

# The Technical Skills of Plant Management Required by Junior College Graduates at the Department of Mechanical Engineering in Taiwan

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**Abstract:** The purposes of this paper were to research the technical skills of plant management of the different ranks of the managers, and to understand the status and requirements of the technical skills of plant management of junior college graduates at the department of mechanical engineering in Taiwan. The samples of this study included 140 top-level managers, 140 middle-level managers, 140 first-line managers, and 400 junior college graduates of 120 organizations of manufacturer. The main findings of the study are : (1) Managers require 18 competencies of technical skills. (2) According to the views of first-line managers, college graduates must be enriched in 8 competencies of technical skills through education. (3) According to the views of middle-level managers, college graduates must be enriched in 15 competencies of technical skills through education. (4) According to the views of top-level managers, college graduates must be enriched in 17 competencies of technical skills through education.

**Keywords:** Technical Skill, Plant Management, Mechanical Engineering, Junior College Graduates

## 1. Introduction

Employee training and management development are attempts to improve current or future employee performance by increasing employee's abilities to perform his job [1]. Training and development is important to organizations in Taiwan because they are rapidly incorporating new technology [2]. Many enterprises emphasis educating and training that can enhance workers' technical skills of plant management.

The goals of technical and vocational education are to cultivate the skills of craftsmen for our national construction, economic development, and the development of society. At the same time, the career development of the students educated for technical skill that is also take into consideration [3].

So, it is very positive signification for junior college graduates on career planning and career development to understand the technical skills of plant management. Besides, it is also very important to know that how to increase junior college students' work abilities through education and training.

Therefore, the purposes of this paper were to research the technical skills of plant management of the different ranks of the managers of manufacturers, and to understand the status and requirements of the technical skills of plant management of junior college graduates at the department of mechanical engineering in Taiwan. Based on the findings, the author provided some suggestions to the educational authority, the junior colleges, and the manufacturers about the educating and training of the manpower of the plant management.

## 2. Literature review

Managers usually have three skills: technical skill, human skill, and conceptual skill [4-8]. Based on the review of literatures [9-27], a list of the needed of plant manager's technical skills of the manufacturer was developed as follows : (1) Management theory, (2) Organization, (3) Product design, (4) Forecasting, (5) Plant location choice, (6) Plant layout, (7) Material handling, (8) Motion and time study, (9) Planning and control of production, (10) Material management, (11) Quality control, (12) Equipment maintenance, (13) Cost analysis and handling, (14) Personnel management, (15) Industrial safety and hygiene, (16) Application of computer technology, (17) Statistics analysis, (18) Marketing management.

## 3. Research design

This study collected data by the method of questionnaire surveys. The instruments used in this study were “The Competencies of Plant Management of Junior College Graduates at the Department of Mechanical Engineering.” questionnaires. The samples of this study included 140 top-level managers, 140 middle-level managers, 140 first-line managers, and 400 junior college graduates of 120 organizations of manufacturer. The return of survey questionnaires included 94 top-level managers( 67.1% ), 91 middle-level managers( 65.0% ), 92 first-line managers ( 65.7% ) , and 254 junior college graduates (63.5% ) .

#### 4. The findings of this study

##### 4.1 The technical skills of plant management of managers at manufacturer

The ranking of competencies of technical skills requires for a first-line manager at manufacturer as follow : (1) Quality control (M=4.40), (2) Planning and control of production (M=4.26), (3) Industrial safety and hygiene (M=4.16), (4) Equipment maintenance (M=4.14), (5) Cost analysis and handling (M=4.11), (6) Material management (M=4.05), (7) Motion and time study (M=4.13), (8) Personnel management (M=4.13), (9) Material handling (M=4.00), (10) Plant layout (M=3.95), (11) Application of Computer Technology (M=3.95), (12) Management theory (M=3.92), (13) Organization (M=3.92), (14) Statistics Analysis (M=3.83), (15) Product design (M=3.77), (16) Forecasting (M=3.76), (17) Marketing Management (M=3.69), (18) Plant location choice (M=3.38) (please refer to Table 1).

The ranking of competencies of technical skills requires for a middle-level manager at manufacturer as follow : (1) Quality control (M=4.31), (2) Cost analysis and handling (M=4.29), (3) Planning and control of production (M=4.26), (4) Management theory (M=4.09), (5) Organization (M=4.08), (6) Industrial safety and hygiene (M=4.07), (7) Personnel management (M=4.05), (8) Motion and time study (M=4.03), (9) Material management (M=3.97), (10) Material handling (M=3.95), (11) Statistics Analysis (M=3.93), (12) Equipment maintenance (M=3.91), (13) Application of Computer Technology (M=3.90), (14) Forecasting (M=3.85), (15) Plant layout (M=3.82), (16) Marketing Management (M=3.67), (17) Product design (M=3.66), (18) Plant location choice (M=3.37) (please refer to Table 1).

