

**MIDDLE EAST TECHNICAL UNIVERSITY
INDUSTRIAL ENGINEERING DEPARTMENT**

IE 300

SUMMER PRACTICE MANUAL

2009

The purpose of summer practice is to improve your understanding of the industry and experience in industrial engineering. These can best be achieved through guided observations followed by a formal reporting. This manual provides guidelines for the summer practice and the preparation of the practice report of METU Industrial Engineering second year students. First, format and style of the practice report is described. The rest of the manual lists questions that are expected to be addressed in the report. The questions are organized in eight sections. Explanations are given before most of the questions. Students should elaborate on their responses to the questions and provide supporting discussions. A list of references is also provided.

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INSTRUCTIONS ON THE FORMAT AND STYLE OF THE REPORT

The report must be written in English, and printed in ink or typed.

The main section headings are to be numbered and written in capital letters. The subtitles must be written in lower case letters and underlined. All pages should be given page numbers. Figures, drawings, tables, pictures, etc. should be numbered appropriately.

The report should consist of the following sections:

Table of contents (with corresponding page numbers)

Introduction (scope of the summer practice; main difficulties faced during the practice which affected the course of the work)

Main body of the report (detailed explanation of the work carried out)

Conclusion (evaluation of the experience gained and feedback on the content of summer practice)

References (list all the material referred to in the report text)

Appendix (all data, tables, diagrams, drawings, etc. which are not immediately relevant to the main text should be included in the appendix).

In writing-up the report, the main sections of the manual and the questions may be followed in the given order. However, the content, the main body or a main section of the report may be reorganized in subsections defined by the student provided that all questions in this guide have been answered.

When a question is not appropriate for the case on hand or a suitable answer is not available, the question can be disregarded. However a clear justification of why the question is not answered should be provided. The student can also attempt to modify and answer the question so that it is relevant to the practice organization.

It is advisable to add a glossary to the end of the report for technical terms used.

Summer practice reports are due within the first two weeks of the following academic term.

EVALUATION OF THE REPORTS

The grading of the reports will be as follows: There is a total of 200 points obtainable from the questions section. You should collect at least 50% of the points for each section. Also any point totalling less than 160 or any section graded less than 50% of its full score will be considered as 'Incomplete' and report will be returned to the student for revision. Any point totalling less than 125 will be considered as 'Unsatisfactory' and the summer practice will be repeated in a different work place, during the next semester break, the earliest. Otherwise the report will be considered as satisfactory. The 200 points will be accorded as follows:

Introductory Features	: 10 points
Analysis of Macro Aspects	: 20 points
Management Information System	: 20 points
An Overview of the Production System	: 35 points
Production Planning and Control System	: 35 points
Quality Planning and Control System	: 20 points
Observation of a Professional at Work	: 15 points
Analysis of a Decision Making Problem	: 20 points
Conclusion	: 15 points
Style and Organization of the Report	: 10 points

You are required to fill out the online questionnaire on the website www.ie.metu.edu.tr/~sp. The questionnaire should be filled out until the submission date of your summer practice report. Otherwise your report will be considered as incomplete.

1. INTRODUCTORY FEATURES

- 1.1 What is the full title of the firm? When was it founded and where is it located? (Give the full address).
- 1.2 The main shareholders and their shares. Is the firm a joint venture, a franchise, a part of a holding company or a part of a multinational group?
- 1.3 Specify the sector and typical products the firm manufactures, and its shares in the domestic market and (if any) international markets.
- 1.4 Who are regarded as the customers of your practice organization (consider the end users, retailers, other manufacturers, employees, etc.)? Identify the stakeholders, i.e. the groups considered by the organization to have any sort of interest in the organization's activities (such as certifying agencies, labor unions, professional societies, government, local community, potential customers, competitors and employees).
- 1.5 Provide a list of functions performed by the industrial engineers in the practice organization

2. ANALYSIS OF THE MACRO ASPECTS

- 2.1 *Production system is the heart of every organization as it consists of all activities that add value to its output. A production system uses many inputs (e.g. materials, equipment, supplies, labor, energy, money, knowledge) some of which are the products of other organizations and transforms them into goods/ services. These goods/ services may also be used as inputs to other production systems. Besides, a production system interacts with its environment (e.g. customers, competitors, national economy, government, creditors, suppliers) during its operation.*

Identify major items of input of the production system you have observed. Specify where and how they are supplied (e.g., sources, means of transportation, volume and frequency of deliveries, usage rates etc.).

