2005

Privatization Initiatives: A Source for Engineering Economy Case Studies

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Original Publication Citation

Kauffmann, P., Abdel-Salam, T., Williamson, K., & Considine, C. (2005). *Privatization initiatives: A source for engineering economy case studies.* Paper presented at the 2005 American Society for Engineering Education Annual Conference & Exposition, Salt Lake City, Utah.

Privatization Initiatives: A Source for Engineering Economy Case Studies

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Introduction

Undergraduate courses in engineering economy provide the opportunity to cover many topics that are essential for the career success of practicing engineers. Primary among these are knowledge of cost analysis, time value of money, and business case analysis of technology investments. However, beyond these core concepts, engineering economy courses have the potential to influence a broader spectrum of learning objectives that contribute to career success. For example, engineering economy can enhance student skills in important topical areas such as technical presentations, report writing, communication, entrepreneurship, risk management, and critical thinking. One approach to achieve this potential is to integrate engineering economy topics into practical and challenging case studies.

Recently, the federal government has developed a number of engineering economy based decision models to support implementation of Office of Management and Budget (OMB) circular A-76[1]. This directive provides impetus and guidance for privatizing government operations that can be performed more efficiently by the private sector. These privatization initiatives and related decision models represent a significant opportunity to develop case studies that can promote not only understanding of many important engineering economy topics but also address, in a team based learning environment, the broader set of curricular topics noted above.

This paper presents an overview of the case study method, reviews the basic structure of the circular A-76 privatization decision model, and describes a case study that was developed based on the privatization concept. It highlights the possibilities for development of case studies that can challenge student teams to apply engineering economy tools while developing skills in a range of curricular areas that are important to undergraduate engineering education and career success in engineering practice.

Case Study Method Overview

The case study teaching method has a long history as a useful and respected instructional tool in many disciplinary areas ranging from psychology to business and management. As early as 1982, Yin[2] published an annotated bibliography on the case study method. In a later work[3], he described the long and respected history of the case study approach and points to classic case studies in diverse areas such as by Whyte[4] in 1943 on an urban community and Allison[5] in 1971 on the Cuban missile crisis. There are also many examples of seminal case study research within the management literature dating back to the 1950's. For example, Gibb and Wilkins[6] cite Blau's[7], Gouldner's[8] and Dalton's[9] work on management related cases. There are numerous current works on the use and impact of case studies in education and these are excellent

resources for faculty interested in learning about using case studies as a learning tool. For example, the University of Western Ontario's web site provides a comprehensive listing of current literature related to case studies in education[10]. In the field of engineering economics, examples like Eschenbach[14] and Plonka[15] demonstrate that case studies have been recognized as a useful tool for demonstrating topical concepts.

A major reason for the continued growth in the application of case studies as instructional tools is their ability to introduce challenging, real-world situations and related decision complexity into the classroom. This is particularly important for engineering students since practicing engineers are confronted, on a frequent basis, with complex decisions such as balancing technology and business priorities. Case studies provide the opportunity to learn how to apply classroom training to work place problem solving so that students can improve analytical skills, reduce the time involved in making decisions, and improve the likelihood of correct decisions. Seperich et al.[11] emphasize another and more subtle educational aspect of case studies. Students involved in group work related to case studies can develop skills required for success in the diverse work place such as group decision making, consensus building, negotiation, and tolerating differences of opinion.

Engineering entrepreneurship is still another area of possible impact for case studies. Perren and Ram[12] are part of a growing body of research into the application of case studies to build decision making skills in entrepreneurial areas. To illustrate this point, they propose that case studies can be categorized in general terms based on a two axis perspective. The first axis (vertical in Exhibit 1) involves the degree of qualitative (lower half) or quantitative (upper half) analysis. The second axis (horizontal) represents the decision context being either an individual (right half) or organizational (left half) scenario. Exhibit 1 applies this two axis concept to the engineering entrepreneurship decision context.

Quantitative focus

Organizational decision context	Individual or entrepreneur decision context
Case requires objective analysis with decisions and issues related to the success of the organization.	Case requires objective analysis with decision by entrepreneur or individual leader
Case requires subjective analysis with decisions related to organization success.	Case requires subjective analysis and decision by individual entrepreneur or leader.

