

2006-1842: DEVELOPMENT AND TREND OF CURRICULUM IN INDUSTRIAL DISTRIBUTION

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**DEVELOPMENT AND TREND OF CURRICULUM IN
INDUSTRIAL DISTRIBUTION**

Introduction

Industrial Distribution has been introduced to the academic field of study for decades. The opportunity for graduates in industrial distribution is growing. There are a wide variety of curricula among the industrial distribution programs across the country. This paper describes an evaluation of the industrial distribution program to determine the basic components of a “typical” industrial distribution curriculum. The result focuses on the similarities and differences of the industrial distribution program offered by each university to be a guideline to define the appropriate curriculum for industrial distribution program.

Industrial distribution curriculum at Purdue University has been changed due to industry and market need. The number of credit hours in each core of study in the current year was compared to curriculum in 1994. There are several changes occurred, especially in the distribution and technology areas. Adjustments in curriculum indicate the change and trend of industry.

Current industrial distribution business

Distribution is the important area in the U.S. industry. Industrial distribution is one of the largest and fastest growing industrial segments in the U.S. According to Eastern Michigan University website, more than \$200 billion of industrial supplies are sold to end-users through distributors each year. It is estimated that there are more than 250,000 industrial distribution outlets in the United States employing more than five million people. Currently, industrial distribution is accounted for 4 trillion dollars, which is more than 10 percent of the gross national product. There is the higher need for new graduates each year and the percentage of placement is high as well. With the power of computer and the Internet, the industrial distribution has been changed a lot during the last 10 years and it has the potential to be more

Frada (1996) concluded that the growth of industrial distribution in the last few years has created more jobs and the need for more highly educated employees. Industry experts contend that many college graduates could have successful careers in industrial distribution if they were only more familiar with it.

Industrial distribution has changed from time to time. Anonymous (1998) suggested that distribution is in the process of redefining itself. The Internet may be the largest single contributor to change in the industry and may manage to eliminate costs from the supply chain. Distribution today and in the future was also stated.

What is industrial distribution?

According to the industrial distribution program description from Envick and Envick (1996), industrial distribution program “...combines the study of engineering technology with business administration, and is designed to meet the demands for technically skilled men and women who are equally adept with personal communications and business skills...”

Industrial distribution is a field of study about moving raw materials and products from the supplier along the supply chain to end customer. It involves several activities in supply chain

such as sales, inventory management, purchasing, warehousing, and transportation by applying mathematics, sciences, engineering, technology, and business knowledge to achieve the most productive distribution of product.

Industrial distribution program in university level

Generally, the industrial distribution program is designed to prepare students with the skills needed to serve the industrial distribution industry. It has been introduced to the academic field of study for decades. It is taught at the university level in both technology and business-oriented programs such as School of Business, School of Engineering, and School of Technology.

Envick and Envick (1996) suggested that industrial distribution programs administered by engineering or technology department offer a balanced engineering/technology/business program of study, while programs offered by business department focus on logistics and transportation as well as marketing and operations. They also mentioned that industrial distribution program was initiated from identifiable forces and events in the history of American business and engineering education. Clarkson University and Texas A&M University were the first two universities that founded their industrial distribution program in 1954 and 1956 respectively.

Further than the general education core and basic mathematics and sciences core, curriculum in industrial distribution provides students with a combination of courses in industrial technology, distribution, and business, which are important in the distribution area. Courses in technology core include general technology disciplines such as material science, computer graphics, manufacturing processes, and automatic identification and data capture. Courses in distribution core include distribution, logistics, and supply chain disciplines such as industrial organizations, marketing, industrial sales and sales management, warehouse and inventory control, global transportation and logistics management and supply chain management. Courses in business core include business and management disciplines such as accounting and finance, and human resource management.

Taj, Hormozi, and Mitshab (1996) suggested that operation management and industrial distribution management programs should consist of well-rounded core offerings and that coordination and collaboration between degree-offering universities and industries in general are beneficial. Moreover, the electives should be tailored for such concentrations as those used to rank the courses

Internship is required by some universities. A study, King (1994), shows that the majority of program directors either requires or strongly recommends that their industrial distribution students take part in some type of internship program regardless of curriculum focus.

