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CAPITAL BUDGETING PRINCIPLES: BRIDGING THEORY AND PRACTICE

Atul K. Saxenaⁱ

ABSTRACT

One of the important qualities that accrediting bodies, e.g., the AACSB are looking for in business schools is learning outcomes that relate theory with practice. In fact, they encourage business schools to include pedagogical tools in the curriculum that foster practical applications of complex theoretical concepts, thereby making them intuitive and somewhat easier to grasp by students. Additionally, prospective employers, college professors, and students themselves are interested in learning valuable skills such as conducting research, team building, leadership, and interdependence that they can take with them to their job. This paper describes a capital budgeting project that is a real world simulation of a new business startup. It allows students to acquire the valuable skills mentioned above. The proposed project is suitable for graduate (MBA) and upper-level undergraduate courses. The project has been assigned in an MBA program with great success in the core corporate finance. But it can also be amended and utilized in the capstone strategic management course. For undergraduate finance students, this project can be assigned in the second (intermediate) finance course. The project is particularly appealing to non-traditional business students, who often desire to establish their own firms. The project directs their focus on the achievement and profitability of their future dreams while applying in practice what they learn in theory.

I. INTRODUCTION

Social scientists and academicians have stressed offering students multiple techniques of pedagogy for better learning outcomes. These techniques include one-minute papers, more detailed research papers, simulations, power point presentations, and real-world projects among others. Research has shown that generation-X actually prefers experiential learning to the more traditional lecture-based pedagogy (Bale and Dudney, 2000). Frequently professors spend a lot of time and effort searching for projects to supplement their lectures to enrich their coursework. The accrediting bodies encourage schools to include such pedagogical tools that bridge theory with practice. While instructors have always desired such tools, lately there is an increased demand from employers and student graduates to obtain these valuable hands-on experiences by simulating the real world before entering it.

While useful to both graduate and undergraduate students, practical learning experience is more important for the former group. This paper describes a project that can be used in upper level undergraduate finance (and strategic management) courses, but is particularly geared towards graduate students. The project requires students to apply financial analysis to the startup of a small company. This project has already been assigned successfully in MBA (and undergraduate) courses at a business school for a number of years with good results. Since most of the students enrolled in the core MBA corporate finance course are classified as non-traditional, they frequently have a dream of establishing their own company, of being

entrepreneurs. This project provides them the opportunity to apply theoretical concepts and focus on the costs and benefits of their future plans.

Viewing various business functions on a small scale provides insight in understanding the interactions among functions in larger, established firms. While this paper involves the application of financial analysis, the project can be modified for any other business discipline, such as management or marketing. Over the course of study in an MBA program, it can also be used as a continuing project, adding facets to the study in each discipline. It may be modified to provide an examination of the practicalities in setting up businesses for other professionals, such as medical offices, engineering firms, etc. Its main benefit for the student is to encourage the disciplined thought and planning required in establishing a successful business.

The rest of the paper is organized as follows. Section II reviews the relevant literature. Section III discusses some desirable attributes of a class project assignment. Section IV explains the project in detail. Based upon procedural logic, Section IV is further divided into four sequential sub-sections. Section V summarizes the paper and provides some concluding remarks.

II. LITERATURE REVIEW

In a classic study on how to frame classroom learning experiences that model necessary attributes for the foundations of success, Bruner *et al* (1999) found the following as important:

1. Select cases that employ, exercise or explore a tool or concept
2. Highlight the dilemmas of the decision maker
3. Set the numbers and critique them
4. Embrace uncertainty
5. Demand the action recommendations arising from analysis
6. Look for unintended consequences
7. Explore opportunities for further work

If a project possesses several of the above attributes, it is considered good. Remarkably, the project explained in this paper meets most of the above criteria.

Bale and Dudney (2000) surveyed students to research their preferred mode of learning. They find from their survey results that for Generation X students (born between 1961 and 1981) “hybrid” teaching models incorporating both andragogy (self-directed, self-motivated) and pedagogy methods are most effective. Making reference to another related study they go on to conclude that Generation X wants to see value and relevance in education, otherwise they are not motivated to learn new skills. They prefer experiential learning using as many of the five senses as possible (Caudron 1997). The startup project explained here is an example of hybrid teaching model that incorporates both andragogy and pedagogy.

