Abstract

The development of Thailand’s economy in the past decades was mainly induced by the rapid growth of the nation’s manufacturing sector. In order to sustain the advantage of such expansion, a sufficient number of skilled personnel in manufacturing-related fields is needed. The higher education system in Thailand is currently playing a key role in preparing such human resources for manufacturing. This paper attempts to present an overview of the status and the recent developments in university-level manufacturing-related education in Thailand. Features of the higher education system and the examples of the manufacturing-related courses from various educational institutes are presented. Concluding remarks and recommendations for preparations to make advances in the 21st century are also provided.

I. Introduction

Over the past decades Thailand has consistently been among the five fastest growing countries in the world.[1] The main factor behind this growth is the balanced development of the agricultural, service, and manufacturing sectors. Within these fields, the manufacturing sector plays an important role in the economy. During the 1990’s a double digit growth (11.8-13.9%) has been recorded.[2] The manufacturing sector’s share of the Gross Domestic Product (GDP) has increased steadily from 13% in 1960 to 26% in 1990. During the same period the agricultural share of the GDP has dropped from 40% to just over 12%.[3]

In order to support the rapidly expanding manufacturing sector, there is considerable need for skilled personnel in the manufacturing field. During the mid 1980’s to the early 1990’s, Thailand has experienced a scarcity of technical personnel at all employment levels. The situation compelled the government to relax the employment regulations governing non-Thai engineers, scientists, and technicians and to establish a long term plan of developing native human resources in the fields of science and technology through the expansion of the university system.[2] Engineering Departments, for example, were established in existing medical and social science universities such as Mahidol University and Thammasat University. Moreover, a number of privately owned universities were established, and most of them offer the engineering degrees in various disciplines. As a result, the overall enrollment capacity in engineering programs has been increased almost 45% since 1987.[4]
In addition to the rising number of engineering students, another important factor is the education and training program. Since manufacturing education is multi-disciplinary in nature, the selection of courses in the curriculum is very critical to the skill-level of the graduate. Although in Thailand there is no engineering program devoted solely to manufacturing, at present, a number of courses in manufacturing are offered through the Departments of Industrial Engineering or Production Engineering in various universities.

II. The Higher Education System in Thailand

Table 1 shows an overview of the education system in Thailand and a comparison to that of the United States. Basically, the education system in Thailand consists of four levels: six years of primary school, three years of lower secondary school, three years of the upper secondary school, and four years of university level. However, students who have completed lower secondary education can elect either to continue their study in the upper secondary level or to enroll in vocational or technical colleges.

Generally, the higher education system in Thailand is quite similar to that of the United States. However, in Thailand, the upper secondary school graduates who wish to continue their study at the university level usually take a competitive national entrance examination to qualify for placement in the program of their choice. The entrance examination, held annually by the University Entrance Examination board, which is part of the Ministry of the University Affairs, is required in most of the state-owned and in some of the privately-owned institutes. The entrance examination for prospective engineering students consists of five main subjects: Mathematics, Physics, Chemistry, English, and Social Sciences. An engineering aptitude test is also required, but has little effect on the overall score.

Once the students have passed the entrance examination, and are admitted to an engineering program; they are all required to take general education, basic science and engineering courses during their freshmen year. Students decide which field of engineering they would like to pursue (i.e. Civil, Industrial, etc.) and declare a major at the end of the second semester. This process may vary somewhat from institution to institution, but most Thai educational institutions follow the general above-mentioned guidelines.

III. Manufacturing-Related Education Programs in Thailand

Table 2 shows the list of the university-level institutions in Thailand that offer a degree in a manufacturing-related area. Most of the programs are offered through the Departments of Industrial Engineering or Production Engineering. Undergraduate students who have a strong interest in manufacturing may enter to these departments after they have completed their academic requirements as first-year students. Students take compulsory engineering departments' core courses during their sophomore year. Practical training is also compulsory in most engineering programs. Students may register for a practical training course during the summer semester. Manufacturing electives may be selected during a student's junior and senior years. However, it must be noted that in most universities one or more basic manufacturing courses is included in freshmen engineering curricula as compulsory courses.
in order to give students a general idea of manufacturing systems regardless of what field of engineering they plan to pursue. Table 3 presents the manufacturing courses offered by various universities.

