. From there using general industry research on quality in marketing we were able to determine ways to increase the ROI of the marketing group by focusing on the web site traffic and using statistical analysis and models to understand how the admission rate trends could be impacted by generating more quality leads from the university web site.

Moving forward additional areas to implement quality management to increase the quality of the university marketing department would be the internal department processes used to determine and decide on which marketing strategies to use and to increase the effectiveness of those strategies by specifically targeting certain desired demographics. The analysis done in this paper could be supported by bolstering the data collected here with demographic information on potential clientele combined with data on the ideal clientele to determine the effectiveness of marketing strategies and initiatives. One other area to investigate for adding quality management techniques would be how the marketing department processes can be continuously improved based on what the statistical analysis is telling the marketing department on the effectiveness of specific marketing campaigns.

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