Qualitative focus

Exhibit 1 Matrix of Case Study Analysis and Decisions

A major advantage of case studies is that they can be developed to build understanding and skills in a single quadrant of Exhibit 1 or overlap several quadrants to reflect the complexity of real world business issues. This flexibility of case studies coupled with the richness of decisions and issues that can be related to engineering economics and entrepreneurship results in a powerful combination that can provide a strong link to a number of ABET criteria. Exhibit 2 summarizes several of these direct relationships.

ABET Criterion	Engineering economy case study impact
(b) an ability to design and conduct experiments, as well as to analyze and interpret data	Case studies require students to find or develop the important information and ignore data that is not important.
(c) an ability to design a system, component, or process to meet desired needs	Case studies require students to confront issues such as trade off analysis and risk management decisions
(d) an ability to function on multi-disciplinary teams	Student teams solve the case problem. Students must negotiate decisions and viewpoints.
(g) an ability to communicate effectively	Presentations of case results include both an oral and written component.
(h) the broad education necessary to understand the impact of engineering solutions in a global and societal context	Critical thinking required by case study analysis promotes system thinking related to larger impact of decision alternatives.

Exhibit 2 Case Study Relationship to ABET Criteria

ABET criterion (h) in Exhibit 2 is a particularly rich area of discussion for a privatization based case study. For example issues for fertile discussion include areas of government activities which are appropriate for privatization, ethics of layoffs, and outsourcing related to reduced benefits for employees. These topics confront students with the realities of the business world and the work place.

This section has discussed the potential and value of case studies as an educational tool and noted the engineering education potential for integrating cases into the study of engineering economy. The following section examines privatization studies as a topical framework for developing case studies that can cover a wide range of engineering economy topics and also cover the ABET criteria noted in Exhibit 2.

Privatization Initiative Context

Many government agencies are examining current activities and processes to determine those that are candidates for outsourcing to a private sector service provider. As early as 1955, a series of Bureau of Budget Bulletins focused attention on the issue that the government should not compete with its citizens in the process of conducting government activities. Rather, the government should rely on commercial sources to supply goods and services since competitive enterprise is the source of national economic strength. These early bulletins culminated in a more detailed policy direction when the Office of Management and Budget (OMB) issued Circular A-76, "Performance of Commercial Activities" in 1966 with revisions following in 1967, 1979, 1983, and 1999[13].

In general, Circular A-76 allows commercial activities to be outsourced in two ways: either direct conversion or by cost comparison study. The direct conversion option does not require a cost comparison but is very limited in the conditions under which this approach can be applied. For example, in outsourcing opportunities involving ten or fewer civilians, direct conversion can be applied and a comprehensive cost comparison is not required. Otherwise a privatization decision requires a detailed cost analysis that must demonstrate clearly that the privatized activity results in equivalent services at reduced cost.

Exhibit 3 provides the basic analytical foundation that must be employed to quantify the privatization decision: from the perspective of the government, the net present value (NPV) of private ownership must be less than the estimated cost of continued government ownership. The analytical approach described in Exhibit 3 is similar in structure to the challenger – defender study that is a common replacement analysis topic in engineering economy studies.

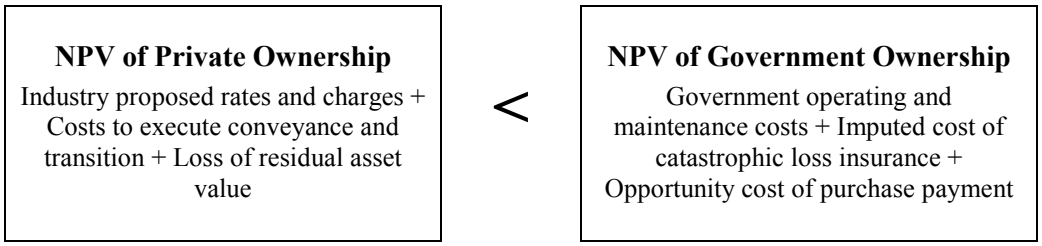

Exhibit 3: Basic Decision Equation for Privatization Study

From the perspective of a case study, privatization studies present many analytical and business opportunities for students. To take advantage of this wealth of educational opportunities, a case study was developed for use in a first engineering economy course. It is described in the next section.