The placement for graduates from Industrial Distribution program is varied from industrial sales engineer, purchasing agent, logistic analyst, warehouse manager, cost designer, operation management assistant and assistant manager of supply chain/distribution operation. Since 1999, rate of industrial distribution graduate placement at Purdue University is more than 95 percent. Examples of major employers are distributors, manufacturers, warehouses, logistics carriers, and consulting firms.

A study by Frada (1998) suggested that the majority of the industrial distribution graduates are satisfied with their careers in either distribution or manufacturing. Many of the graduates credit the university and their ID degree for much of that satisfaction. An industrial distribution degree prepares students for various careers in the industrial channel, and the curriculum is usually made up of business and engineering courses.

We can see that graduate from industrial distribution program is needed for industry. Many universities offer these kinds of program to support the market need. Opportunities for graduates in industrial distribution area are growing. There are a wide variety of curricula existing among the various industrial distribution programs across the country, and there is currently much confusion about what an industrial distribution curriculum should look like. There is a need to better define appropriate curriculum for industrial distribution programs in order to provide technologists with a better understanding of this field of study

There are some other fields of study that are closely related to industrial distribution such as supply chain management and logistics management. Simchi-Levi, Kaminsky, and Simchi-Levi (2004) defined supply chain management as a set of approaches used to efficiently integrate suppliers, manufacturers, warehouses, and stores so that merchandise is produced and distributed at the right quantities, to the right locations, and at the right time in order to minimize systemwide costs while satisfying service-level requirement. Supply chain considers the whole chain from suppliers, manufacturers, warehouses, distributors, retailers, stores, to customers, included suppliers of a supplier, and customers of a customer. The objective of supply chain is to minimize the entire system costs while satisfying customers such as inventory cost (raw materials and finished products) and transportation cost (internal and external). Therefore, industrial distribution is a subset of supply chain.

Logistics management mainly considers the flow in supply chain from suppliers to end-customers. This flow consists of raw materials, inventories, and finished products. Several activities are involved with logistics such as transportation, shipping, purchasing, warehousing, packaging, and material handling. In terms of education, logistics management program is similar to industrial distribution. However, program in logistics is mostly offered by the school of management. It is more focus on the business perspective. On the other hand, industrial distribution program is directed to the technology point of view. It concentrates on the mathematics and technology than logistics program. The example of logistics program is at Michigan State University, which under the Broad College of Business. Many logistics, however, are offered in the school of engineering.

Objectives

The purpose of this paper is to increase awareness in the industry and technology community about what industrial distribution programs seek to provide for their graduates, and, in particular, what distribution curriculums are emerging in Industrial Distribution program. Another important issue is to point out that the curriculum has been changed from time to time due to the market change. Universities need to be conscious of this change.

Since, in these days, there are several collaborations between university and industry. The relationship between company and university is higher. For example, a company can ask faculty and students to do researched or conduct experiments. Faculty may initiate the training or workshop at the company. Students have a chance to take a field trip at the company. Generally, the board of committee consists of people from various industries. In this case, people from industry have worked closely with the faculty about the current market situation and trend in industry. They may exchange their perspectives and experiences to update information on both academic and industry. This study is served as another source of information.

This paper presents results and analysis from a research on the current curriculum of industrial distribution program from several universities, and what the current market job is. A feedback from industry is an important indicator to the trend of industrial distribution curriculum. Furthermore, to verify the adaptation of curriculum to the market need, an example of a change in industrial distribution curriculum is presented.

Methodology

Though industrial distribution and similar programs are offered in varied department in universities, this study focuses only on industrial distribution in technology. Therefore, the scope of study is narrowed to industrial distribution program in School of Technology or School of Engineering Technology, depended on university.

