

Where the Money Is: Teaching Design with Financial Institutions

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Abstract

Industrial engineering (IE) involves the design, installation and improvement of integrated systems of people, equipment, software, materials and energy. Even though in concept industrial engineers are trained to apply their skills across many different industries, many academic programs concentrate on preparing students for successful careers in the manufacturing sector. Traditionally, IE design projects have focused on areas such as improvements to manufacturing facility layouts; optimization of production flows; implementation of statistical quality control systems; and manufacturing process reengineering to name a few. Students seeking an industrial engineering degree, do not however always desire a manufacturing emphasis. Productivity and quality improvement, as well as system integration issues are fundamental concerns in all industrial sectors.

At New Mexico State University, we are addressing students' needs for experience in, and exposure to non-manufacturing industrial settings. One industry in particular that has provided a number of partnering opportunities is the financial industry. For the most part, financial products, services, processes and systems are designed by people with backgrounds other than engineering. Due to the highly competitive nature of the industry, financial institutions have been extremely receptive to the application of industrial engineering tools and methodologies that lead to improvements in quality, productivity and customer satisfaction.

By means of several different design projects conducted in upper-division undergraduate classes, in capstone design courses, and as graduate masters' technical projects, IE students at New Mexico State University have the opportunity to apply their engineering skills in financial organizational settings. The benefits financial organizations receive are many. Projects have covered areas such as new financial process design; existing process reengineering; facility customer flow; large scale systems simulations; call center optimization; and establishment of productivity metrics. Such projects are as intense as any manufacturing project but expose students to a different industry with unique needs.

The paper that follows discusses the partnering activities between the IE department at New Mexico State University and the financial industry. Specifically, the mechanisms required for establishing these partnerships as well as the differences between traditional design projects focusing on the manufacturing sector and projects focusing on a service industry will be addressed. Last, the skills necessary for students researching, interacting and presenting to a non-engineering, financial audience in contrast to an engineering, technical audience will also be covered.

Introduction

The famous bank robber, Willie Sutton, stated he robbed banks because “that’s where the money is.” In the world of systems improvement, financial institutions are a wonderful and rich source of design and analysis problems for industrial engineers. Additionally, such efforts lead to new career options for industrial engineering students. As the economy tends toward a service base, service industries such as financial institutions have become a potential career focus for industrial engineering students.

Industrial engineering (IE) involves the design, installation and improvement of integrated systems of people, equipment, software, materials and energy. Traditionally, many of our industrial engineers have been hired into the manufacturing sector. Yet, the skills and tools of an industrial engineer such as systems analysis, statistics, mathematical modeling, queuing theory, facility design, and simulation can benefit any type of organization or industry.

Financial institutions offer an environment that is highly integrated in terms of both computer and human systems coupled with the complexity of direct customer interaction. Systems changes are seen immediately by the end-customer– for example, there’s nothing quite like having your account debited in error or waiting in line for a lot longer than planned. Such opportunities for system improvements can provide a challenge to the thoughtful industrial engineer. Customers can walk or, even, click away from a credit union or bank to another within minutes. The same may not be true in a manufacturing setting, where there may be a limited number of sources for producing or supplying a product. Some manufacturing organizations that our students work with are essentially sole sources of products and might not provide industrial engineering students with the range of experiences found quite often in competitive service industries.

At New Mexico State University, we have encouraged an interest in financial institutions as a source for systems design and improvement projects. Such projects are part of upper-division electives including our capstone design class. These projects can be constructed as individual or team projects as appropriate for the specific class. One more involved project served as a Master of Science engineering technical project. This project analyzed through simulation analysis whether a present facility could withstand the increased demand associated with several growth scenarios. In the end, a decision was made not to renovate the existing financial facility, instead plan and budget for a multi-million dollar capital investment for a new facility. As will be discussed below, many useful industrial engineering projects can be generated that serve two goals: (i) providing a rigorous industrial engineering education and (ii) generating new career interests and insights.

One financial institution that we have worked with continually over the past three year is Fort Bliss Federal Credit Union (FBFCU). With Fort Bliss, we have completed a number of projects in the area of systems design, analysis, and improvement. This credit union owns two branches in Las Cruces, NM, three in El Paso, TX and a recently opened “internet” branch. Additionally, the credit union operates a number of walk-up and drive-through ATM machines and participates in a global “shared facility” network. In total, the credit union serves approximately 55,000 members (note that credit unions are membership-based) with about 90 employees. Asset holdings are approximately 300 million dollars. FBFCU has provided projects of significant interest with excellent industrial engineering potential. The chief executive officer of FBFCU has been an active participant in the projects–another significant benefit for our students. An executive-level focus on a project adds a new dimension in communications for students.

Approach

Three courses in our industrial engineering curriculum primarily provide the opportunities to interact with FBFCU. Two are senior-level required courses, one is a graduate industrial engineering elective. The first, IE 467 Simulation, (open to both undergraduate and graduate students) has a semester-long project requirement as part of student work. This project can be an individual or group project. IE 480, Production Systems Synthesis, is our capstone design class. The primary student product is a team project conducted in teams of 3-5 industrial engineering seniors. Last, IE 522, Queuing Systems, is a graduate elective.