Overview of Privatization Case Study and Learning Objectives

This section provides an outline of the case study developed using a privatization Request for Proposal (RFP) as a core scenario. The case involves an actual RFP issued for privatization of the waste water system at Shaw Air Force Base in South Carolina. The students receive a number of documents, similar to those a potential proposing firm would receive from the government. These include an RFP and several attachments (all of which are abbreviated versions of original documents) and are available from the authors:

- Attachment J-40 describes the base and the components in the waste water system that is proposed for privatization. This document provides a simulated version of the original RFP and presents the base information for the case.
- Attachment J-4 covers instructions and examples on how to complete the forms in the RFP. This also provides the basis for the analysis per Exhibit 3 and provides the engineering economy framework for valuing the business opportunity.
- Summary of waste water system components and estimated replacement costs. In the actual RFP, the proposers are required to value the list of assets. In our case, this is provided to the students since cost estimating software is not available to the students.

The students are divided into proposing teams that compete for the privatized waste water system. From a decision context, the students are the proposal team for a specific firm and they receive various information that other groups within the company have developed. This includes a summary of projected operating costs, a staffing plan, and other related information including restraints on the amount of cash that is available from the proposing company.

Using the RFP documents and the provided data, students must develop an after tax cash flow analysis and use this to develop a proposal to the government for the privatized waste water system. This proposal must be presented in a formal written report and also presented in a

fifteen minute management meeting. A complete copy of the case documents can be obtained from the authors.

Several of the more interesting teaching aspects of the case involve risk, estimation, and valuation of assets and business opportunities. For example, examination of the terms in Exhibit 3 reveals that the proposing firm does not have the information to evaluate the government's cost position and the proposing firm knows only a limited number of the terms in Exhibit 3. On the left side, the NPV of Private Ownership represents the costs for private operation and is defined as the proposer's case. However, for the NPV of Government Ownership on the right, the proposer knows only the opportunity cost of purchase payment since this is the amount the proposer is willing to pay for the assets involved in the privatization. The remaining government costs are unknown.

Based on instructional goals and course focus, the learning objectives of the case can be selected from any or all of the following points:

- Develop an after tax cash flow analysis of a business acquisition opportunity.
- Valuation of assets from an entrepreneurial perspective
- Data analysis, estimation, and trend identification in operating and maintenance cost.
- Strategy and proposal differentiation: Analysis of what competitors may propose and how to differentiate a winning proposal.
- Development of a risk analysis and mitigation management plan involving tactical operational failure and strategic or long term risks.
- Cash management planning. The firm has limited cash to invest in this venture and this must cover start up costs such as office expenses, spare parts and other working capital, and any cash shortfalls. Does the proposal avoid the potential bankruptcy due to cash shortage?
- Issues related to borrowing and the costs related to debt.
- Sensitivity analysis to determine where financial risks are involved in the proposal.

Summary

Case studies have a long history of application and have demonstrated their adaptability across a broad range of fields. Their strength in bringing real world complexity and decision analysis into the class room context presents great potential for engineering educators. This flexibility of case studies coupled with the richness of decisions and issues that can be related to engineering economics and entrepreneurship results in a powerful combination. Case studies that are integrated into engineering economy courses can be a powerful instructional tool to build career skills needed for success in the engineering work place. Beyond building quantitative and qualitative business analysis skills, engineering economy cases can enhance student skills in other important topical areas such as technical presentations, report writing, communication, entrepreneurship, risk management, and critical thinking.

Privatization studies present rich scenarios for engineering economy case studies since they present a wide spectrum of decision and analytical opportunities. A case study based on developing a proposal to privatize a government utility system has been presented and is available for use by engineering educators. These privatization initiatives and related decision models represent a significant opportunity to develop case studies that can promote not only

understanding of many important engineering economy topics but also enhance human relations oriented skills in a team based learning environment.

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BIOGRAPHICAL INFORMATION

PAUL KAUFFMANN received a Ph.D. from Penn State in Industrial Engineering, and a MENG in Mechanical Engineering and a B.S. in Electrical Engineering from Virginia Tech. He is Department Chair of Industrial Technology at East Carolina University and research interests include technology management and managerial decision methods. During his industrial career, he held positions as project engineer, plant manager, and engineering director.

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