Deeter-Schmelz, Kennedy, and Ramsey (2002) conclude that team projects play a vital role in modern pedagogy. Moreover, as team projects become even more common in business courses, an increased understanding of factors contributing to team effectiveness is necessary for instructors to assist students in realizing the potential benefits of this pedagogical tool. Their results support the positive and direct role of cohesion as an input variable on teamwork. Ashraf (2004) finds that in business schools across the United States, one of the most common pedagogical tools is the use of group projects. "Passive" instruction (i.e., lecture only) is

considered to be an inferior mode of teaching. He highly recommends the use of group-based projects as pedagogical tools. Since we suggest that our project be preferably given as a team assignment, recommendations of both Deeter-Schmelz *et al* (2002) and Ashraf (2004) are met.

A simulation, like any pedagogical tool, must be evaluated in terms of its effectiveness in achieving course objectives. In a study, Chapman and Sorge (1999) investigate how well a particular simulation does in achieving course objectives and compare its performance to the textbook and papers used in the course. They find that compared to the textbook and research papers, students consistently gave simulation the highest ratings. In another study, Olson *et al* (2006) discuss and encourage the use of simulation as a pedagogical tool. While their simulation is developed for Eastern European transition economies, it is applicable to any pedagogical learning situation, specifically to the general operations of the firm at the microeconomic level of decision-making. Our project conforms to both studies, Chapman and Sorge and Olson *et al*.

While most of the above studies pertain to general education and business courses, there is some literature that is specifically relevant to finance courses. For example, Gurnani (1984) extensively reviews and compares capital budgeting concepts as advocated in theory with the methods employed by industry. Capital budgeting is an interdisciplinary function, involving diverse areas such as engineering, finance, and management. The ability of a firm to make sound decisions in this area rests not only on the theoretical techniques employed but also on the judgment, intuition, and creativity of the analysts and decision makers. He claims that the academic literature has concentrated heavily on developing and refining quantitative evaluation criteria, methods of measuring return, risk analysis techniques, and procedural aspects of capital investment decision making. However, academic research has been criticized because it tends to be essentially concerned with accuracy of analysis, sophistication of methodology, and improving conditions in a laboratory setting without regard to the realities of corporate decision making. One reason for the gap is a lack of bridging theory with practice at the school level. We feel that this project is the perfect bridge.

Benton Gup (1994) surveys academics and practitioners and ranks those finance concepts considered most important for students to acquire. The academics rank time value of money, capital budgeting, CAPM, capital structure, and valuation as the top five financial concepts for this purpose. It is striking that all five are included to some degree in the project discussed in this paper. The practitioners ranking excluded CAPM and valuation but included accounting and cost of capital. This project requires a critical understanding of the cost of capital concept.

In what has to be one of the most comprehensive and impressive studies in corporate finance, Harvey and Graham (2001) sampled 4440 firms receiving responses from 392 chief financial officers (CFO's) to examine the proverbial *bridge* between theory and practice. Their findings are both reassuring and surprising. It is reassuring to them that NPV is dramatically more important now as a project evaluation method than it was 10 or 20 years ago. The CAPM is also widely used in the real corporate world. However, they find it surprising that more than half of the respondents would use their firm's overall discount rate to evaluate an investment in an overseas market, even though the investment likely has different risk attributes than the overall firm. This indicates that practitioners might not apply the CAPM or NPV rule correctly, perhaps indicating a need for a better bridge between theory and practice. A class assignment such as proposed in this paper would be useful to reinforce this bridge.

Weaver and Michelson (2004) suggest a project that could accompany a corporate finance course to enhance the learning of theoretical concepts. It is a simple Excel model that

provides measures of the standard deviation of forecasted internal rate of return (IRR) given traditional data inputs such as annual cash flows, terminal values and equity. The model first calculates IRR using traditional discounted cash flow methods and then provides heuristic estimates of variability measured in terms of "high," "low" and "most likely" values. It also provides an actual measurement of risk in terms of mean and standard deviation and upper and lower quartiles, along with a graphical presentation of various risk parameters. While the Excel model just described is a good class project, our startup project is more comprehensive in nature covering a wider variety of financial concepts.

