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MAJOR CONCERNS IN PHILIPPINE MANUFACTURING AND THE ROLE OF PRODUCTION AND OPERATIONS MANAGEMENT TECHNIQUES AND APPROACHES

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The importance of the production/operations management (P/OM) function is apparent in the face of increasing competition particularly in the global market. There are indications that local manufacturing companies are addressing this concern through the use of appropriate techniques which are intended to improve operations. This paper presents the results of a survey which looked into the major problems of local manufacturing companies and the extent to which they make use of known P/OM approaches.

1. Introduction

A number of investigations into the state-of-the-art in production and operations management (P/OM) in the US manufacturing industry have been conducted the last 30 years (Berry, 1979; Davis, 1974, 1975; Ford *et al.*, 1987; Fryer, 1973; Gaither, 1975; Ledbetter and Cox, 1965; Malcolm, 1954; Oakland and Sohal, 1987; Schumacher, 1965; Vatter, 1967.)

No such study has ever been reported in the Philippines despite the growing concern over the role that the P/OM function plays in local manufacturing. The present study attempts to address this gap.

1.1. The Problem

The P/OM function is the backbone of any manufacturing organization. With increasing global competition, many companies have drastically changed their view of P/OM and its role in achieving competitive advantage in the marketplace. They have come to

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realize that the key to survival is a long-run perspective made possible only through steady, continuous improvements in manufacturing.

There is an abundance of theories, techniques and approaches intended to improve manufacturing operations. Unfortunately, little is known about the actual extent of usage of such techniques and approaches in local manufacturing.

Of equal concern is the question of whether people in the academe, particularly those in the P/OM field, are prepared to reorient and educate management professionals on the significance of the P/OM function and how this function can be carried out more efficiently.

1.2. Objectives of the Study

The study aims to provide academicians in P/OM with information on the major problems and concerns of local manufacturing companies, and the extent to which they make use of known and proven P/OM techniques and approaches. This should allow people in the academe the opportunity to redesign courses, develop materials, and modify approaches to better prepare managers on the use of appropriate techniques to address specific P/OM issues and problems.

2. Methodology

A three-part questionnaire was develop which looked into the following:

1. the company's current concerns with respect to the different aspects of manufacturing operations;

2. the techniques and approaches employed to improve operations and to address these concerns; and

3. the company profile.

The questionnaire listed 43 potential concerns and 42 known techniques/approaches which were selected by going over existing literature and P/OM textbooks. The approaches identified are

more or less well-established, so that informed practitioners could be expected to be familiar with them, and at least some companies would already have implemented them. The emphasis was on general rather than specific techniques.

The study does not focus on any particular industry in the manufacturing sector. The sample includes a wide range of firms including food processors, garments manufacturers, semiconductor firms, and furniture manufacturers. There was also no prior knowledge on company size, age or production environment. The actual sample turned out to be a mixture of large, medium and small firms, companies of various ages and production setups.

Responses to the questionnaire were obtained from either the person directly in charge of production or from a high-level production person. Respondents were asked to rate each concern on a scale of 1 to 5, where 1 denotes "no concern" and 5 denotes "critical concern." Respondents were also asked to rate the techniques and approaches (labeled in the questionnaire as "improvement activities") using the same scale, where 1 denotes "no emphasis" and 5 denotes "critical emphasis."

Since the study relies heavily on nominal scaling, the main descriptive statistics used were those which would remain unchanged by one-to-one transformations: the mode and frequency counts. The nonparametric statistical test, chi-square, was also found appropriate because it focuses on enumerative data.

3. Results

3.1. Sample Profile

The sample consists of 65 companies. Forty-six of these were 100 percent locally-owned. This represents approximately 70.77 percent of the total sample. Only six (9.23 percent) were subsidiaries of multinational companies.

Most of the firms included in the survey had been in operation for over 25 years (41.54 percent). About 29.23 percent were no more than 10 years old.

Roughly 40 percent of the sample companies had less than 100 employees, 23.08 percent had from 100 to 199 employees, while 30.77 percent had labor complements 200 and larger. Four of the companies surveyed gave no indication of employment size.