Graduate programs are limited to the Master's level. At the present time, there are no educational institutions which offer Ph.D. level programs in Industrial or Production Engineering. Graduate students may take courses in manufacturing, and elect manufacturing engineering as individual research topics.

IV. Concluding Remarks

As mentioned earlier, the manufacturing sector has contributed very much in transforming Thailand's economy. It is important not only to maintain the benefits from the manufacturing sector, but also to seek an opportunity to become more competitive in the global market. One of the important mechanisms that helps to drive the nation forward is the development of human resources in the field of science and technology. There is no doubt that the university system must play a key role in developing quality personnel through well-designed curricula.

Since manufacturing engineers are expected to deal with the practical engineering problems that occur in various manufacturing activities, they should be prepared to have multi-disciplinary skills, including technical, analytical, and managerial abilities. In the near future, the establishment of an engineering program dedicated mainly to manufacturing is necessary. In such a program lecture and laboratory hours should be appropriately integrated. The student should be given a broad knowledge in manufacturing technology, as well as in management, computer, industrial ecology, human relations, economics, etc. Also, a practical training with the cooperation from industry would provide students with work experience in a real manufacturing environment.

Another important consideration is the development of indigenous technological capabilities. The country's resources should be amplified, since the main force behind the expansion of manufacturing in Thailand is the huge investment of foreign manufacturing facilities. However, Thailand cannot rely solely on foreign investments. Manufacturing engineers should be able to absorb, and make further use of this transferred technology. Courses in foreign languages, especially English, should be given regularly. Moreover, engineering programs should not only prepare skilled students to fulfill market requirements, but also encourage entrepreneurial thinking qualities in all engineering students. With these improvements in manufacturing engineering education, Thailand will rapidly advance among the newly industrialized countries in the region.

V. Bibliography


VI. Biography

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YILDIRIM OMURTAG is a Professor and Chairman of Engineering Management Department, University of Missouri-Rolla.

<table>
<thead>
<tr>
<th>AGE</th>
<th>Thailand</th>
<th>United States</th>
</tr>
</thead>
<tbody>
<tr>
<td>22 and up</td>
<td>Graduate Study</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>University Level</td>
<td>Senior</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>Junior</td>
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<tr>
<td>19</td>
<td></td>
<td>Sophomore</td>
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<tr>
<td>18</td>
<td></td>
<td>Freshmen</td>
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<td>17</td>
<td>Upper Secondary Level</td>
<td>M6</td>
</tr>
<tr>
<td>16</td>
<td></td>
<td>M5</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>M4</td>
</tr>
<tr>
<td>14</td>
<td>Lower Secondary Level</td>
<td>M3</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>M2</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>M1</td>
</tr>
<tr>
<td>11 and below</td>
<td>Primary Level</td>
<td>Elementary/Middle School</td>
</tr>
</tbody>
</table>

