OPIM 5641

Spring Semester

2016

Group Project

Team-10

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EXECUTIVE SUMMARY

Due to high profitability of non-degree programs and surplus of funds, a University in Connecticut has decided to introduce a 3rd non-degree program in its line of other non-degree programs. This new program is aimed for teaching older generations of the community (55 years and more). Since this program is for social good, profit margins could be slashed by 25%. The University wants to have a thorough analysis of the feasibility and profitability of this new endeavor within the shell of all internal constraints, demand of the program and associated risks.

We, the team 10, worked as consultants with the university's finance department and higher management throughout the duration of this project.

Objective of the Team:

- Build a base model that can help in analyzing the feasibility of the client's new Business. Generate the optimized results through spreadsheet Engineering for maximum profits. Conduct thorough analysis of market fluctuations, internal parameter variations and associated risks.
- Generate Managerial-level insights and detailed Business-case findings. Identify scope for improvement in internal constraints and address the specific requirements.
- Deliver a highly efficient business model to address the problems at hand.

"The work contained and presented here is the work of Spring 2016 class Team#10 and Spring 2016 class Team#10 alone"

I. Feasibility and challenges

BACKGROUND
Currently, the University offers 8 'degree' and 2 'non-degree' programs. Every year, a permanent budget of 6M comes to the university as sponsorship from state to support 8 degree programs. The non-degree programs are typically self-funded from tuitions and other sources of revenue. However, every fiscal year there is a surplus of 500,000, on average, which university decides to allocate to areas in need at their own discretion. This year, university is considering the benefits of starting a 3rd non degree program. The surplus of permanent funds can be allocated to start the new non-degree program. The 2 other non-degree programs, which are running from last 5 years, have generated average profit of $100,000 every year. Since this program is on offer to the 55 year and older community, profit expectations can be sacrificed for the social good by 25%. Due to space constraints enrollment cannot exceed 600 (10% of space) students. Also, student-teacher ratio can't exceed 30, as per University policy.

PROBLEM
The finance department has to decide what amount to take from permanent budget to start the new program and what should be the distribution of this budget over the years. They have to decide on optimal spending in Advertisement Expenditures over the years. Also, they have to propose what fee to charge during the course of the program. The proposal, then, could be put forth to the trust committee board of the University. The board then decides whether the fee is workable for the older community or not, ensuring typical profits of non-degree programs. The higher management has to analyze what percentage of the total market they are able to capture and

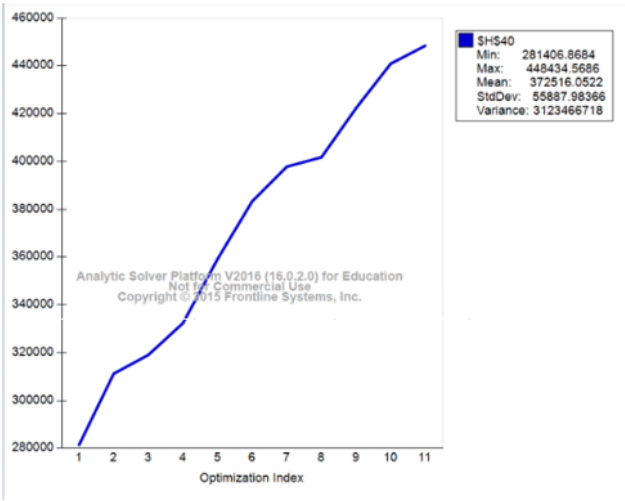
Economics of the situation and concerns
On average, an additional 20% is collected in parking revenues from each program, including the non-degree program. The advertising budget has an impact on no. of enrollments but limited to a certain extent. However, when to allocate most of the resources has always been a big question? Starting the program would also require: Customize space for the program, Recruitments, Training, Material and Launching advertisement. Once the program starts collecting fees, they are charged a percentage for general staff, resources and facilities used, and space occupied apart from the Program's regular expenses that include salaries to teachers and advertising expenses. Based on prior trends, enrollment rates are expected to increase every session but fees can be increased for the next class only. Also, Fringe rate increase 3% each year and Utilities expect to increase 1% per year.

II. Problem Formulation

Refer Appendix (at the end) for Problem formulation, complete calculation and variable description.

III. Case Findings:

- An average profit of around $46,000 is expected every year after discounting to first year.
- 50% of the total budget available would do same good as the total budget.
- The rate of increase of profit with increase in student-teacher ratio is fluctuating. Thus making some ratios – 31, 34, 35 and 38 more critical than remaining between 30 and 41.