A large percentage (61.54 percent) of the respondents manufactured strictly for the domestic market.

3.2. Critical Concern and Approaches

Table 1 presents the various concerns grouped in order of decreasing mode. The percentage of respondents indicating the corresponding mode is also shown for each concern.

Table 1 - Problems and Concerns

Mode = 5	
• High or rising material cost	52.31 %
• Producing to high quality standards	36.92
• Low labor productivity	32.31
• Insufficient manufacturing capacity	27.69
Mode = 4	
• Impact of government regulations	44.62 %
• Weakness of the Philippine peso	38.46
• High or rising overhead costs	35.38
• Availability of skilled workers	27.69
Mode = 3	
• Inability to deliver on time	38.46 %
• Making new process technology work	38.46
• Unpredictable customer demand	36.92
• Long production lead times	35.38
• Ineffective material control systems	35.38
• Poor sales forecasts	35.38
• Rising cost of labor	33.85
• High or rising inventory levels	33.85
• Falling behind in process technology	33.85

Table 1 (continued)

• Introducing new products on schedule	33.85
• Excess manufacturing capacity	33.85
• Inability to respond to rush orders	33.85
• Inappropriate accounting methods	32.31
• Incorrect inventory information	32.31
• Communicating with other functions	32.31
• Poorly articulated goals and strategies	32.31
• Unreliable vendor quality	32.31
• Aging plant and equipment	32.31
• Availability of supervisors	30.77
• Direct labor turnover	29.23
• Rejects	26.15
• Communicating needs to top management	26.15
Mode = 2	
• Too broad a product line	36.92 %
• Aging workforce	35.38
• Low indirect labor productivity	32.31
• Availability of management staff	32.31
• Falling behind in information technology	32.31
• Direct labor absenteeism	29.23
• Inappropriate capital budgeting methods	27.69
• Availability of technicians/craftsmen	27.69
Mode = 1	
• Competition from government-owned companies	53.85 %
• Foreign tariff barriers	44.62
• Inadequate patent/copyright protection	41.54
• Too many engineering changes	35.38
• Availability of engineers	30.77

The P/OM techniques and approaches (improvement activities) have likewise been grouped as shown in Table 2.

Table 2 - P/OM Techniques and Approaches (Improvement Activities)

Mode = 4	
• Productivity improvement program	50.77 %
• Training in production control systems	49.23
• Production and inventory control systems	49.23
• Worker skills development	47.69
• Maintenance improvement program	47.69
• Worker safety and health programs	46.15
• Production lead time reduction	43.08
• Zero defects program	41.54
• Defining a manufacturing strategy	41.54
• Integrating manufacturing information systems	41.54
• Integrating information systems across functions	40.00
• Quality circle program	40.00
• Vendor quality improvement program	40.00
• Capacity expansion	38.46
• Giving workers a broader range of tasks	36.92
• Changing labor-management relationships	33.85
• Purchasing management	33.85
• Developing new processes for old products	32.31
• Training in manufacturing management	32.31
• Modernization/reconditioning of physical plants	32.31
• Statistical quality control: product	32.31
• Developing new processes for new products	30.77
• Statistical quality control: process	30.77
• Making existing systems work better	27.69
Mode = 3	
• Automating jobs	38.46 %
• Giving workers a broader range of tasks	36.92
• Giving workers more planning responsibility	36.92
• Manufacturing reorganization	33.85
• Flexible manufacturing systems	33.85
• Setup time reduction	29.23
• Focusing factories	29.23
• Group technology	29.23
• Value analysis	27.69
• Office automation	27.69
• Reducing size of workforce	26.15
• Just-in-time system	24.62

Table 2 (continued)

Mode = 2	
• Narrowing product lines	24.62
Mode = 1	
• Introducing robots	76.92 %
• Plant relocation	50.77
• Computer-aided design	44.62
• Computer-aided manufacturing	41.54
• Reducing size of manufacturing units	32.31

Results of the survey indicate that the four most critical problems facing the sample companies are associated with material cost, product quality, productivity, and manufacturing capacity. A chi-square test of independence was performed to determine whether this pattern varies depending on the age or size of the company. Results of the test show that as far as these four issues are concerned, there seems to be no difference whether the company has been in operation for less than 10 years or over 25 years, or whether the company is small, medium or large. They considered the above-mentioned problems their most critical concerns. The test was performed at a 95 percent level of significance.