III. DESIRABLE ATTRIBUTES OF A CLASS PROJECT

Project assignments vary widely in their complexity and the amount of time needed for completion. For example, an economic ordering quantity (EOQ) model with imperfect quality items can be rather challenging for a typical corporate finance course, it may be well suited for a decision science course (Wang, Tang, and Zhao, 2007). Most finance class projects do not necessarily have to be as complex as EOQ models. The project outlined in this paper is rigorous yet relatively simple. It is a real world simulation of a firm and the decision making that goes on within it by its financial managers. As discussed above, Chapman and Sorge (1999) recommend the prudent use of such pedagogical tools. However, designing an appropriate project can be tricky and time consuming. From our own experiences in the classroom, we have found that certain key factors must be considered when designing a project assignment.

First, a well-designed class project must logically follow the concepts learned in class and/or the text. There ought to be opportunities for students to clearly and easily relate to certain key theoretical concepts and apply them in practice through the project. Second, it must be doable within the term of the course, which is the case of the proposed assignment. Another issue is whether a project can be done individually or in a group setting. Most instructors encourage projects to be done in small groups of 3 or 4, depending on the class size. Despite the potential for the classic free-rider problem (Ashraf 2004), group projects support the important goals of team building, leadership, responsibility and mutual trust. Business program accrediting bodies, e.g., AACSB, put enormous weight on these values. Moreover, there are alternative means of mitigating free ridership, e.g., peer evaluation by team members. However, a situation may arise that is not suitable for teams and group assignment. For instance, if the class size is very small or students are extremely busy (executives, etc.) who do not have enough flexible time to meet in teams. A desirable project can be done individually, as is ours.

IV. THE PROJECT

There are several steps involved in this project assignment. The first step involves selecting the type of business to be established. Step two entails setting the assumptions under which the financial analysis will be performed. The third step involves calculating a financing rate (the cost of capital), estimating the revenues and expenses over an extended period of time (say a 5-year period). The fourth step consists of applying various capital budgeting techniques to reach an accept/reject decision. The final step consists of evaluating and assessing the risk involved in the cash flows and profitability. Each step is explained in detail in the following subsections.

IV-A: Selection of the Business Type

It is helpful to select a business that does not depend on results of research and development activities, exploration, etc. These unknown or future factors add considerable complexity to the project and undermine the task of estimating probable cash flows from the business by making the whole project seem unreal. Business types such as retail, most manufacturing, consulting, construction, or service make the project more manageable for the student. For those students who do not have a specific type of business they would like to establish, a business run by a family member or friend can be a good choice since discussions with these owners can provide a solid base for estimating the startup requirements, revenues, costs and growth potential.

Occasionally, students run into problems with certain business selections. For instance, franchises can be problematic if estimates of revenues, costs, franchise fees, and other data are not provided by the franchiser. Buying an existing business for project analysis moves the student outside the procedures provided in classroom discussion in the MBA's core corporate finance course and therefore makes the project more difficult for them. This activity is best analyzed with acquisition procedures rather than capital budgeting used in this project. Indeed, this variation of the project can be used for a finance course on Mergers and Acquisitions.

Not-for-profit businesses are frequently avoided by students because they assume that they are not suitable for a profit analysis. However, since these businesses must take in at least as much money as they spend to stay in existence, they are as appropriate for this project as a for-profit business. Businesses that require very large capital outlays at startup for assets with lives longer than the project horizon (say 5 years) will generally not be profitable within the analysis period. This problem can be overcome and is discussed in Section IV-C.