Table 1. A comparison of general education system between Thailand and the United States
<table>
<thead>
<tr>
<th>Institution</th>
<th>Type</th>
<th>Dept.</th>
<th>Degree Offered</th>
<th>Institutions</th>
<th>Type</th>
<th>Dept.</th>
<th>Degree Offered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chulalongkorn University</td>
<td>S</td>
<td>IE</td>
<td>B,M</td>
<td>Kasetsart University</td>
<td>S</td>
<td>IE</td>
<td>B,M</td>
</tr>
<tr>
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<td>S</td>
<td>IE</td>
<td>B</td>
<td>Chiang Mai University</td>
<td>S</td>
<td>IE</td>
<td>B</td>
</tr>
<tr>
<td>Thammasat University</td>
<td>S</td>
<td>IE</td>
<td>B</td>
<td>Mahidol University</td>
<td>S</td>
<td>IE</td>
<td>B</td>
</tr>
<tr>
<td>Prince of Songkla University</td>
<td>S</td>
<td>IE</td>
<td>B</td>
<td>Nareasuan University</td>
<td>S</td>
<td>IE</td>
<td>B</td>
</tr>
<tr>
<td>King Mongkut’s Institute of Technology</td>
<td></td>
<td></td>
<td></td>
<td>Suranaree University of Technology</td>
<td>S</td>
<td>IT</td>
<td>B</td>
</tr>
<tr>
<td>- North Bangkok Campus</td>
<td>S</td>
<td>PE</td>
<td>B,M</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Thonburi Campus</td>
<td>S</td>
<td>PE</td>
<td>B</td>
<td></td>
<td></td>
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<td>IE</td>
<td>B</td>
<td>Valailuk University</td>
<td>S</td>
<td>IT</td>
<td>B</td>
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<td>IE</td>
<td>B</td>
<td>Rungsit University</td>
<td>P</td>
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<td>B</td>
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<tr>
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<td>B,M</td>
<td>Vongchawalitkul University</td>
<td>P</td>
<td>IE</td>
<td>B</td>
</tr>
<tr>
<td>Rajatani Technology College</td>
<td>P</td>
<td>IE</td>
<td>B</td>
<td>St. John College.</td>
<td>P</td>
<td>IE</td>
<td>B</td>
</tr>
</tbody>
</table>

Notes:
S : State-Owned  B : Bachelor’s degree  IE: Industrial Engineering  PE: Production Engineering

Table 2. University-level institutions offering the degrees in manufacturing related area
<table>
<thead>
<tr>
<th>Institution</th>
<th>Courses in Manufacturing Related Area</th>
</tr>
</thead>
</table>
| Chulalongkorn University | - Industrial Plant Operation  
- Packaging and Packaging Materials  
- Maintenance Management  
- Welding Technology  
- Physical Properties Development of Engineering Metals  
- Value Engineering  
- Tool Engineering  
- Automation  
- Foundry Technology |
| Kasetsart University | - Manufacturing Processes  
- Industrial Technology  
- Tool Engineering  
- Industrial Pollution  
- Simulation  
- Maintenance Engineering  
- System Engineering  
- Production Planning and Control  
- Industrial Management |
| Chiang Mai University | - Welding Engineering  
- Foundry Engineering  
- Productive Maintenance  
- Metal Forming  
- Industrial Production Technology  
- Computer Application in IE  
- Application of Simulation |
| Thammasat University | - Manufacturing Process Technology  
- Computer Aided Manufacturing  
- Tool Engineering  
- System Engineering  
- Computer Simulation  
- Maintenance Management  
- Plant Engineering  
- Principles of Metal Cutting  
- Welding Engineering  
- Automation  
- Industrial Packaging  
- Automatic Control System |
| Mahidol University | - Industrial Packaging  
- Failure Analysis  
- Foundry Technology  
- Tool Engineering  
- Machine Design  
- Welding Technology  
- Automation |
| Prince of Songkla University | - Tool Engineering  
- Rubber Technology  
- Engineering Metallurgy  
- Computer Simulation  
- Machine Design  
- Pollution Control  
- Manufacturing Engineering Lab |
| King Mongkut’s Institute of Technology, Thonburi Campus (Production Engineering) | - Computer Aided Manufacturing  
- NC Programming  
- Computer Simulation in Industry  
- Energy Conservation in Industry  
- Dynamic System and Control  
- Tool Engineering  
- Plant Engineering  
- Flexible Manufacturing Systems  
- Industrial Automation |
| Naresuan University | - Automatic Control Systems  
- Textile Engineering  
- Metallurgy Engineering  
- System Engineering |

Table 3. Courses in manufacturing related areas offered by various institutions