Based on the mode, none of the approaches falls under the "critical emphasis' category. In other words, there was no strong agreement that a particular approach was critical in improving manufacturing operation. A look at Table 2 would show, however, that the top 10 to 15 activities appear to address the critical concerns mentioned in the preceding paragraph. Training in production control and improvement in production and inventory control systems are most probably directed at cost reduction. Maintenance improvement, zero defects, quality circle, and vendor quality improvement programs may be in response to the problem of meeting quality standards. Low labor productivity is addressed by productivity improvement programs, as well as programs on worker skill development and worker safety. Production lead time reduction and capacity expansion may be directed at solving the problem of limited manufacturing capacity.

The chi-square tests indicate, however, that emphasis on certain improvement activities and techniques varies depending on the size and age of the manufacturing firm. Tables 3 and 4 outline the results of the test.

Table 3 - Results of Chi-Square Test
Control Variable: Age of Business
$\alpha = .05$

TECHNIQUE/ACTIVITY	d.f.	chi-square value
• Group technology	10	21.719
• Integrating mfg. info systems	10	19.904
• Office automation	8	24.834
• Just-in-time system	10	21.090
• SQC: Process	10	21.395
• SQC: Product	10	24.055

Table 4 - Results of Chi-Square Test
Control Variable: Size of Business
$\alpha = .05$

TECHNIQUE/ACTIVITY	d.f.	chi-square value
• Worker safety and health	16	30.881
• Automating jobs	20	40.570
• Computer-aided manufacturing	20	42.033
• Setup time reduction	20	37.562
• Value analysis	20	36.335
• Reduction of size of mfg. units	20	36.616
• Defining a manufacturing strategy	20	47.274
• Integrating mfg. info. systems	20	52.888
• Office automation	16	36.573
• Training in prod. control systems	20	39.931
• Training in manufacturing mgt.	20	47.591
• Modernization/reconditioning plants	16	30.638
• Introducing robots	20	38.890
• Flexible manufacturing systems	16	30.638
• Just-in-time system	20	35.576
• SQC: Product	20	36.640

The corresponding frequency distributions for the activities and techniques given in Tables 3 and 4 are shown in Tables 5 and 6.

Table 5 - Frequency Distributions
P/OM Techniques (Improvement Activities)
Control Variable: Age of Business

- Group Technology

Degree of Emphasis	Years in Operation ≤ 10	> 10 but ≤ 25	> 25
No emphasis	26.32 %	27.78 %	3.85 %
Small emphasis	42.11	38.89	7.69
Moderate emphasis	21.05	16.67	46.15
Significant emphasis	5.26	16.67	34.62
Critical emphasis	5.26	-	7.69

- Integrating Manufacturing Information Systems

Degree of Emphasis	Years in Operation ≤ 10	> 10 but ≤ 25	> 25
No emphasis	26.32 %	38.89 %	3.70 %
Small emphasis	5.26	16.67	3.70
Moderate emphasis	31.58	22.22	18.52
Significant emphasis	31.58	22.22	62.96
Critical emphasis	5.26	-	11.11

- Integrating Information Systems Across Functions

Degree of Emphasis	Years in Operation ≤ 10	> 10 but ≤ 25	> 25
No emphasis	26.32 %	38.89 %	3.70 %
Small emphasis	15.79	27.78	3.70
Moderate emphasis	21.05	11.11	25.93
Significant emphasis	31.58	22.22	59.26
Critical emphasis	5.26	-	7.41

Table 5 (continued)

