Teaching Cost Analysis with a Bicycle Business Startup Project

by

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Abstract

Cost analysis is an important aspect of the technology management curricula. It covers many principles and methods that all managers and engineers must know in order to be successful. This paper shows how utilizing a business startup model as a group project covers most of the principles and methods typically addressed in an undergraduate cost analysis course.

Simulating business startup situations within the classroom environment contribute to enhancing a student's appreciation and capacity for cost analysis. The findings indicate that this type of approach shares many characteristics of the interdisciplinary and learning-by-doing approach of entrepreneurship education. This case study shows that mock business startup simulations have an educational value which can be applied to cost analysis.

Introduction

Using a mock business startup as an educational model is an effective way of teaching because it engages the students in direct and indirect learning, develops team work and leadership, and provides for multi-skill interactive learning. Students must research, develop, and present a realistic business model. This involves coordinating job assignments, meeting deadlines, enlisting cooperation, and creating credible documentation. In this case, the group researched the possibility of starting a specialty bicycle manufacturing facility. The assignment was as follows:

> "Assume you will start a custom made lightweight bicycle company. Assume it is a Limited Liability Corporation (LLC) and you will have one employee who will produce the frames and you will assemble them. You will produce the frames and purchase all other components off the shelf. You can choose materials for the frame. You expect to produce one bicycle model and sell the bicycles using the Internet. You expect demand to average five bicycles per week.
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> Determine the startup costs and using time value of money (TVM) concepts, determine the price you need to charge for each bicycle to achieve a target return on Investment (ROI) of 15%. You will have costs for designing the frame, patenting the frame design, renting a shop, and equipping it with tools to get started. You will have recurring costs of materials and labor including overhead. Also consider shipping and warrantee issues.
>
> Be creative and try to factor everything realistic into the analysis."

This project was assigned to a group of five students who were responsible for obtaining and analyzing realistic costs and presenting the results in written and oral presentations over a period of about two months. This format is similar to the one described by Attarzadeh [1], in which he divided the students into groups of three or four and assigned an engineering construction project to be designed, built, and completed within a specific budget and timeframe. However, the Swift Bicycle project had no actual budget and no products were fabricated.

Developing the Team Project

Defining Phase

This educational model developed both cost analysis skills and the soft skills that work groups need to be an effective team. The team encountered challenges that occur in a typical industrial setting but also faced the additional challenge of limited on site contact. When the project was completed the team would have to decide if the business could be profitably created and sustained.

The specific functions, materials, location, business objectives and time tables were generated first. Individual and group task assignments were developed and a timetable with incremental deadlines was created to ensure the project would be completed in a timely manner. The initial brainstorming yielded these primary costing groups.

- Inventory and Pricing
- Web Site
- Shipping
- Raw Material
- Warranty
- Shipping container
- Design and Patent
- Rent
- Equipment (Capital Assets)

This created the scope for the startup model and started the group thinking about the business.

The next activity was the division of labor for accomplishing these tasks. The tasks were grouped to divide the work evenly. Each team member selected an assignment:

- Team Member #1 – Cost ready made parts from vendors to assemble the bicycle, shipping cartons and small parts containers.
- Team Member #2 – Cost manufacturing equipment including replaceable parts for cutting, welding, painting, and any related safety equipment for these processes.
- Team Member #3 – Cost raw material for the frame with a tolerance for scrap, cost the business location, determine labor time and cost for manufacture and assembly including warranty work.
- Team Member #4 – Cost the frame and manual design, printing, patenting, shipping, web site design with interactive ordering and hosting, and determine the price using TVM calculations.
- Team Member #5 – Perform breakeven and payback analysis.

The resources available to gather costs and complete the analysis included internet sources, the course text book [2], and retail outlets. The instructor served as a consultant to the project team.

Implementation Phase

Each team member submitted their results in an Excel workbook to the team leader for compiling into a single team workbook to develop spreadsheet proficiency. The group determined the startup costs, estimated annual costs, used time value of money (TVM) calculations to determine the product price, and analyzed the breakeven quantity and payback period. The costs were divided into the three groups shown in Tables 1 through 3. Total initial startup costs were a modest $37 thousand (Table 1). Recurring overhead costs totaled about $13

thousand per year (Table 2). Recurring direct costs, which include raw material and labor, totaled about $709 per bicycle (Table 3).