IV-B: Statement of Assumptions

A statement of assumptions used to estimate cash flows is an important habit for students to build. While in the project its function is strictly to build the initial cash flow estimates and provide a base for risk analysis, in an actual establishment of a firm it allows periodic reassessment of the progress expected. Should what initially appeared to be a profitable venture fail to meet projections or economic conditions worsen beyond expectations, the owner may need to either take alternative measures or shut down before losses become excessive. For a project manager in an established firm, changing assumptions may invalidate prior capital budgeting cash flow estimates. It is the responsibility of the project manager to keep upper management informed of these changing circumstances and to re-estimate the probable profit of the project. Failure to do so can significantly impact the profitability of the firm and in turn have a devastating effect on the career of the project manager. Finally, assumptions are also required for the instructor to evaluate the student's ability to apply the concepts. Assumptions generally include such things as the economic conditions, growth in revenues/costs, hiring of employees, increases in fixed assets, cost of capital, termination revenues and expenses, initial inventories and fixed assets, etc. Table 1 contains an example of the set of assumptions to be used for this case.

As suggested in the simplified example in Table 1, the best estimate for sales growth is projected to be 10% annually. Students might more reasonably predict sales growth of 25% in year 2, 15% in year 3 followed by 5% growth in the last two years. As examples, assumptions

might also include a significant increase in payroll in year 3 as a planned administrative staff addition occurs. At the same time one might see increased office expenses and depreciation. Students need to be encouraged to be creative, imaginative, yet realistic when making these assumptions.

TABLE 1	
AN EXAMPLE OF A SET OF ASSUMPTIONS	
Business Type: Retail Outlet	
Expected Case Assumptions*:	
1. Sales Growth	10% of Revenues per year
2. COGS	60% of sales
3. Utilities	\$5,000 per year
4. Advertising	\$10,000 per year
5. Miscellaneous exp.	\$9,000 per year
*Note that this is only a partial set of assumptions for illustration purpose.	

IV-C: Cost of Capital and Cash Flow Estimates

Since the project involves a startup company, a basic assumption is that at least initially, it is a sole proprietorship and the cost of capital is composed of the student's own required rate of return plus the cost of borrowing money. Students are asked to call a financial institution to determine what lending rate would be required for a business of the type chosen. The weighted average of these two rates is used as the discount rate for capital budgeting purposes. Students may wish to assume additional investors and incorporate their required rates as well when computing the overall cost of capital.

Students are also asked to estimate cash flows for the initial startup costs and revenue/expenses for five years at which time the business is shut down or sold. The five year life span may appear somewhat arbitrary at first. However from experience, this is a long enough horizon to include most of the changes a new company may encounter so students have the opportunity to manage the growth. At the same time, a 5-year life span of the project is not so long as to make long-term estimates of cash flows too unrealistic and far-fetched. The process and organization of cash flows in this paper follow that presented by Titman, Martin, and Keown (2014).

To demonstrate knowledge of technology (a desirable tool by AACSB), spreadsheets are required for the organization and estimation of cash flows. The initial outlay includes all cash flows that occur at the beginning. Table 2 provides a complete output of the capital budgeting analysis. It shows that our sample project requires modifications to the proposed property as well as furniture and fixtures to open. It also has deposits and opening expenses. These could be utility and phone deposits, operating licenses, and the initial advertising campaign. Working capital requirements might include cash.

TABLE 2**AN EXAMPLE OF A COMPLETE CAPITAL BUDGETING SPREADSHEET**

Initial Expenses	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Fixed Assets	\$100,000					
Renovations	\$20,000					
Working Capital	\$10,000					
Bank Balance	\$25,000					
Inventory	\$30,000					
<u>Miscellaneous</u>	<u>\$9,000</u>					
<u>Initial Cash Outlay</u>	<u>\$194,000</u>					
Revenues		\$500,000	\$550,000	\$605,000	\$665,500	\$732,050
Cost of Revenues		\$300,000	\$330,000	\$363,000	\$399,300	\$439,230
Payroll		\$50,000	\$52,500	\$55,125	\$57,881	\$60,775
Utilities		\$5,000	\$5,000	\$5,000	\$5,000	\$5,000
Lease/Rent		\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
Advertising		\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
Maintenance		\$1,000	\$1,000	\$1,000	\$1,000	\$1,000
Insurance Expense		\$500	\$500	\$500	\$500	\$500
Other Overheads		\$500	\$500	\$500	\$500	\$500
Depreciation		<u>\$2,000</u>	<u>\$2,200</u>	<u>\$2,420</u>	<u>\$2,662</u>	<u>\$2,928</u>
Earnings before Tax		\$121,000	\$138,300	\$157,455	\$178,657	\$202,116
Less Taxes @ 40%		<u>\$48,400</u>	<u>\$55,320</u>	<u>\$62,982</u>	<u>\$71,463</u>	<u>\$80,847</u>
Earnings After Tax		\$72,600	\$82,980	\$94,473	\$107,194	\$121,270
Add Depreciation		<u>\$900</u>	<u>\$900</u>	<u>\$900</u>	<u>\$900</u>	\$900
Salvage Value/Inventory						<u>\$51,000</u>
Net Cash Flow	\$194,000	\$73,500	\$83,880	\$95,373	\$108,094	\$173,170
Cumulative NPV*	(\$194,000)	(\$127,182)	(\$57,860)	\$13,796	\$87,625	\$195,150