Student-Teacher Ratio	Maximum Profit	Rate	Percentage Increase
30	281406.8684		
31	309963.7002	28556.83173	10.148%
32	319071.5015	9107.801309	2.938%
33	332353.1223	13281.62087	4.163%
34	359197.1618	26844.03951	8.077%
35	384436.2998	25239.13795	7.027%
36	398764.1544	14327.85462	3.727%
37	399786.0091	1021.854718	0.256%
38	422339.6471	22553.63793	5.641%
39	440932.9955	18593.34843	4.402%
40	448439.8047	7506.809164	1.702%

Fig (1) Profit vs Maximum Student-Teacher Ratio

- Though maximum popularity of the program is achieved in the 4th year, maximum spending in expenditures are realized in 2nd year, thus, limiting the maximum no. of admissions. This unusual trend is caused by capped student-teacher ratio which is acting as the binding constraint to the total profit. It also explains the fluctuating trend in rate of increase of profit with increased maximum student-teacher ratio.
- Increasing maximum student-teacher ratio by 10 causes a whopping 61% increase in profit which is almost double the regular proportionate expectation.
- The increased student-teacher ratio calls for much more spending in the 3rd and 4th year as compared to previous years, thus, opening new possibilities for risk-cover through budget allocation over years.
- Even with increase in maximum student-teacher ratio, the total no. of admissions is not affected much. The further need of space customization arises when max student-teacher cap reaches 36
- With increase in Tuition from 1500 to 1600, the maximum allowable tuition without affecting the demands, overall profit increases 30%.
- The total no. of admissions does not cross 250 over 5 years. Thus, there is no need of space customization. However, if the maximum student-teacher ratio cap is increased there are optimized situations when total no. of admissions cross 250 and space customization becomes feasible and necessary.
- If Instructor base pay rate goes over $350/hour, the program will not make any profits in 5 years. Thus, this is the highest end pay-rate for this program (as per given conditions) The management

should hire instructors well below this rate.

- The variation in total profits with increase in instructor pay are shown in fig (2)

Instructor pay	Total Profit
$ 200.00	$ 428,860.08
$ 210.00	$ 399,335.71
$ 220.00	$ 369,816.81
$ 230.00	$ 340,438.61
$ 240.00	$ 310,884.17
$ 250.00	$ 281,402.89
$ 260.00	$ 251,741.21
$ 270.00	$ 222,222.31
$ 280.00	$ 196,496.09
$ 290.00	$ 168,783.99
$ 300.00	$ 140,909.45

Fig (2) Variation of Total Profit with variation in Base Instructor Pay

- Random fluctuations of profit with market behavior are expected to be in the range $160,000 to $403,000 with a 90% confidence
  Assumed Normal distribution of Instructor base pay with standard dev of 25 (as per market)
  Assumed Normal distribution of the tuition with standard deviation of 10.

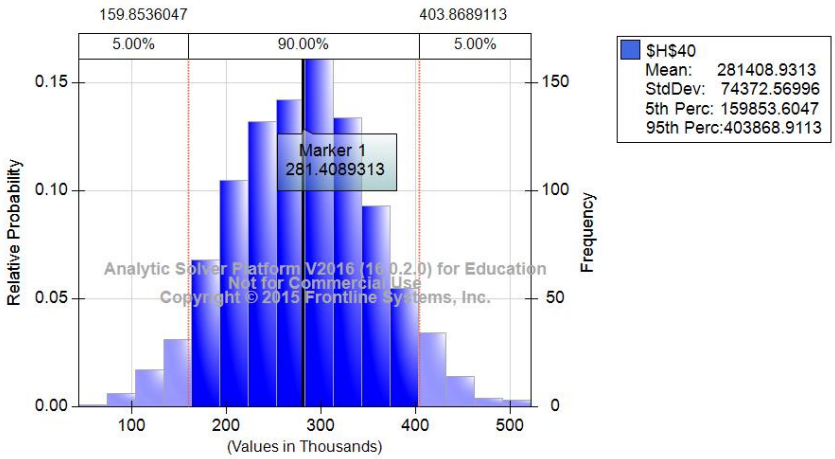


Fig (3) Simulation analysis of Total profit

IV. Managerial Insights:

- We highly recommend to reduce the budget by 50% for starting this program with given criteria as no improvements in the profit could be observed beyond certain no. of admission in each year. Thus, allocated budget is on a higher scale as per the situations. For details refer Project_Team_10.xls
- The total no. of admissions does not cross 250 over 5 years. Thus, there is no need of space customization.
- Maximum Student-Teacher ratio cap is proving to be the limiting criteria on total profits generated. Hence, it's very important to analyze the flexibility of this criteria. The more the no. of students per class, the higher the profit. Also, increase in maximum student-teacher ratio cap demands for higher enrollments for optimized conditions. Thus, profit increases two-fold.
- Each year, Total no. of admissions has to be capped as per maximum student-teacher criteria in order to realize the optimized profits.
- Approximate optimal allocation of budget over years (assuring 20% advance cash needs) is recommended as:
  Year 1: $200,000
  Year 2: $50,000
  No budget is required after 2nd year as program would be able to meet its cash needs and up-front expenditures from year 3 while generating overall profits. An important insight to be noticed from here is that risk factor cannot be covered through budget allocation over years which was initially expected.
- Return on Investment from this business is limited to 100% in a 5-year period.