To compute the price per unit required to earn a 15% ROI, the costs were annualized over seven years. The recurring costs were incremented with an annual 2.5% increase over the seven year production life to ensure cost increases would not jeopardize the cost analysis. The results, shown in Table 4, include two pricing options. The first price is incremented annually in the same manner as the costs and the second price is constant. The price required to meet the required return on investment (ROI) of 15% is roughly $1,000, which is at the low end of the specialty bicycle business. Normal prices for specialty bicycles are in the range $700 to $6000. Therefore, assuming projected sales of five bicycles per week is realistic, opening a bicycle manufacturing company could be a profitable venture.

Table 1. Initial Startup Costs

Lease Requirement	$900.00
Cutting Equipment	$1,169.34
Welding Equipment	$11,671.00
Painting Equipment	$1,099.99
Cutting Face Shield	$6.50
Cutting / Welding Gloves	$15.80
Welding Face Shield	$33.90
Design, Patent and Manual	$21,000.00
Web Site / Ordering	$1,500.00
Initial Start Up Costs Total	$37,396.53

Table 2. Recurring Overhead Costs per Annum

Paint Gloves Box Monthly (12)	$45.48
Cutting Blades Quarterly (4)	$195.76
Paint Respirator Monthly (12)	$189.00
Paint 5 bicycles per gallon (52)	$2,028.00
Utilities & Rent (12)	$10,800.00
Annual Recurring Costs Total	$13,258.24

Table 3. Unit Raw Material and Labor Costs per Bicycle

Labor Cost	$150.00
Raw Materials	$61.72
Purchased Parts	$336.74
Packaging and Manual	$10.81
Shipping	$150.00
RM / Labor Cost / Single Unit	$709.27

Table 4. Cost Analysis and Pricing Estimate

Year	1	2	3	4	5	6	7
Init Costs	$8,989	$8,989	$8,989	$8,989	$8,989	$8,989	$8,989
Indirect	$13,258	$13,590	$13,929	$14,278	$14,635	$15,000	$15,375
Direct	$184,410	$189,020	$193,746	$198,590	$203,554	$208,643	$213,859
Annual	$206,657	$211,599	$216,664	$221,856	$227,178	$232,632	$238,223
Required Rev	$237,656	$243,339	$249,164	$255,134	$261,254	$267,527	$273,957
Incr. Price	$914	$936	$958	$981	$1,005	$1,029	$1,054
Const. Price	$982	$982	$982	$982	$982	$982	$982

Given the unit price, the payback and breakeven analysis were performed. Payback Selling five bicycles per week at the constant price of $982 per unit, would payback annually between the eighth and ninth week of the business year as shown in Figure 1. By the start of ninth week the business would be producing a profit.

The annual breakeven point was also calculated as illustrated in Figure 2. The unit sales annual breakeven point occurs with the sale of 82 units, which is considerably less than the expected 260 units per year assuming five per week.