***Assume 10% Discount Rate**

The next cash flow category includes revenues and expenses occurring throughout the five-year life of the project on an annual basis. Generally called after-tax cash flows, these include annual revenues, annual expenses, depreciation, and taxes. The format of these cash flows follows the general format of an income statement except that interest expense is not included. All after-tax financing expenses are recovered by the level of the interest rate used to discount the cash flows. The final cash flow category is the terminating cash flows. These include all one-time cash flows occurring at shut down and could include after-tax salvage value, disposal/restoration expenses, sale of business revenue, etc. Since these cash flows occur in year five, they should be netted with the year five after-tax cash flows. At this point students should have six cash flows: total initial outlay and cash flows for years 1-5 (year 5 includes the terminal cash flow). Additional instructions given to students in this phase can include:

- After-tax cash flows in years 1-5 must vary. Texts frequently repeat the use of year 1 cash flows in all succeeding years of the project life for ease of classroom instruction. Requiring variability forces a more realistic picture of a firm.
- Record cash flows as they occur. While the after-tax cash flows format resembles an accounting income statement, it does not follow accounting practices. Cash flows should coincide with cash going into and out of a bank account.
- At termination students can assume a complete shutdown with or without salvage value or the sale of the company. For firms that had costly and long-lived fixed assets, realistic profitability will require the sale of the assets or the company in year 5.
- Categories estimated in the after-tax cash flows should be moderate in breadth. For instance, estimates for total revenue and total cost are too broad. For a retail outlet, estimating revenue and costs for every item sold is too detailed.
- Straight line depreciation or MACRS can be used.

Students who are seriously considering starting the business analyzed in the project are permitted and encouraged to be as detailed as they feel necessary.

IV-D: Capital Budgeting Techniques and Acceptability Analysis

Once the net cash flows are obtained, the acceptability of the business is evaluated. Students are required to use several decision criteria methods: pay back period, discounted pay back period, net present value (NPV), profitability index, internal rate of return (IRR), and modified internal rate of return.

- Payback period provides the number of years required for the initial outlay to be recovered from the after-tax cash flows. Since this is strictly an accumulation of the cash flows in years 1-5, it fails to account for the *time value of money* and is considered to be a less than accurate method and, financially speaking, a naïve way of evaluating the acceptability of the project. Acceptability of the business depends on owner-set criteria. For example, the initial outlay must be recovered within 3 years. If the pay back is equal to or less than this hurdle, the business is acceptable. Despite its limitations, the pay back period method remains a popular capital budgeting technique (Harvey and Graham, 2001). It is frequently used as a *preliminary* screening measure in large firms and as the sole requirement in cash poor firms.
- Discounted pay back corrects for the lack of use of the time value of money in the pay back method by discounting each year's cash flow to year zero using the cost of capital as the discount rate. Therefore, this technique is regarded as an improvement on its predecessor and not as naïve. It is interpreted in the same manner as pay back but will obviously take longer to recover the

initial outlay since the cash flows are in present value terms. Once again, the owner must set the acceptability criterion.