- Office Automation

Degree of Emphasis	Years in Operations ≤ 10	< 10 but ≤ 25	> 25
No emphasis	31.58 %	52.63 %	-
Small emphasis	21.05	15.79	22.22
Moderate emphasis	36.84	21.05	25.93
Significant emphasis	5.26	10.53	44.44
Critical emphasis	5.26	-	7.41

- Just-In-Time Systems

Degree of Emphasis	Years in Operations ≤ 10	< 10 but ≤ 25	> 25
No emphasis	26.32 %	27.78 %	3.85 %
Small emphasis	42.11	38.39	7.69
Moderate emphasis	21.05	16.67	46.15
Significant emphasis	5.26	16.67	34.62
Critical emphasis	5.26	-	7.69

- Statistical Quality Control: Process

Degree of Emphasis	Years in Operations ≤ 10	< 10 but ≤ 25	> 25
No emphasis	15.79 %	44.44 %	-
Small emphasis	10.53	16.67	3.85
Moderate emphasis	31.58	22.22	30.77
Significant emphasis	26.32	16.67	46.15
Critical emphasis	15.79	-	19.23

- Statistical Quality Control: Product

Degree of Emphasis	Years in Operations ≤ 10	< 10 but ≤ 25	> 25
No emphasis	15.79 %	44.44 %	-
Small emphasis	5.26	5.56	-
Moderate emphasis	36.84	38.89	26.92
Significant emphasis	31.58	11.11	50.00
Critical emphasis	10.53	-	23.08

Table 6 - Frequency Distributions
P/OM Techniques (Improvement Activities)
Control Variable: Size of Business

- Worker Safety and Health

Degree of Emphasis	No. of Employees < 100	100 - 199	≥ 200
No emphasis	15.38 %	-	-
Small emphasis	15.38	13.33	-
Moderate emphasis	38.46	13.33	35.00
Significant emphasis	15.38	73.33	55.00
Critical emphasis	15.38	-	10.00

- Automating Jobs

Degree of Emphasis	No. of Employees < 100	100 - 199	≥ 200
No emphasis	34.62 %	21.43 %	-
Small emphasis	19.23	14.29	20.00
Moderate emphasis	34.62	28.57	50.00
Significant emphasis	7.69	35.71	30.00
Critical emphasis	3.85	-	-

- Computer-Aided Manufacturing

Degree of Emphasis	No. of Employees < 100	100 - 199	≥ 200
No emphasis	70.83 %	33.33 %	20.00 %
Small emphasis	16.67	40.00	15.00
Moderate emphasis	8.33	13.33	35.00
Significant emphasis	4.17	6.67	10.00
Critical emphasis	-	6.67	10.00

Table 6 (continued)

- Setup Time Reduction

Degree of Emphasis	No. of Employees < 100	100 - 199	≥ 200
No emphasis	32.00 %	13.33 %	-
Small emphasis	36.00	20.00	-
Moderate emphasis	16.00	33.33	47.37
Significant emphasis	8.00	33.33	47.37
Critical emphasis	8.00	-	5.26

- Reduction of Size of Manufacturing Units

Degree of Emphasis	No. of Employees < 100	100 - 199	≥ 200
No emphasis	60.00 %	30.77 %	10.00 %
Small emphasis	16.00	15.38	35.00
Moderate emphasis	24.00	23.08	25.00
Significant emphasis	-	30.77	25.00
Critical emphasis	-	-	5.00

- Value Analysis

Degree of Emphasis	No. of Employees < 100	100 - 199	≥ 200
No emphasis	28.00 %	6.67 %	-
Small emphasis	16.00	40.00	35.00
Moderate emphasis	28.00	26.67	25.00
Significant emphasis	16.00	20.00	30.00
Critical emphasis	12.00	6.67	10.00

- Defining a Manufacturing Strategy

Degree of Emphasis	No. of Employees < 100	100 - 199	≥ 200
No emphasis	28.00 %	6.67 %	-
Small emphasis	20.00	6.67	-
Moderate emphasis	20.00	40.00	35.00
Significant emphasis	28.00	40.00	55.00
Critical emphasis	4.00	6.67	10.00