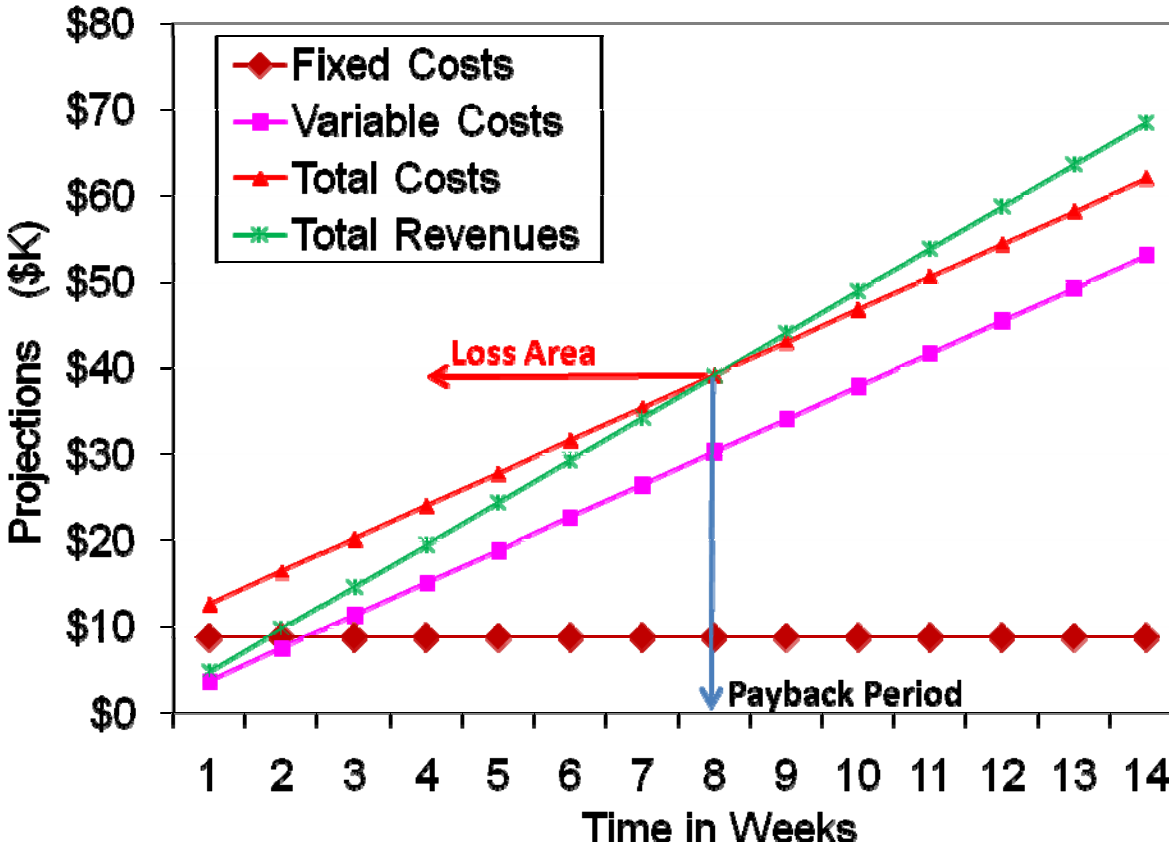

Figure 1. Payback Analysis

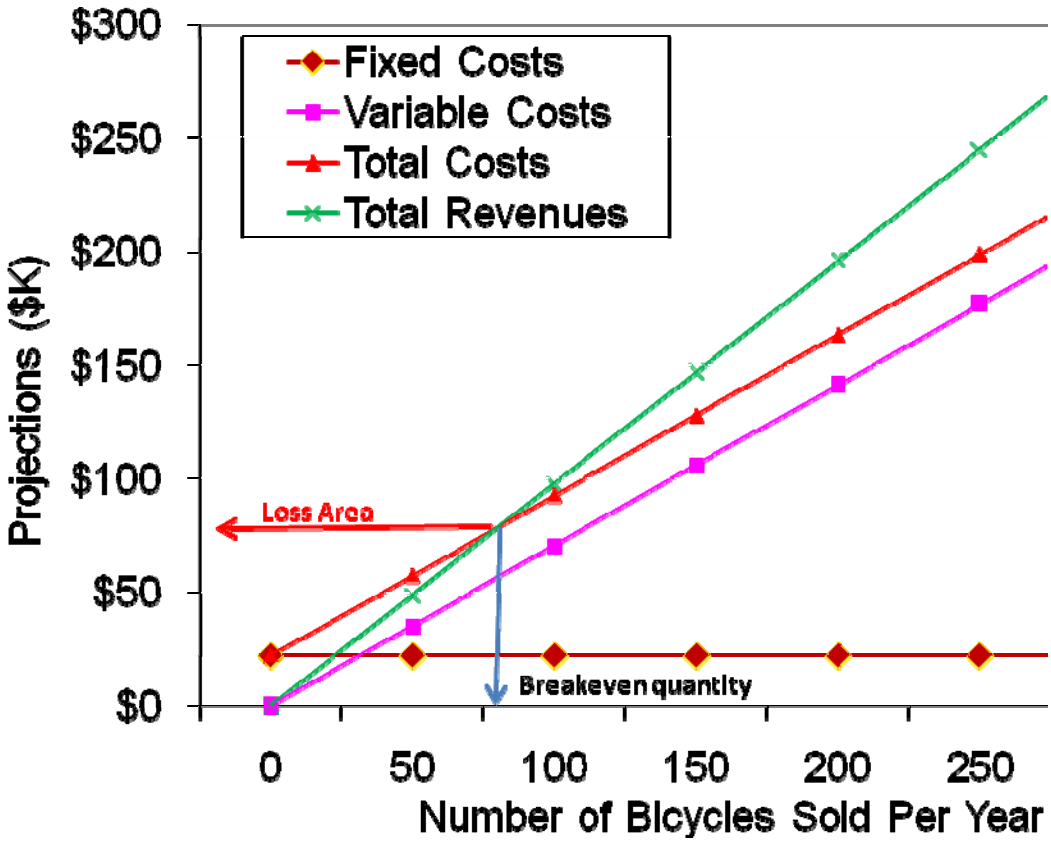

Figure 2. Breakeven Analysis.

Documentation Phase

An effective team presentation was prepared to communicate the findings to the class, and in this case, demonstrate the business creation was feasible. The presentation had to meet the following criteria:

- Time frame: 15 to 30 minutes.
- Smooth transition between speakers.
- Describe the project objective.
- Describe the approach to meeting the objective.
- Describe the findings.

The team also generated a memo to justify the creation of the business. Each team member presented a portion of the project to the rest of the class, the instructor, and invited guests. This experience provided a realistic opportunity to exercise students' managerial communication skills.

"Accurately replicating operations, although often on a smaller scale than used in industry, is an important tool to help learners to recognize and appreciate real-world applications… [3]." This educational model is adaptable to various curricula augmenting normal coursework with critical soft skills.

More Than Theories

The educational value of a project is enhanced by the practicality of the examples used. "Simulating realistic manufacturing, assembly, or transportation operations used in industry can be a valuable learning experience for students."[3] When modeling is used for instruction, the correlation to reality increases the value of the process. In this project, students learned the planning, organizing, and decision making process that envelopes the creation of a business along with mathematical calculations used in cost analysis. This modeling produces an enhanced skill set by teaching underlying skills needed in business as well as the textbook principles.

The criteria set forth comprised the cost analysis necessary to create a functional business unit. Three activities included in the project were cost estimating, determining startup costs, and breakeven analysis. These also appear on the Small Business Administration website (www.SBA.gov) as activities imperative for new business success [4]. Startup costs were tabulated, recurring manufacturing costs were estimated, and a breakeven analysis was calculated based on a project sales volume. These activities were all accomplished within a group structure that simulated an actual work environment with job duties and deadlines for completion. Unlike typical work environments, the group did not have a site or regularly determined work times other than weekly class meetings. In order to overcome this challenge, the group had to develop communication strategies used by off-site work groups. Telephone and email contact were more important because group member's varying schedules minimized the amount of group meeting time available.