- Net present value (NPV) is the present value of the cash *inflows* minus the present value of the cash *outflows* and provides the dollar estimate of the change in the value of the firm. The business is acceptable if the NPV is positive.
- Profitability index is the present value of the cash *inflows* divided by the present value of the cash *outflows* and provides the dollar return for each dollar invested. The business is acceptable if the profitability index is greater than one.
- The internal rate of return (IRR) is the discount rate that equates the present value of the future cash flows to the initial outlay. It provides the percent return on funds invested *assuming* that the cash flows are reinvested at the internal rate of return as they flow into the firm. This is known as the reinvestment rate assumption. If these funds cannot be reinvested at that rate, the return will not be achieved. For this reason, sometimes the IRR rule is regarded as too optimistic, and the *modified* IRR is computed as discussed in the next paragraph. The internal rate of return must be greater than the firm's cost of capital for the business to be profitable.
- When the reinvestment rate assumption cannot be met, or when a relatively more conservative technique is desired, the *modified* internal rate of return is calculated. All the cash flows are compounded to the final year (year 5 for the project) using a reasonable rate for reinvestment, generally the cost of capital, and totaled to arrive at the future value of all cash flows. The modified-IRR is the implied rate that equates the initial outlay with the future value just calculated. This modified-IRR must be greater than the cost of funds.

If the business is unprofitable, students are asked to discuss some methods that might make it profitable. For example, operating from a home office or obtaining lower cost facilities might delay costs, or slowing/increasing the growth rate might provide a greater spread between revenues and costs. Students are not required to apply these suggestions.

IV-E Risk Assessment

Students are also asked to analyze business risk using one of four risk analysis techniques and to discuss their findings. The methods suggested are sensitivity analysis, scenario analysis, decision tree analysis, and simulation. In all cases, the student can also determine the probability of the net present value falling below zero since this requires the average of several estimates of the net present value and its standard deviation. Although these techniques carry different nomenclature depending on the source, their definitions below should be familiar to faculty.

- In sensitivity analysis, the assumptions used in the analysis are changed one at a time to determine those with high impact on the net present value. These are called driver variables and generally require a high degree of confidence in the estimate or the ability to be well managed for an overall assessment of low business risk.
- Scenario analysis involves modifying the expected scenario already presented with the worst case and best case estimates of the assumptions used to create the model. This has the advantage of incorporating the interactions of all the variables into the analysis.
- Decision tree analysis provides re-evaluation points as the establishment of the business progresses. Owners can incorporate their experience at these points to re-estimate profitability. They may decide to expand/contract the business, modify facilities, shut down, etc. The decision tree provides "legs" to determine the net present values for each of the possible paths that the firm might take. The expected net present value and its standard deviation can assist in the risk assessment.

- Simulation provides estimates of the net present value by randomly selecting a value from each variable's probability distribution and combining them for the trial NPV calculation. Computer simulation software is generally instructed to make 1,000 to 10,000 trial runs, creating a net present value probability distribution. The area under the curve below a net present value of zero provides an assessment of the risk of the business.

Summarization of the acceptability of the business including both the decision criteria and the risk analysis concludes the project. Since risk analysis provides no definitive answer for how much risk is acceptable, students must apply their own risk preferences to this decision. Depending upon the preparedness of students, this section can be excluded from undergraduate finance courses if it becomes too overwhelming for them.

V. SUMMARY

This paper describes a capital budgeting project for the startup of a new business (e.g., a sole proprietorship). It is a real-world project that is do-able in a semester. It is preferably assigned as a group project, but can be adapted for individual student assignment. The company/business type is chosen by the student(s). Based on the types of assets and services required, students estimate the initial startup cost, the recurring revenues and expenses over the life of the business and any terminating cash flows. Once the cash flows are estimated, the business is evaluated for profitability and risk using the capital budgeting techniques of the *net present value* (NPV) and the *internal rate of return* (IRR). Students then must decide if they would proceed with that “dream” business.

The project can be assigned to MBA students in their core corporate finance course or with slight modifications it can also be included in courses such as management, marketing or entrepreneurship. A remarkable characteristic is that the project can be used as a thread connecting much of the MBA curriculum, creating a management business plan, a marketing plan, a cash budget, etc. in different classes. The described project has also been used in undergraduate finance classes by eliminating the risk analysis. Certain non-business professional programs, such as health care or engineering, where students frequently plan to open their own business, may also find it beneficial to include it in their curriculum.

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