Table 6 (continued)

- Integrating Manufacturing Information Systems

Degree of Emphasis	No. of Employees < 100	100 - 199	≥ 200
No emphasis	48.00 %	6.67 %	-
Small emphasis	-	20.00	5.00
Moderate emphasis	24.00	26.67	25.00
Significant emphasis	24.00	40.00	65.00
Critical emphasis	4.00	6.67	5.00

- Integrating Information Systems Across Functions

Degree of Emphasis	No. of Employees < 100	100 - 199	≥ 200
No emphasis	48.00 %	6.67 %	-
Small emphasis	12.00	26.67	5.00
Moderate emphasis	12.00	26.67	30.00
Significant emphasis	24.00	-	60.00
Critical emphasis	4.00	-	5.00

- Office Automation

Degree of Emphasis	No. of Employees < 100	100 - 199	≥ 200
No emphasis	53.85 %	6.67 %	5.00
Small emphasis	11.54	13.33	25.00
Moderate emphasis	15.38	53.33	30.00
Significant emphasis	11.54	20.00	40.00
Critical emphasis	7.69	6.67	-

- Training in Production Control Systems

Degree of Emphasis	No. of Employees < 100	100 - 199	≥ 200
No emphasis	24.00 %	6.67	-
Small emphasis	16.00	-	10.00
Moderate emphasis	28.00	13.33	35.00
Significant emphasis	28.00	73.33	55.00
Critical emphasis	4.00	6.67	-

Table 6 (continued)

- Training in Manufacturing Management

Degree of Emphasis	No. of Employees < 100	100 - 199	≥ 200
No emphasis	32.00 %	6.67 %	5.00 %
Small emphasis	12.00	6.67	5.00
Moderate emphasis	40.00	33.33	30.00
Significant emphasis	8.00	53.33	45.00
Critical emphasis	8.00	-	15.00

- Modernization/Reconditioning of Physical Plants

Degree of Emphasis	No. of Employees < 100	100 - 199	≥ 200
No emphasis	30.77 %	-	-
Small emphasis	15.38	26.67	10.00
Moderate emphasis	26.92	6.67	30.00
Significant emphasis	3.85	60.00	55.00
Critical emphasis	23.08	6.67	5.00

- Introducing Robots

Degree of Emphasis	No. of Employees < 100	100 - 199	≥ 200
No emphasis	88.46 %	73.33 %	68.42 %
Small emphasis	3.85	26.67	26.32
Moderate emphasis	-	-	5.26
Significant emphasis	3.85	-	-
Critical emphasis	3.85	-	-

- Flexible Manufacturing Systems

Degree of Emphasis	No. of Employees < 100	100 - 199	≥ 200
No emphasis	36.00 %	13.33 %	10.00 %
Small emphasis	16.00	13.33	20.00
Moderate emphasis	28.00	40.00	35.00
Significant emphasis	20.00	33.33	35.00
Critical emphasis	-	-	-

Table 6 (continued)

- Just-In-Time System

Degree of Emphasis	No. of Employees < 100	100 - 199	≥ 200
No emphasis	40.00 %	14.29 %	10.53 %
Small emphasis	28.00	57.14	5.26
Moderate emphasis	16.00	14.29	47.37
Significant emphasis	12.00	14.29	31.58
Critical emphasis	4.00	-	5.26

- Statistical Quality Control: Product

Degree of Emphasis	No. of Employees < 100	100 - 199	≥ 200
No emphasis	33.33 %	20.00 %	-
Small emphasis	4.17	-	5.00
Moderate emphasis	45.83	13.33	35.00
Significant emphasis	4.17	60.00	45.00
Critical emphasis	12.50	6.67	15.00

With age of business as the control variable, the extent of usage of five improvement activities is particularly worth noting. These are group technology, integrating manufacturing information systems, office automation, the just-in-time system, and statistical quality control. Except for office automation, these techniques have not yet covered much ground in local manufacturing.