- 2.2 *Any manufacturing organization performs its activities in some physical environment consisting of land, buildings, warehouses, roads, shops, garages, docks, storages, etc. These are part of the facilities of the organization. In some cases not all facilities of a firm are located on the same property and they may be far away from each other, even in different cities.*

Identify the major facilities of the manufacturing firm you observed during your summer practice on a rough (free hand) sketch. Show a few items that flow among them (e.g., painted parts, sheet metal, vehicles to repair, spare parts, steam, fabric, design information, cardboard boxes, etc.).

2.3 *When deciding on the location of a manufacturing facility, there are many factors to be considered. Some of these are:*

- a) distribution needs for the products,*
- b) availability or physical characteristics of raw materials,*
- c) physical characteristics of the products,*
- d) labor availability and quality,*
- e) transportation facilities,*
- f) proximity to suppliers,*
- g) environmental factors,*
- h) laws, taxation, incentives, government politics etc.*
- i) cost of land and buildings*

Specify the most prevailing factor for selecting the current location of the facility with regard to the factors listed above or the like. Support your ideas. (You may use a sketch, a table, a graph or a map, if necessary).

3. MANAGEMENT INFORMATION SYSTEM

3.1 *Every organization has an information system which is designed to meet its information requirements. In this system data are recorded, classified, summarized and processed to produce information. Management information system should support decision making at three different levels:*

- a) Strategic level decisions (e.g. plant expansion, determination of product lines, mergers, diversification, capital expenditures, etc.).*
- b) Tactical level - implementation of plans (e.g. allocation of resources to different products, formulation of budgets, funds flow analysis, plant layout decisions, personnel problems).*

- c) *Operational level, day-to-day routine operations (e.g. receiving and shipping operations, scheduling, inventory control, quality control and allocating workers to jobs).*

Specify the decision makers (individual or group, their positions within the organizational structure) and the related subject of decision-making with regard to one decision-making activity in each of these decision levels.

- 3.2** *Computers are widely used in processing data and providing information for managerial decision making. They are also employed in organizations to improve productivity and provide better utilization of resources. The physical units making up a computer system are called hardware.*

Identify the computer systems (computer networks, stand-alone PC's, workstations, main frames etc. -their types and approximate capacities) in use and their spread (functions or departments with extensive or low computer support in their operations) in your practice organization.

4. AN OVERVIEW OF THE PRODUCTION SYSTEM

- 4.1** *A production system takes inputs and transforms them into outputs with some inherent value. The transformation process is, in fact, a flow process of input materials and information. Material flows through several processes: It first flows from supplier to the production system to become raw material inventory. It then moves to the production floor, where the material conversion process takes place; the material, in the form of work-in-process inventory (WIP), moves through different workstations by traversing certain routes on the production floor. Finally, it becomes a finished product and stored in finished goods inventory.*

Provide a schematic representation of the material flow of a particular product in your practice organization. Note that your diagram should include the complete flow from raw materials inventory through finished goods inventory with every point of conversion (workstations, stock points) being indicated.

- 4.2** *Manufacturing processes can be categorized as follows:*

Those processes that are characterized by continuous flow as in steel making, sugar refining and chemical processing are called continuous processes.

When items are produced in large lots following an unchanging sequence of operations, the process becomes a repetitive process. Standardized product types characterize it. Due to unchanging routing of parts, facilities can be arranged as a flow shop. The automobile industry is a good example of a flow shop.

Intermittent processes are those processes in which items are processed in small lots to customer specifications. Job shop, batch shop and project shop typify these. A job shop produces low-volume highly customized products. Product routing varies widely and facilities are arranged on a functional basis. Metal, plastic and woodworking industries where non-standard products are processed are examples of job shops. Between the extremes of job shops and flows shops is the batch shop. In batch shops, product variety is lower; batch sizes are large; and repetitiveness of operations is higher compared to job shops. Project shop produces a single, customized product such as large turbines, aircraft and ships.

A manufacturing system may be a combination of the above classes.

Explain the type of operations in your practice organization with regards to any one of the followings: production volume or product variety.

Describe your reasons in detail.

- 4.3** *In a production system, the material conversion process takes place on the production floor, which is arranged in a certain way to facilitate conversion. Production volume and product variety determine the type of arrangement or layout.*

One typical job shop layout is process layout in which all similar equipment and operations are grouped together in the same department. For example, all stamping is done in the press department. A flow shop, on the other hand, uses a product layout. Equipment is arranged so that the product always follows the same routing through the layout. For example, assembly line is a typical example for product layout (automobile industry, home appliances, and electronics industry). Group technology (GT) or cellular layout can be used to develop a hybrid between pure process layout and pure product layout. The equipment is arranged into cells, each containing the equipment used to process a particular family of parts. A project shop uses a fixed-position layout. The product (aircraft, ship) stays in one place while the material and equipment are brought to it. Most plants are laid out using a combination of these layouts.