A simulation modeling project is often a student's first opportunity to do consulting-style work. Such a project requires the student or student group to first select a potential project by working with the client. Clients may be found by the student or the professor but all project interaction is by the student. To do such a project, the student meets with the client and develops a systems analysis of the opportunity under study. Students gain experience in areas such as developing interview questions, observation, process flows, client contact, writing specifications, and then building a simulation model. The model is tested and its output is assessed for resource utilization, sensitivity, constraints, and usability. A report and presentation are then created and given to the class and to the client.

A number of different simulation projects have been undertaken in the simulation class for Fort Bliss. Each project focused on different client objectives. In most service systems, performance metrics such as customer time in the system, time in line, efficiency of facility or process flows, and system utilization are closely monitored as measures of competitive advantage and customer satisfaction. As an industrial engineering tool, simulation is ideally suited to model a system's performance metrics and provide the basis for systems improvement.

Projects undertaken in the simulation class have involved areas such as call center optimization, evaluation of the construction of drive-through ATMs, reengineering of loan processing flows, optimization of staffing plans, facility redesign, and evaluation of new parking lot construction layouts. In each of these projects, students worked with management and staff on-site at one of the credit union's locations collecting extensive data that documented the various "as-is" systems. After creating simulation models of the as-is system, improvements, and design changes were incorporated into the models for the purpose of optimizing credit union operations. In all cases, system improvements identified by the students were incorporated into Fort Bliss's strategic and operational planning.

In addition to the technical skills we expect of all industrial engineers, a number of "soft" skills were integral to achieving simulation project success. Since the creation of valid simulation models involve the highest degree of human interaction by the student with all workers in a system, exceptional communication skills in writing, and presenting to audiences with very different backgrounds and levels of technical ability are essential. In addition, the ability to understand and incorporate the business side of operations in system redesign is critical in today's competitive marketplace. Last, the integrative, multi-disciplinary aspect of most service organizations requires that a student have the critical thinking skills to synthesize and use information from many different functional areas.

Another opportunity for industrial engineering students is the senior capstone design class (IE 480 Production Systems Synthesis), informally known as the senior design course. At NMSU, this class is conducted as a team design project. This course is considered to be the final industrial engineering course in the students undergraduate program. Thus, students are expected to have completed courses such as simulation, production planning, quality, linear programming, engineering economy, etc. Students are assigned to teams based on their particular interests, backgrounds, and interaction styles. Projects are

selected by the instructor on their interdisciplinary focus and level of detail requirements. In the past, projects have been conducted primarily with manufacturing firms in New Mexico, west Texas, and Cd. Juarez, Mexico. Typical projects include new product introduction, facilities design, process management, and systems design. In some cases, the projects require one or more bilingual (English, Spanish) students. This project-based course provides an opportunity for students to integrate their knowledge, skills, and experiences in a group project that serves a real customer. The projects are conducted with faculty and customer supervision. FBFCU executives were active participants in this project. This was an added advantage as well as responsibility for our students—they were not just working with an area industrial engineer or supervisor as they would in many other projects. They were working directly with the decision makers.

In the Spring semester of 1999, our first capstone design project with FBFCU was undertaken by a team of three students. This project studied the credit union's plans to move members from traditional customer-teller interactions to automated customer services. Financial institutions have been moving to services such as Internet-based banking and automated phone banking systems for some years. As FBFCU had a business plan that focused on expansion of such services, an industrial engineering study that focused on use potential and then studied impacts on the existing branch office structure could offer significant value. FBFCU would then be better able to allocate its resources to meet their business plan. For example, questions of how to staff the branches, how to redesign customer flow in the branches, and what new services might be offered were evaluated by FBFCU management.

This project required the student team to stretch their education in new ways. First, they designed a credit union member survey to be conducted over the telephone. Their purpose was to evaluate FBFCU members on their interests in automated banking and whether FBFCU would meet its goal of member satisfaction. Industrial engineering students take courses in statistics and quality which helped these students in survey design, a new task they had not encountered in their course work. Another aspect of this study was an analysis of member flow through the branch offices. A simulation was designed and written in ProModel based on data collection and analysis. Through interviewing FBFCU executives and employees, and evaluating their survey data, the students developed several operating scenarios of automated and traditional banking—again, a stretch of their education and experience. They then created a set of management recommendations based on their evaluation of the operating scenarios. Their recommendations were presented to FBFCU in both report and presentation form. Our students provided recommendations that include the unique focus of an industrial engineer—integration of systems of people, materials, software, equipment. The FBFCU executives were extremely satisfied with their study and were looking forward to future studies. One important result was that FBFCU was going to consider the creation of an industrial engineering co-op position.

Conclusions

Working with financial institutions such as FBFCU can be extremely valuable and interesting for industrial engineering students. They have an opportunity to employ their knowledge, skills and abilities in a unique environment not traditionally covered in industrial engineering curriculum. We have learned that students may have to stretch their education to new areas such as marketing and product design for conceptual rather than physical products, e.g., Internet banking. Most important is that students must research, analyze, design, and present in a non-technical environment. Students must work with customers, employees, and executives who do not share their engineering-based view of the world. They must gain acceptance of their design ideas not just through technical superiority but through financial analysis, market-based research, and communications skills. In the world of ABET 2000, this is especially exciting!

Industrial engineering students appreciate the opportunity to develop their professional abilities in settings outside of manufacturing. They quickly learn that their world view applies in any business operation creating benefits for that business through better use of its limited resources. Their learning leads to learning by other students as they communicate results through formal class presentations and informal communications. Our program benefits through new opportunities as our students extend their abilities and enthusiasm on new projects.