Industrial Distribution programs within School of Technology or School of Engineering Technology are offered at the below universities

- East Carolina University(College of Technology and Computer Science)
- Eastern Michigan University (School of Technology Studies)
- Minnesota State University at Moorhead (College of Business and Industry)
- Purdue University (College of Technology)
- Southern Polytechnic State University (School of Engineering Technology and Management)
- Texas A&M University (Department of Engineering Technology and Industrial Distribution)
- University of Houston (College of Technology)
- University of Nebraska at Kearny (College of Business and Technology)
- Western Carolina University (School of Technology)

In evaluating the technology-oriented industrial distribution curriculum to determine the basic components of a “typical” industrial distribution curriculum, the common components of curriculum will be identified and calculated the average number of credit hours. Then, mode will be used to establish courses should be included and the number of credit hours. Finally, the component of “typical” industrial distribution curriculum will be established.

Courses included in general education core are related to basic requirement for student in every study area such as English composition, fundamental of speech, communication, and economics. Humanities, fine arts, social sciences, politics, and psychology are also considered as general

education core. Courses included in mathematics and sciences core are mathematics, algebra, calculus, statistics, physics, chemistry, laboratory, and etc.

Courses included in distribution and technology core are courses that are directly related to the industrial distribution career such as purchasing, inventory control, warehouse management, supply chain management, transportation, logistics, process control, and etc. However, several courses are not directly to the distribution but included in this category to make students familiar, get more understand in industrial process such as material, fluid systems, and safety in industry. Some are related to computer and information technology applications such as database management, information system, and computer programming. Internship program is included in this category as well.

Courses included in management core are courses that make students have ability to work in the business environments, not only in industry. Examples of courses in this core are accounting, finance, marketing, and management.

Results

According to the criteria above, the curriculum for industrial distribution program in ten universities can be separated into each category in table 1.

University	General Education	Math and Science	Distr. /Tech	Management (Bus.)	Electives	Total Credit Hours
East Carolina University	33	12	54	15	12	126
Eastern Michigan University	35	10	72	6	0	123
Minnesota State U. at Moorhead	28	14	56	12	13	123
Purdue University	19	18	57	9	18	121
Southern Polytechnic State U.	29	12	81	0	0	122
Texas A&M University	29	22	57	12	8	128
University of Houston	39	12	63	6	3	123
U. of Nebraska at Kearny	39	6	55	18	7	125
Western Carolina University	36	22	36	15	11	120
Average Credit Hours	31.9	14.2	59.0	10.3	8.0	123.4

Table 1. Number of credit hours for each study core of different universities

The typical curriculum of industrial distribution program averaged 123.4 credit hours. Texas A&M University has the most credit hours, equal to 128, while Western Carolina University has the least credit hours, which are 120.

Distribution and technology core has the most credit hours, ranged from 36 at Western Carolina University to 81 at Southern Polytechnic State University. The average number of credit hours is 57.9, which is about 50 percent of total credit hours.

General education core is averagely 32 credit hours, ranged from 19 at Purdue University to 39 at University of Houston and University of Nebraska at Kearny.

Mathematics and Science core is averagely 14.8 credit hours, ranged from 6 at University of Nebraska at Kearny to 11 at Texas A&M University and Southern Polytechnic State University.

Management core is averagely 10.2 credit hours, ranged from 0 at Southern Polytechnic State University to 18 at University of Nebraska at Kearny.

Purdue University has the most credit hours for free and/or technical electives, which can be chosen to any area cores. At the same time, Eastern Michigan and Southern Polytechnic State universities do not have electives in their curriculum. Students need to choose the subject they want to take only within the specific field.

Analysis

Since students need the specific knowledge and skill in their future career, distribution and technology core is the major part of curriculum in every university, ranged from 30-66 percent. Southern Polytechnic State University has the most credit hours in this area. However, management core and free/technical electives are not required. It is because many courses that related to management are taught within Department of Industrial Distribution. Also, no “pure” management courses are included in the curriculum.

Since they are the basic knowledge for further courses, mathematics and science core is important for students to be successful in program. Most university does not require students to take science area, which is generally including Physics in the curriculum. Only University of Nebraska at Kearny and University of Houston do not require students to take Physics or other science course. However, every university has at least one course in Mathematics such as calculus, trigonometry and algebra. For statistics, about half has it from Mathematics or Statistics departments. Some universities count it as the industrial statistics though.