Discuss the type or combinations of the types of layout you have observed in your practice organization. Support your points using rough sketches.

- 4.4 *The flow and movement of materials and components within the plant is essential for carrying out successive operations. This is referred to as materials handling.*

Identify some of the materials handling equipment in the plant and state where and for what purposes they are used. On a rough free-hand drawing, identify a path followed by any one of the materials handling equipment.

- 4.5 *Productivity implies the enhancement of the production process. Enhancement means favorable comparison of the quantity of resources employed (inputs) to the quantity of goods and services produced (outputs). Productivity, then, is the ratio of the outputs produced for use outside of an organization, divided by the resources used. It can be measured in a variety of ways, such as labor, capital, energy, material usage and so on.*

Compute / Describe an appropriate productivity measure for your practice organization.

- 4.6 *Based on the determination of standard times for each part/product, unit-manufacturing costs can be estimated. Unit-manufacturing cost of a product has to be determined to be utilized in various planning and decision making functions. There are three basic cost elements: direct material cost, direct labor cost and factory overhead cost. Unit-manufacturing cost can be calculated as:*

Unit-manufacturing cost = Unit direct labor cost + Unit direct material cost + allocated factory overhead to a unit.

Are unit-manufacturing costs calculated in your practice organization? If yes, explain how they are calculated and provide an example. If no, describe how expenses will be accounted for under different cost items for any one of the products.

- 4.7 *Balance sheets and income statements are the basic tools to analyze the firm's financial situation. Ratio analysis is often carried out for this purpose.*

Carry out comparative ratio analysis using the balance sheets and income statements for the last two years and evaluate the financial standing of the organization. (Calculate all the necessary ratios for such analysis), or itemize titles for the balance sheet/income statement for the organization.

5. PRODUCTION PLANNING AND CONTROL SYSTEM

- 5.1 *Production planning and control is concerned with providing information to: (a) efficiently manage the flow of materials, (b) effectively utilize people and equipment, (c) coordinate internal activities with those of suppliers, and (d) communicate with customers to meet their requirements. Production planning and control can be viewed as a system. Its components (like managing the demand, supplying the materials, planning the deliveries, adjusting the capacity, etc.) contribute to the overall objectives of the organization through the cost, volume, quality and timeliness of production activities.*

Management of the types of products (so called product-mix) and their respective quantities brings the problem of determining the demand. This may require analysis of past data, collecting and processing of separate customer orders, signing contracts for supply on an agreed-upon routine basis or conducting a market research (especially for a new product).

State subjects of typical decisions on the types and quantities related to some specific products of your practice organization. Who make(s) these decisions? How are the decisions recorded and transferred to others in the organization? What is the basis for these decisions?

- 5.2 *When and how to produce is the subject in another set of decision making of production planning and control. This set of information conveys the decisions related with the allocation of scarce (limited) resources needed for production.*

What resources are controlled as scarce through careful planning in your practice organization? Name a few. How are their uses planned? How are the plans monitored?

- 5.3 *Almost every business stocks goods to ensure smooth and efficient running of its operations. Inventories of various uses may exist in a firm: (a) stocks accumulated against seasonal fluctuations, (b) stocks caused by receiving in large quantities, (c) stocks of parts being processed due to movement in batches or processing rate differences between successive stages, (d) stocks due to transport delays during delivery. Hence inventory exists whenever it is necessary (or sometimes unavoidable) to stock for the requirements over a specified time into the future. Decisions regarding how much and when to order are typical in any production planning and control system as problems in inventory management. Stocking large quantities would require higher invested capital but would result in less frequent shortages and*

placement of orders. On the other hand, little or no stocks would decrease the invested capital, but would increase the frequency of ordering as well as the risk of not satisfying requirements on time. Both extremes are costly.

State four different items kept in stocks in your practice organization. What requirements do they serve, or what causes them? Use a graph to plot the inventory on hand (i.e. in the storage or use areas within the facilities of the company) versus time for at least one of these items. Do you observe any pattern? How can you explain that pattern (or none)? Supply your sources of data used in the plot.

What difficulties do you observe with regard to managing inventories?