V. Plan for future upgrades

- Having discussed the insights from modelling (for the current situation) with finance department and higher management, the team-10 and the management together will identify the scope for improvement – that is optimally as well as practically feasible.

- Perform different case-specific analysis similar to current situation analysis as per the identified changes in variables.

- Converge to the best possible solution with improved but practically feasible internal constraints.

APPENDIX

Parameters:

Fixed costs parameters: These are the costs which are realized before the start of the program. As they are not recurring every year, they are named as fixed costs. Also, they are not further dependent on any factors, therefore, are identified as parameters. It includes the following

- Space Customization
- Launch Advertisement Expenditure
- Material
- Training

However, it may be noted that if the enrollments in the program exceed a certain limit there will be need to expand on the launch/starting setting. This will incur some more fixed cost.

Variable cost parameters: All variable costs incurred are divided into five sub-categories. These include - Staff, Resources, Space, Instructor Salaries and Advertisement Expenditure. These in turn are dependent on the following identified parameters.

- Resources cost/session
- Utilities increment rate
- Base Instructor pay/hour
- Fringe Rate
- Each session duration
- No. of sessions/year
- Space cost/student/month
- Total Staff cost
- Percentage charged to program
- Max. student-teacher ratio for the program
- Earning percentage apart from Tuition on Tuition

Functional Parameters: From the consultants and based on prior trends for similar programs, it has been identified that –

1.) Total target audience (or popularity of the program) increases with time up till a certain limit and then starts decreasing. For a typical 5-year duration, the total target population (Y) varies as: $Y = 150(5 + 6x - x^2)$, where x = no. of years elapsed from the start of the program. Thus, parameters identified are

- 150
- 5
- 6
- -1

2.) Response rate increases with increase in Advertisement expenditure but with diminishing returns. The consultants have provided the following function: $Y = 20^{(1-\frac{1}{x})}$, where x = Advertising Expenditure in multiples of $10,000 and Y = Response rate. Parameter identified for this function is

- 20

Decisions

- Tuition

Typically, Consultants have identified that tuition between the range $1200 and $1500 per year does not affect the decisions of our target audience. However, higher Tuition may cause target audience to decide against joining the program despite of all other factors in favor. Consultants are working to come up with some drop-off percentage function as variation of tuition. Thus, "what best fee to charge" remains a decision for the Executive Committee.

- Advertisement Budget distribution over 5 years

It is clear that advertisement causes popularity and awareness. Better advertisements cause increased response rates as well. However, they account to be one of the primary expenses. Thus, it has always been a big question that when is the ideal time, starting from the launch of a commodity, to spend most on advertisements. Distribution of Advertisement expenditure over time is, clearly, a decision.

- Fixed Budget withdrawal Amount

Although a total of $500,000 is available at the disposal of this new program but taking all of it would do equally good to the program as taking some less amount would do has been a perplexing deciding factor to the committee. Moreover, Executive Trust board wants to make sure that there should not be any opportunity loss due to lack of funds which could be required for throttling advertisements when there is a call for such a need.

Outputs

- Average profit per year or Total profit for 5 years.

The Executive committee would like to ensure that min profit margins are met if they start the program. The detailed analysis would also enable them to know what profit margins to expect beforehand in optimistic and pessimistic situations. If model suggests against starting the program, a further detailed study could be called for. Whether it is the lack of interest of audience/limited audience for this new program or there is something wrong in the approach/model itself that is causing model to develop negative results. If some corrective measures could be incorporated or some factors could be altered, we can re-examine the situation with another model. If things don't change much it would be better to invest the money for developments and expansion of other ongoing programs or start some other program.

Dependent variables involved (Intermediate Calculations)

- Popularity max Target Audience: It is calculated by $Y = 150(5 + 6x - x^2)$, where
  x = 0 for year 1 calculations,
  x = 1 for year 2 calculations,
  x = 2 for year 3 calculations and so on…
- Response rate: It is calculated by $Y = Max\ Response\ rate^{(1-\frac{1}{x})}$, where x = Ad Expenditures in multiples of $10,000
- No. of Students: It is calculated as $\frac{Response\ rate}{100} * Popularity\ \max Target\ Audience$

Total costs: Fixed costs + Variable costs
Fixed Cost: Total fixed costs are summation of all fixed cost incurred before start of each year. It is given by $\sum Space\ customization, Launch\ Ad\ expenditure, Material, Training$
Variable cost: We divided the total running cost (variable cost) incurred every year into 5 sub-categories.

