Education for Production and Operations Management

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The Department of Mechanical Engineering Enterprise Management at the Faculty of Mechanical Engineering of the Czech Technical University in Prague has its own doctoral programme, and runs postgraduate and master's courses. The Department is engaged in a great deal of research in the field of marketing, financial and mainly operations management. A new Production and Operations Management programme was started in 1997. The programme consists of: Management of Change and the Importance of Innovations, Forecasting and Operations Strategy, Design of Work Systems, Total Quality Management and Inventory Control, Material Requirements Planning and Just-In-Time Systems, Logistics and Practical exercises. The study programme is organised in two stages, winter and summer semesters. The study programme has a strong international orientation. The teaching goal is to prepare students for dealing with real-world settings and implementing the most effective up-to-date practices. The Department aspires to lead in research, and in developing modern concepts and tools. Research is being conducted in the mechanical engineering industry under a grant from the EU LEONARDO programme. We invite you to email with questions or to schedule a visit to the Department at any time.

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1 Introduction

The Department of Management at the Faculty of Mechanical Engineering of the Czech Technical University in Prague was set up in 1960, following the University Reform Act, bringing together various groups within the university that had previously worked separately.

The Department is headed by Professor Karel Macík, and has a staff of some 20 lecturers. It has its own doctoral programme, and runs postgraduate and master's courses. The Department is engaged in a great deal of research, mainly in the field of marketing, financial and operations management. It offers a general study programme in Economics and Management in Mechanical Engineering, as well as a special programme in Production and Operations Management.

In 1994 I successfully completed a four-week instructors training course at Saint Mary's University in Halifax, sponsored by the Government of Canada. My present post is as a lecturer in Production and Operations Management.

The new programme in Production and Operations Management was started in 1997, and is linked to research work and technology transfer within the Department. The programme comprises courses in: Management of Change and the Importance of Innovations, Forecasting and Operations Strategy, Design of Work Systems, Total Quality Management and Inventory Control, Material Requirements Planning and Just-In-Time Systems, Logistics and Practical exercises.

The programme is organised in two stages, in the winter and summer semesters. The courses taught in each semester are compulsory for all students of the Department, and provide a wide overview of the subject.

The programme has a strong international orientation. The participation of students from a wide range of countries provides an opportunity to exchange ideas and experiences, and enriches the intellectual and social life of the Department. European exchange programmes add further diversity to our student community, as visiting students study in Prague and Czech students have the opportunity to study at overseas universities. I have a internationally ranked program of research, teaching and corporate contacts in operations management. This programme brings together theory and practice in a broad overview of operations management (OM), dealing with the production process, interactions with other business functions, and also business strategy.

Production and Operations Management (POM) is the study of order, structure and relationship. It is a powerful tool for solving practical problems, and a highly creative field of study, combining logic and precision with intuition and imagination.

An understanding of Production and Operations Management is extremely valuable in today's technologically oriented workplace. A very wide range of employment opportunities are available to students who can handle operational concepts. Employers in Czech business and industry like to hire students and graduates with a background in this type of management, because they are able to think and reason critically, logically and analytically.

My teaching goal is to prepare students for dealing with real-world settings and for implementing the most effective up-to-date practices in the area of operations management. As part of this effort, students are required to participate in a field project. I aim to integrate the latest theoretical findings and problem solving tools into coursework. I engage in active course development which leverages on the joint professional, teaching and research experience of the Department.

At our Department we aspire to lead in research, and in developing modern concepts and tools that aid executives. We are particularly interested in management activities involving: Designing and Operating Production Systems, Strategy Decisions for Operations, Forecasting and Decision Making Process, Value Analysis, Process Selection and Capacity Planning, Layout of Facilities, Design of Work Systems, Modern Quality Management, Manufacturing Planning and Control, Aggregate Planning, Master Scheduling, Inventory

Management, Material Requirements Planning, Just-In-Time Systems, Materials Management and Purchasing, Logistics and Computer Integrated Manufacturing.

Students are required to gain 10 credits during a year of Productcion and Operations Management study. My key benchmark in assessing the success of the programme is its impact on management practice.

Increasing importance has been attached in recent years to various aspects of education as the complex of systematic facts and knowledge gained either through formal education (learning) at universities and institutes of education or through informal training at one's place of work. Qualitative changes and ongoing trends of development in education are closely connected with scientific and technical progress, or – expressed more dramatically – with the scientific and technical revolution. This holds true especially for such a complicated phenomenon as the achievement of operations management of products and services to meet the needs of the customer-consumer.

Scientific and technical innovation forms the framework within which this shift in the importance of operations management for economic and social life is taking place. One cannot complain that questions of education and training in this particular field have been neglected. On the contrary, proof of the interest in them is provided by this article, the main theme of which is education and training.