Additionally, the project was similar to the real life experience of David Sanborn, who bought a failing retail bicycle shop and now successfully sells custom mid-range bicycles [5]. Although Sanborn's retail outlet does not manufacture as the project model did, his success with custom sales demonstrates that the project represented real business issues and success potential.

Summary

The curriculum of the engineering cost analysis class included grass-roots costing, business startup costing, pricing analysis using time value of money concepts, breakeven analysis, and payback calculations. The educational value of the cost analysis course was enhanced by the realistic analysis required by this project. This enhancement included soft skills of interdependent team building and development.

The project simulated on-site and off-site work environment attributes requiring the group members to overcome location and scheduling obstacles in order to complete the project on time and successfully. Cooperation and communication were important soft skill objectives that ensured project completion.

The completed project used Microsoft Word, Excel, PowerPoint and extensive costing research. This allowed individuals to increase their computer skills and research skills. These components of Microsoft Office are widely used by businesses of all disciplines and proficiency is an expectation of employers.

The project results were presented to the class, which gave each team member a chance to further develop their speaking skills. The presentation was intended to persuade the management of a large company (represented by the class) to create a new division. Adept presenters are crucial to many business areas, including training, business development, and business growth. Although the manufacturing phase of this project was not physically completed by the student group, there are many success stories for this type of business endeavor.

This instructional method utilized and integrated many more skills than would a normal text book curriculum. This made the teaching method more effective. Additionally, this technique provided necessary experience and skill building in peripheral competencies.

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