Table 1.The importance of technical skills of plant management as managers at manufacturer

Competencies	Degree of importance		
	view of first-line managers ( N=92 )	view of middle-level managers ( N=91 )	view of top-level managers ( N=94 )
1.Management theory	3.92 #	4.09 #	4.27 # #
2.Organization	3.92 #	4.08 #	4.34 # #
3.Product design	3.77 #	3.66 #	3.95 #
4.Forecasting	3.76 #	3.85 #	4.34 # #
5.Plant location choice	3.38 #	3.37 #	3.87 #
6.Plant layout	3.95 #	3.82 #	4.01 #
7.Material handling	4.00 #	3.95 #	3.91 #
8.Motion and time study	4.03 #	4.03 #	4.14 #
9.Planning and control of production	4.26 # #	4.26 # #	4.26 # #
10.Material management	4.05 #	3.97 #	3.96 #
11.Quality control	4.40 # #	4.31 # #	4.32 # #
12.Equipment maintenance	4.14 #	3.91 #	3.85 #
13.Cost analysis and handling	4.11 #	4.29 # #	4.38 # #
14.Personnel management	4.03 #	4.05 #	4.20 # #
15.Industrial safety and hygiene	4.16 #	4.07 #	4.13 #
16.Application of Computer Technology	3.95 #	3.90 #	3.96 #
17.Statistics Analysis	3.83 #	3.93 #	3.94 #
18.Marketing Management	3.69 #	3.67 #	4.11 #

# # very important      # important

The ranking of competencies of technical skills requires for a top-level manager at manufacturer as follow : (1) Cost analysis and handling (M=4.38), (2) Organization (M=4.34), (3) Forecasting (M=4.34), (4) Quality control (M=4.32), (5) Management theory (M=4.27), (6) Planning and control of production (M=4.26), (7) Personnel management (M=4.20), (8) Motion and time study (M=4.14), (9) Industrial safety and hygiene (M=4.13), (10) Marketing Management (M=4.11), (11) Plant layout (M=4.01), (12) Material management (M=3.96), (13) Application of Computer Technology (M=3.96), (14) Product design (M=3.95), (15) Statistics Analysis (M=3.94), (16) Material handling (M=3.91), (17) Plant location choice (M=3.87), (18) Equipment maintenance (M=3.85) (please refer to Table 1).

4.2 *The demand of technical skills by junior college graduates at the department of mechanical engineering from the view of first-line managers*

There are differences between the competencies of technical skills of junior college graduates at the department of mechanical engineering and the standards as a first-line manager (please refer to Table 2).

From the view of first-line managers, junior college graduates at the department of mechanical engineering have some good competencies of technical skills (please refer to Table 2). Those are: (1) Product design, (2) Material handling, (3) Motion and time study, (4) Planning and control of production, (5) Quality control, (6) Equipment maintenance, (7) Cost analysis and handling, (8) Personnel management, (9) Industrial safety and hygiene, (10) Application of computer technology.

But, some competencies of technical skills those still need training are: (1) Management theory, (2) Organization, (3) Forecasting, (4) Plant location choice, (5) Plant layout, (6) Material management, (7) Statistics Analysis, (8) Marketing Management.

Table 2. The demand of technical skills by junior college graduate at the department of mechanical engineering from the view of first-line managers (N=92)

Competencies	The demand of technical skills		
	Importance	Ability of college Graduate	t-test
1.Management theory	3.92 #	3.28	5.95 * * *
2.Organization	3.92 #	3.33	5.30 * * *
3.Product design	3.77 #	3.38	3.30 * * *
4.Forecasting	3.76 #	3.20	5.04 * * *
5.Plant location choice	3.38 #	3.14	2.20 *
6.Plant layout	3.95 #	3.29	5.75 * * *
7.Material handling	4.00 #	3.40	5.76 * * *
8.Motion and time study	4.03 #	3.36	6.36 * * *
9.Planning and control of production	4.26 # #	3.37	8.36 * * *
10.Material management	4.05 #	3.32	6.74 * * *
11.Quality control	4.40 # #	3.51	8.84 * * *
12.Equipment maintenance	4.14 #	3.54	5.64 * * *
13.Cost analysis and handling	4.11 #	3.35	7.61 * * *
14.Personnel management	4.03 #	3.37	6.53 * * *
15.Industrial safety and hygiene	4.16 #	3.42	6.87 * * *
16.Application of Computer Technology	3.95 #	3.45	4.54 * * *
17.Statistics Analysis	3.83 #	3.22	5.34 * * *
18.Marketing Management	3.69 #	3.13	4.74 * * *

# # very important      # important      good      average      \* P<.05      \* \* \* P<.001

4.3 *The demand of technical skills by junior college graduates at the department of mechanical engineering from the view of middle-level managers*

There are differences between the competencies of technical skills of junior college graduates at the department of mechanical engineering and the standards as a middle-level manager (please refer to Table 3).