As a professional teacher, I am often faced with the difficult problem of deciding what to include in my lectures for future mechanical engineers, who will be engaged in the design, technology and management of production in engineering plants, so that they will have the best preparation for their jobs from the point of view of production and operations management. This is not only a completely new discipline for them, but also a new approach to their jobs. We can no longer make do with only industrial statistics and operational research, both of which are, of course, essential tools in the new concept.

To be an effective teacher, one must not only know WHAT to teach, but also HOW to teach it. My teaching process has several steps, and along the way there are several questions I should ask myself as teacher.

- What am I going to teach (Curriculum)
- How am I going to teach it (Lesson Planning)
- How will I know when I've taught it (Assessment)
- How can I teach it better next time (Reflection)

If one does not ask the third question, there is no way to know if the teaching is truly effective. Asking the fourth question is the key to staying current, fresh, and enthusiastic about teaching. For this reason the students not only do formal coursework, but also participate in a series of management development seminars, which provide an overview of Czech business concepts and practices. Business and industry field trips, seminars with Czech executives, and other special activities provide a further dimension to the programme. The course is intended to be intensive, flexible, and adapted to individual needs. Competency is assessed by comprehensive written and oral examinations. The final programme requirement is the successful oral presentation and defence of a thesis.

Engineering is a very large profession. Many people are employed in this country as engineers, and the field will continue to expand as long as there are technical problems to solve. My students are trained to be problem-solvers who invent new products and make things work better, more efficiently, more quickly and less expensively. They will turn ideas into products and services. Engineering graduates have excellent prospects for finding employment in private industry, government, or academia.

We welcome students from around the world. I have a growing number of international students joining my classes taught in English language.

2 Principles and practices of modern manufacturing

Modern manufacturing is a total business philosophy built on four major principles: value analysis, flow, just-in-time, and perfection. Students learn how integrated application of these principles can raise a company's performance – in terms of value delivery to customers, total cost of production, product quality, lead times, inventory turnaround, production flexibility, floor space needs, in-house technology development, labour utilization, safety, and employee satisfaction – to world class levels.

I attempt to cover lean philosophy in depth, along with the key supporting tools and practices for successful implementation. These concepts and their application are studied through hands-on demonstrations, real world case studies, and numerous exercises. Students learn to:

- Identify waste in an existing operation and develop countermeasures to eliminate it.
- Articulate the shortcomings of traditional manufacturing thinking, and express the ways in which lean thinking overcomes them.
- Develop a production improvement strategy for an existing operation.
- Establish visibility, efficiency, and control through effective "5S" (which refers to the five words that encapsulate the principles for maintaining an effective, efficient workplace) and visual management systems.
- Make real progress towards zero defects by enhancing the quality systems with lean tools, such as poke yoke and self/successor inspection.

3 Lean operations management

Operations management has seen a revolution in recent years, becoming a topic of critical importance in business today. Demands for quality, time-based competition, and international production have demonstrated that superior management of the operations function is vital to the survival of a firm. Success in any venture requires the ability to identify what potential customers need, then to produce the products or services that satisfy this need better, faster, and cheaper than their competitors. Students concentrate on the critical operational functions that allow an organization to do just that. They explore the roots of the Toyota Production System, learning leadership, design management, quality management, and workplace management principles.

Through a progressive series of class discussions and hands-on practical applications, students will develop problem solving strategies aimed at continuously improving their business systems. Students learn:

- How to apply the principles and practices required to effectively operate a lean system.
- The basic concepts of operations management and lean manufacturing (customer focus, process orientation vs. results orientation, value, value stream, flow, pull, and perfection, systems thinking).
- To focus on improving people as the most important resource in any continuous improvement plan.

4 Organizational learning for lean manufacturing

The core issues of transforming existing organizations into lean enterprises focus on learning and continuous improvement. Presentation segments provide an overview of important concepts and practices of organizational learning, based on a comparison of craft, mass production, and lean work design principles. Students discover how all work is embedded in and managed through meaningful communication. This is followed by a closer investigation of the role of organizational change and personal change agency, leading up to a design strategy for the learning organization. A description of specific knowledge management tools for the lean enterprise, such as models and scenarios, and of the necessary policy and network support, concludes the programme.

Students learn to:

- Appreciate and develop the creative potential in all workers.
- Better understand the role of knowledge and learning in their work environment.
- Target education needs more specifically.
- Improve motivation by developing a new sense of work ownership.

5 Management for a lean system

Improvement of the process – from the factory floor to the offices and throughout an enterprise – is critical to the success of lean implementation. I guide discussions on how to perform job instruction training, facilitate problem solving using teams, involve suppliers and customers, and manage cost parameters based on processes. In a discovery workshop, students will establish teams to develop management solutions to tackle actual situations. Through a series of self-guided exercises, the teams will learn how to use several effective problem-solving techniques, including kaizen methods. Students learn to:

- Assess the current state of a factory and develop an overall lean implementation plan, identifying key supporting kaizen activities.
- Define product families and machine groups as a basis for implementing work cells and focused factories to achieve flow.
- Design group technology work cells including lot sizing, equipment layout, workstation design, and work-design strategies to achieve high labour utilization.
- Train team members and leaders in job instruction methods to develop multifunction workers for all process operations.
- Build effective Employee Involvement Teams (Kaizen Teams, Quality Control Circles, work teams).
- Develop creative problem-solving techniques.
- Involve suppliers and customers in continuous improvement activities (supply chain management).
- Manage the financial aspects of a lean enterprise (target costing, kaizen costing, building a cost management system).