Total = $\sum Staff, Resources, Space, Salaries, Ad\ Expenditure$. Calculations of these are as follows:

- Staff: This program is charged a certain percentage of the total staff cost of the department in which it is carried. Thus, Staff = $\frac{\%age}{100} * Total\ staff\ cost$
- Resources: These includes utilities, basic care and others. They are typically calculated as $No.of \frac{sessions}{year} * cost\ incurred\ each\ session$
- Space: This is charged for the space and available facilities used. It is calculated as: $Cost\ each\ student * No.of\ students$
- Salaries: These are total money paid to Instructors every year. It is calculated as: $part_1 * part_2$

  (part_1) Money paid to each instructor for taking each session throughout the year = $Base\ Instructor\ Pay\ each\ hour * Session\ duration * No.of\ session\ per\ year$

  (part_2) Requirement of min. no. of Instructors = $\frac{Total\ no.of\ students}{Max\ Student-teacher\ ratio}$

- Ad Expenditure: This is the cost decided by our decision making directly.

Total Revenues: It is calculated as $No.of\ Students * Charges/student$

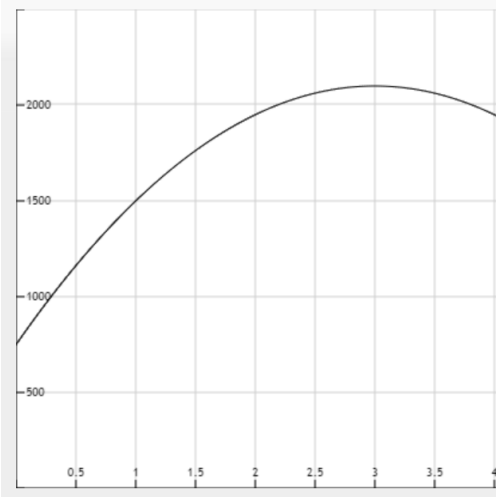
- Charges: $Tuition + Others$
- Others: $\frac{\text{Earning percentage apart from Tuition on Tuition}}{100} *$ Tuition

Profit: For each year, it is calculated as Total Revenues − Total costs
Total Profit: $\sum_1^5 Profit$

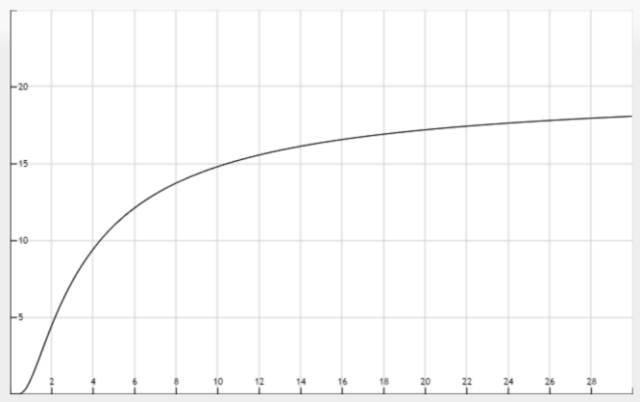
Note:
For subsequent years, calculations are applied to incorporate fringe rate rise in Instructor and Staff salaries. Also, calculations are applied to incorporate utilities rate rise in Resources and Space costs.

Assumptions:

1) Effect of Tuition fee, popularity of the program and Advertisement Expenditure on Total no. of students eventually getting enrolled are considered separately. This helps in analyzing the structure more clearly as impact of every factor can be monitored. However, de-synthetization is on grounds of root multivariate relationships between each factor and No. of students eventually getting enrolled. For e.g.
   1) Popularity of the program should first cause no. of students enrolled to increase. Later on, it should cause no. of students enrolled to decrease. Thus, it should be increasing-decreasing function in 5-year period



2) Advertisements should always cause increase in response rates but with diminishing returns. Also, response rates should flatten after a certain value no matter how much one spend (Limit to the spreading awareness and convincing ability of adds). Thus it should be some function like:



Thus, there may be some complex variation of all factors combined and No. of students eventually getting enrolled, but the basic relation of each factor with No. of students enrolled would be as per our de-synthesized model. Therefore, we can safely work with this assumption to analyze the situation.

2.) For a range of Tuition, Enrollments are insensitive to Tuition fee. They are primarily dependent on the popularity of the program and conversion rate.
Rational: Getting particular Education is one of the higher level decisions that an individual take. So, it is not judged primarily on the cost if the cost is within a certain range. Moreover, this assumption is only associated with typical market range Tuition for similar other programs. An increase in tuition above typical market range is associated with a drop-off function.

Definitions

Fringe-Rate: an employment benefit (as a pension, a paid holiday, or health insurance) granted by an employer that has a monetary value but that does not affect basic wage rates.