From the view of middle-level managers, junior college graduates at the department of mechanical engineering have a few good competencies of technical skills (please refer to Table 3). Those are : (1) Quality control, (2) Equipment maintenance, (3) Application of computer technology.

But, there are many competencies of technical skills those still need training. The competencies of technical skills are : (1) Management theory, (2) Organization, (3) Product design, (4) Forecasting, (5) Plant location choice, (6) Plant layout, (7) Material handling, (8) Material management, (9) Motion and time study, (10) Planning and control of production, (11) Cost analysis and handling, (12) Personnel management, (13) Industrial safety and hygiene, (14) Statistics Analysis, (15) Marketing Management.

Table 3. The demand of technical skills by junior college graduate at the department of mechanical Engineering from the view of middle-level managers (N=91)

Competencies	The demand of technical skills		
	Importance	Ability of college graduate	t-test
1.Management theory	4.09 #	3.08	10.51 * * *
2.Organization	4.08 #	3.12	9.55 * * *
3.Product design	3.66 #	3.21	4.09 * * *
4.Forecasting	3.85 #	2.93	8.45 * * *
5.Plant location choice	3.37 #	2.92	2.83 * *
6.Plant layout	3.82 #	3.25	5.11 * * *
7.Material handling	3.95 #	3.25	6.68 * * *
8.Motion and time study	4.03 #	3.25	7.13 * * *
9.Planning and control of production	4.26 # #	3.22	9.48 * * *
10.Material management	3.97 #	3.27	6.72 * * *
11.Quality control	4.31 # #	3.40	9.93 * * *
12.Equipment maintenance	3.91 #	3.37	4.68 * * *
13.Cost analysis and handling	4.29 # #	3.08	11.86 * * *
14.Personnel management	4.05 #	3.11	8.66 * * *
15.Industrial safety and hygiene	4.07 #	3.24	8.03 * * *
16.Application of Computer Technology	3.90 #	3.41	4.05 * * *
17.Statistics Analysis	3.93 #	3.12	7.39 * * *
18.Marketing Management	3.67 #	2.98	5.77 * * *

# # very important    # important    good    average    \* \* P<.01    \* \* \* P<.001

#### 4.4 The demand of technical skills by junior college graduates at the department of mechanical engineering from the view of top-level managers

There are differences between the competencies of technical skills of junior college graduates at the department of mechanical engineering and the standards as a top-level manager (please refer to Table 4).

Table 4. The demand of technical skills by junior college graduate at the department of mechanical engineering from the view of middle-level managers (N=94)

Competencies	The demand of technical skills		
	Importance	Ability of college graduate	t-test
1.Management theory	4.27 # #	3.05	13.45 * * *
2.Organization	4.34 # #	3.06	13.12 * * *
3.Product design	3.95 #	3.26	6.32 * * *
4.Forecasting	4.34 # #	2.91	14.17 * * *
5.Plant location choice	3.87 #	2.87	9.13 * * *

6.Plant layout	4.01 #	3.17	8.09 * * *
7.Material handling	3.91 #	3.22	6.41 * * *
8.Motion and time study	4.14 #	3.15	10.15 * * *
9.Planning and control of production	4.26 # #	3.21	9.40 * * *
10.Material management	3.96 #	3.23	6.61 * * *
11.Quality control	4.32 # #	3.31	9.83 * * *
12.Equipment maintenance	3.85 #	3.33	4.59 * * *
13.Cost analysis and handling	4.38 # #	3.05	13.18 * * *
14.Personnel management	4.20 # #	3.03	11.79 * * *
15.Industrial safety and hygiene	4.13 #	3.30	7.83 * * *
16.Application of Computer Technology	3.96 #	3.40	5.06 * * *
17.Statistics Analysis	3.94 #	3.00	8.60 * * *
18.Marketing Management	4.11 #	2.96	10.70 * * *
# # very important	# important	good	average
			* * * P<.001

From the view of middle-level managers, junior college graduates at the department of mechanical engineering has a good competency of technical skill that is “Application of computer technology” (please refer to Table 4).

And, almost competencies of technical skills those need training are : (1) Management theory, (2) Organization, (3) Product design, (4) Forecasting, (5) Plant location choice, (6) Plant layout, (7) Material handling, (8) Material management, (9) Quality control, (10) Equipment maintenance, (11) Motion and time study, (12) Planning and control of production, (13) Cost analysis and handling, (14) Personnel management, (15) Industrial safety and hygiene, (16) Statistics Analysis, (17) Marketing Management.

## 5. Conclusions

The data obtained from this study, through means and t-test, could be concluded mainly as follows:

- 1.Managers (first-line managers, middle-level managers, and top-level managers) both require 18 competencies of technical skills of plant management.
- 2.According to the views of first-line managers, college graduates must be enriched in 8 competencies of technical skills through education.
- 3.According to the views of middle-level managers, college graduates must be enriched in 15 competencies of technical skills through education.
- 4.According to the views of top-level managers, college graduates must be enriched in 17 competencies of technical skills through education.

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