This course aims to expand students' understanding of the lean enterprise. It demonstrates the need for a profound transformation of the organization according to lean principles, and argues against an implementation approach focusing on tools alone. Such a transformation requires a deep understanding of the human system, of culture, and of leadership strategies and behaviours. Both the corporate and the operational level of the enterprise are reviewed from this perspective.

The course concludes with a two-hour, applied transformation strategy exercise in which teams develop specific blueprints for their lean future.

I have more than 20 years of experience in university education. My current research takes a broad look at speed and flexibility in manufacturing and logistic systems. More specifically, how these systems develop the attributes necessary to respond quickly and efficiently, to changing customer demand. This research is conducted primarily in the mechanical engineering industry under a grant from the EU LEONARDO programme.

In particular, much of my work focuses on the interface between manufacturing and retail organizations. I am a member of the Czech Association for Mechanical Engineers. Prior to embarking on an academic career, I spent five years in various managerial positions in Czech companies.

One of today's realities is that knowledge is a continually moving target. What was considered current as recently as five years ago is now, in many disciplines, considered to be hopelessly out-of-date. Whether a student is considering enrolling for an undergraduate or a graduate level certificate or diploma programme, or for a professional development course, he or she can be sure that whatever we offer will be consistent with what is happening in today's market place.

At the Department of Management at the Faculty of Mechanical Engineering of the Czech Technical University, we are constantly updating our courses and programmes to reflect not just today's reality, but also, as best we can anticipate it, the reality of the decade ahead. One example is the new diploma programmes in the rapidly evolving field of Production and Operation Management. We are also working hard to ensure that our physical facilities will enhance students' learning experience. Our computer laboratories have been upgraded and expanded to provide state-of-the art equipment that reflects the real world in which students will be working.

Designed for those who wish to pursue an interest or develop a new understanding, courses are also offered in English language.

Every year, more than eighty students at the Department study economics and management at Bachelor's, Master's and Doctoral levels. The Department offers tuition and training comparable to well-known academic institutions abroad, and occupies a leading position among all schools of its kind in the Czech Republic. The academic staff includes numerous personalities who are at the top of their fields, both as teachers and as researchers, a number of whom have been recognized abroad for their scholastic achievement. The Department maintains an ongoing relationship with state and other public sector institutions, as well as important contacts with the business community. This strategy will continue to pay dividends in strengthening our position as a desirable partner for foreign institutions.

In principle we distinguish between two basic forms of education and training. The first concerns formal education for those who are still preparing themselves for a certain profession and gaining qualifications for it. The aim of this type of education is not just to acquire new knowledge, but above all to learn how to think. The second form provides employees already working in organisations and enterprises with new knowledge and skills through training at work or externally. This can be achieved in several ways; for instance, ongoing contact of the employee with his surroundings and problems at work, with his supervisors, by individual study, or by training offered by the employer, including sending the employee for a post-graduate study programme at an institution of higher education.

From the point of view of an enterprise, the training of employees may be considered as an internal form of education. An external form of education, on the other hand, involves the training of people who are not employees of the firm but are important to it as the producer of products or services.

Operations activities such as forecasting, choosing a location for an office or plant, allocating resources, designing products and services, scheduling activities, and assuring quality are core activities of most business organizations. Very often, most of the employees and assets of an organization are controlled by the production/operations function.

Historically, production and operations management techniques developed in manufacturing organizations. However, as time went on, it became more and more apparent that nonmanufacturing organizations have to contend with problems similar to those encountered in manufacturing settings. Consequently, the scope of production and operations management has been expanded to cover both manufacturing and service organizations. Moreover, many of the techniques can be directly applied to both areas without modification.

I have always found operations management to be the most relevant and enjoyable part of my own business studies. It deals with the fundamental essence of a firm, how its products are made, and how its services are delivered to customers. It involves everything from strategic concerns such as aggregate planning, plant location, and service capacity expansion, to tactical issues such as daily order scheduling, statistical quality control, and inventory control. Studying such a broad range of topics helps a student achieve a balance between skilful use of necessary analytical tools and an understanding of the underlying conceptual issues.

Production and Operations Management lies at the heart of the great changes sweeping through today's business environment. The competitive pressures for higher quality, quicker response time, superior service, and total customisation can only be met through more intelligently run business operations. Even the recent enthusiasm for corporate re-engineering is fundamentally about better management of operations.

I invite you to email me at any time with questions, or to schedule a visit to the Department of Management at the Faculty of Mechanical Engineering of the Czech Technical University in Prague.

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