6. QUALITY PLANNING AND CONTROL SYSTEM

6.1 *There is little agreement on what constitutes quality. Most people conceive quality as an attribute of a product or service that can be improved. However, quality is not only associated with products and services, but also includes processes, environment and people. It is an ever-changing state; what is considered quality today may not be enough to be considered quality tomorrow. Hence, quality can be defined as a dynamic state associated with products, services, processes, environments and people, that meets or exceeds expectations.*

The following is just a few other definitions proposed for "quality":

- *Quality is fitness for use.*
- *Quality is conformance to requirements.*
- *Quality is the total composite product and service characteristics of marketing, engineering, manufacture and maintenance through which the product and service in use will meet the expectations of customers.*
- *Quality is the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs.*

Hence, a high quality product or service should well meet expectations of all involved customers or stakeholders.

Quality control is exercised at all four stages of a product/service life cycle:

- a) Product/service design stage (innovation, robust design, tolerance design)*
- b) Manufacturing/service process design stage (innovation, robust design, tolerance design)*
- c) Manufacturing/service delivery stage (detecting problems and correcting them, compensating for known problems, screening undesirable products.)*
- d) Usage stage (warranty and repair).*

Choose a product and explain how the organization defines quality of it. How are customer requirements translated into product or service specifications (or characteristics)? Provide examples. Also describe the quality control activities that take place throughout the life cycle of that product.

7. OBSERVATION OF A PROFESSIONAL AT WORK

7.1 *In every organization, we encounter professionals with different backgrounds and expertise such as product/process designers, marketing managers/specialists, accountants, human resource managers/specialists, production planners, purchasing managers, manufacturing supervisors, maintenance engineers, quality engineers, and computer specialists. One of the major difficulties lies in communication of these people for achievement of common objectives of the organization. On the average, 75% of a workday passes by communicating. Effectiveness of communication is essential for industrial engineers due to the nature of their work. Hence, industrial engineers are expected to have high communication skills.*

Understanding and appreciating the people we communicate with and the characteristics of their work is an important requirement of successful communication.

Identify the most appealing position to you at the firm. Observe a professional who has this position, and narrate your observations. You may want to mention his/her tasks/responsibilities, how he/she lives a typical workday, %breakup of activities, who he/she manages, who he/she reports to, and which background and skills he/she needs, and so on.

8. ANALYSIS OF A DECISION MAKING PROBLEM

8.1 *In every organization, we encounter various decision making problems. Deficiencies occurring in production planning may be the consequence of ill-structured forecasting done by the marketing department. The low utilization of machinery may be due to high level of absenteeism among workers. Deficiencies in production planning and low utilization of machinery are symptoms of the problems. Problems are identified by observing such symptoms through a careful analysis of the existing system. Observations of symptoms should be validated by objective measurements (e.g., low utilization of machinery should be proven by data collected on utilization rates). Possible causes of the symptoms should be studied. This analysis can be supported by some of the questions in this document. The guidance and proposals of the authorities in the firm may also help in the identification of a decision making problem.*

Identify a decision making problem in your organization.

Formulate the defined problem pointing the following issues.

- who is the decision maker (owner of the problem)?
- what is the goal or the objective (direction of and satisfactory amount of improvement) of the decision maker?
- what are the alternative courses of action (to achieve the objectives)?
- what are the limitations, restrictions and requirements of the system?

9. CONCLUSION

9.1 *The following questions are prepared to obtain your own assessment of the summer practice. You can add as many ideas as you wish besides answering these questions. You should not, however, ignore any question. Your answers and additional ideas and suggestions will guide the reorganization of this manual in the future.*

Is the procedure you have followed in this summer practice sufficient in its scope, method and general approach? If not, identify the drawbacks. State your suggestions for an improved procedure. If you found it sufficient, state what you enjoyed most about it.

If you had another four weeks of time in the same firm, what would you be occupied with and why?

What do you expect to learn in your future training as an industrial engineer that will help improve your understanding of production systems? How can you further develop your capability of handling problems of these systems?

Drawing on your experience of this practice, discuss the differences between industrial engineering and other engineering disciplines with respect to their responsibilities and ways of approaching their duties in the production environment.

If industrial engineers are employed by the firm, what are the areas they work in? If no industrial engineer is employed, what activities (if any) do you think are suitable for IEs in your practice organization?

Discuss top management's impression and attitudes towards industrial engineering functions and activities.

- 9.2 *You are required to fill out the online questionnaire on the website www.ie.metu.edu.tr/~sp. The questionnaire should be filled out until the submission date of your summer practice report. Otherwise your report will be considered as incomplete.*

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