Results of the survey show that these approaches are more popular among older companies. A possible explanation is the fact that the older a company gets, the greater the need to explore newer technologies to replace or upgrade existing ones. Older companies which have attained some level of success have probably accumulated adequate resources to support the acquisition and implementation of the newer systems. On the other hand, companies which have been in operation for many years and which are experiencing difficulties adapting to recent developments may be compelled to find solutions in more advanced approaches.

For the rest of the improvement activities, there seems to be no strong indication that the age of the firm has any bearing on the degree of importance given to particular techniques.

It is interesting to note, however, that company size appears to be a more significant factor than age in ascertaining the amount of emphasis given to the different improvement activities. This is especially true in the case of 16 out of the 42 listed techniques and approaches.

Worker safety and health programs are more popular among bigger companies. This is expected because with a larger labor complement, the pressure to formalize efforts to address issues concerning worker needs is greater. Likewise, the same pressures may compel these companies to seek ways of reducing the workforce or relieving workers of certain tasks, most likely through automation.

More advanced technologies such as computer-aided manufacturing (CAM), flexible manufacturing systems (FMS), just-in-time (JIT) systems, and statistical quality control (SQC) are practically given little attention by smaller companies, most probably because they are not as informed as larger, more sophisticated firms. Moreover, smaller companies may not find it necessary to install these systems given the limited scope of their operations.

3.3. Non-Critical Concerns and Approaches

Table 1 shows that among the companies surveyed, the least critical concern, based on the value of the mode, is competition from government-owned companies. This is not surprising because the national government's participation in local manufacturing is indirect and limited to regulation. There are few state-controlled manufacturing companies and they are confined only to certain industries.

Another non-critical factor is foreign tariff barriers. This is understandable because a large percentage of the companies included in the study operate only in the domestic market.

Patent and copyright protection is also considered non-critical by a fairly large percentage of the respondents, most likely because

most of them are in traditional industries or are manufacturing standard products. Availability of engineering expertise, as well as engineering specifications, does not seem to be a problem in many of the firms covered by the study.

Among the improvement activities, the least emphasized are introduction of robots, plant relocation, computer-aided design, computer-aided manufacturing, and reduction of size of manufacturing units. The first four of these activities require substantial capital outlay, which may explain why they are not as popular as the other techniques and approaches. Downgrading of manufacturing units, likewise, may not be considered an appropriate activity to improving manufacturing operations, because it would appear to most companies to constrict rather than strengthen the P/OM function.

3.4. Improvement Activities for the Future

The questionnaire included a direct question on which activities the respondent believes would be most effective for the company's future operations. Table 7 gives a list of the top 10 approaches which have been identified.

Table 7 - Most Effective Activities for the Future

Activity	Percent of Respondents
• Productivity improvement programs	27.69 %
• Upgrading worker skills	27.69
• Capacity expansion	24.62
• Maintenance improvement programs	20.00
• Zero defects program	20.00
• Quality circle program	20.00
• Automating jobs	18.46
• Developing new processes for new products	16.92
• Developing new processes for old products	15.38
• Making existing systems work better	15.38

Most of these activities are apparently directed at solving current critical concerns which may be expected to persist in the future. In fact, except for job automation, all of the activities listed in Table 7 appear in the first group (mode = 4) of Table 2. In other words, these techniques which are given significant emphasis at the present time would most likely be given critical attention in the future.

4. Conclusion

Results of the study suggest that our local manufacturing companies have identified appropriate activities to address current critical problems. There are also indications that company size and age are important factors which influence the degree of emphasis given to certain improvement activities. Unfortunately, the study did not go so far as to determine the actual extent of usage of the techniques **within** each firm; then it would have been possible to determine whether the activities have so far been effective or not. In addition, there were approaches which were less popular than others. The study did not look into the reasons behind this. These issues should be pursued as potential areas for further research.

The present study has several other limitations, prominent among which is the smallness of the sample size. Findings therefore may not be conclusive. On the other hand, the study is intended to be exploratory. It should provide some basis for future research efforts.

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