Since working distribution environment has a great chance to deal with people from management such as accounting, marketing, and it is management area is another important area. However, since this study focuses on industrial distribution program in School of Technology, most universities do not concentrate much on this area. Compared to mathematics/science core, only University of Nebraska at Kearny and East Carolina University require it more than mathematics and science.

Only University of Nebraska at Kearny and Minnesota State University at Moorhead accept internship in the required curriculum, which is accounted for 12 and 3 credit hours respectively. Since internship is involved with the experience in the distribution or technology field, it is included in the distribution/technology core.

Purdue University has the most credit hours for electives while the least in general education core. Though the required credit hour for general education is only 19, students have the opportunity to choose the educational course.

Change in plan of study for industrial distribution at Purdue University

Compared the current curriculum (year 2005) of Industrial Distribution program at Purdue University to year 1994, there are many changes occurred, shown in the table below.

Program Cores	1994	2005
General Education	30	19
Math and Science	17	18
Distribution/Technology	52	57
Management	15	9
Electives	9	18
Total Credit Hours	123	121

Table 2. Total number of credit hours for each study core in year 1994 and 2005

Credit hours for general education and management cores have been decreased almost fifty percent. These credit hours appear in the distribution/technical and electives core. It means the need of market has concentrated more on distribution and technology areas. Several courses are no longer required such as political sciences, humanities, business law, or leadership. Some areas are less required such as English and psychology. The curriculum in 1994 needs 6 credit hours each, which is decreased to 3 now. However, students are free to choose to take these subjects as free electives.

For mathematic and science core, chemistry is no longer required. Students can choose to take it or more advanced physics or other science instead. Calculus or statistics are also disappeared but changed to be more specific as Introduction to Statistical Quality. So this is belonging to distribution/technology core.

When considering the distribution and technology core in detail, there are a lot of changes in the curriculum. Several courses have been updated such as Industrial Purchasing is changed to Purchasing, Inventory and Warehouse Management and Quality Control is changed to Introduction to Statistical Quality. More distribution courses have been added such as Industrial Supply Chain Management and Industrial Organization. At the same time, technology courses have been deleted such as Hydraulics and Pneumatics, technical writing, and electronics. The example is Metallic Materials and Non-Metallic Materials are two courses in 1994, which is merged to be Material in 2005.

For management core, it is dramatically decreased in the number of credit hours because several courses have been changed to be more distribution or technology core. For example, Financial Accounting was modified to be Financial Transactions in Distribution. Also, some courses are no longer required such as Business Law and Leadership.

It can be noticed that there are several changes occurred in only 11 years. The curriculum has changed from times to times due to market need. Several courses have been updated to more concentrated on distribution. At the same times, many courses are changed to be electives. These changes are affected by the change of industry trend. The curriculum is discussed and designed by board of committee at Purdue University regularly. One objective of the meeting is to consider the curriculum if it follows and supports the market needs. Since the industry has

changed considerably over the last 10 years. Supply chain management and global business became the significant topic in industry. The requirement for technical area is less as well. Therefore, several courses in supply chain and logistics in global perspective have replaced the technical courses.

Conclusions

Currently, not many universities offer the industry distribution program, especially in terms of technology. There are only about 9 universities in the U.S. that offer it. Among these universities, there are common themes in the curriculum. Main cores consist of general education core, mathematics and science core, distribution and technology core, and management core. Each university has varied combination of the number of credit hours required for each core. Nonetheless, the main focus is at distribution and technology core. Especially when considered in detail, most courses are related to distribution, logistics, and supply chain. It is very important for students to have knowledge and skill in these areas because they are directly involved with the distribution in industry. Some courses in technology are included to make student get more understanding and skill in industry. There are also wide variations in course titles, areas of concentrated study, and use of internships among programs. Finally, the changes in industry have reflected to the curriculum of the program due to the market needs.

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