MIDDLE EAST TECHNICAL UNIVERSITY
INDUSTRIAL ENGINEERING DEPARTMENT

IE 400
SUMMER PRACTICE MANUAL
(for Service Systems)

2011

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 for preparation of the practice report of METU Industrial Engineering third year students. First, format and style of the practice report is described. The rest of the manual lists questions to be addressed in the report. The questions are organized in eight sections. Explanations are given before most of the questions (The explanations are based on the references listed in Bibliography at the end of the manual). Students should elaborate on their responses to the questions and provide supporting discussions. In a separate section students should also define and formulate an industrial engineering problem, or report exclusively on a project they participated in throughout their summer practices. The Appendix at the end of this manual provides some clues on how these might be done.

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INSTRUCTIONS ON THE FORMAT AND STYLE OF THE REPORT

The report must be written in English, with font style Times New Roman, font size: 12 and 1,5 line spacing. There is a report cover that should be used which is available at summer practice website.

The main section headings are to be numbered and written in capital letters. The sub-titles 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 including sections on an IE problem or contributed project)

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 then 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 including the company specific jargon.

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

EVALUATION OF THE REPORTS

The grading of the reports is as follows: The Questions section is 200 points in total. Problem (or participated project) section is 100 points. **Students must pass separately on both counts.** For the Questions section any grade between 125 and 160 points or any grade less than 50% of the full score of a section will be considered as 'Incomplete' and the report will be returned to the student for revision. Grades less than 125 will be considered as 'Unsatisfactory' and the summer practice will be repeated in a different work place the following year. For the Problem (or participated project) section, any grade between 40 and 65 points will be considered as 'Incomplete' and the report will be returned to the student for the revision of this section. Grades less than 40 for the Problem (or participated project) section will be considered as 'Unsatisfactory' and the summer practice will be repeated in a different work place the following year.

The 200 points will be accorded as follows:

Introductory Features	: 10 points
Analysis of the Macro Aspects	: 20 points
An Overview of the Service System	: 35 points
Planning and Control System	: 50 points
Quality Planning and Control System	: 20 points
Management Information System	: 20 points
Work Study	: 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.

PROBLEM / PARTICIPATED PROJECT SECTION

The content of the problem/participated project section will be evaluated on the basis of the following:

- Problem/Project context (relevance to industrial engineering and significance for the practice organization)
- Technical content of the work reported on
- Style and organization of the section (language, presentation order, clarity)

PROJECT-TYPE SUMMER PRACTICE REPORT

If the student performs the summer practice for at least 6 weeks and takes part in a project, an independent report describing the project can be submitted as the summer practice report. It is required that a project proposal is submitted to the committee within the first week of the practice to check the suitability of the project. The proposal should be approved by the supervisor at the firm.

A project-type summer practice report must include the following sections :

Introduction	: 5 points
▪ Description of the company and scope of the project	
Literature Review	: 10 points
Problem Definition	: 30 points
▪ See Identification and Definition of a Problem (in Appendix A).	
Data Gathering and Analysis	: 10 points
Solution Approaches	: 20 points
Results	: 15 points
Conclusion	: 10 points

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 mailing address)

1.2 What is the type of ownership of the firm? State the main shareholders and their shares. Is the firm a partnership, 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 services the firm provides to its customers Include a few samplers of its advertising brochures or pamphlets or catalogue pages in your appendices to illustrate typical services, if available. What are the firm's shares in the domestic market and (if any) in the international markets?

1.4 Who are regarded as the customers of your practice organization (consider the end users, retailers, manufacturers, 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 *A productive system is the heart of every organization. It consists of all the activities that add value in the conversion of inputs to outputs. A productive system uses many types of resources (e.g. materials, equipment, supplies, labor, energy, money, information) some of which are the products of other organizations and transforms them into goods or services as outputs. Service systems are regarded as* intangible output conversion systems *while manufacturing systems are* tangible output conversion systems*. However, there are cases where the productive system is a combination of both. For example a retail store is generally considered to be a service system, but its output consists of tangible items sold and the intangible utility of offering an assortment of items in one location. In many services, the form of the resource does not change during the conversion process. For example real estate services usually accept property as the owner supplies it to sell.*

In contrast to manufacturing, in service system one must distinguish "resources" and "inputs". For services, inputs are the customers, which arrive with unique demands on service system, while resources are facilitating goods, labor, capital, etc. A service system must interact with the customers in order to function. In a self-service system a customer is regarded beyond an input, as a co-producer. The characteristics of the output also differ in a service system. Outputs may fall into one of the three categories: (i) consumed simultaneously with its production (e.g. hair cutting, medical treatment), (ii) in the form of information or energy packaged in a storage device to be used later (e.g. book), and (iii) a supporting activity (e..g, interior decorating, transportation).

The outputs of one productive system may be used as resources to other productive systems. Besides, a productive system interacts with its environment (e.g., customers, competitors, national economy, government, technology, creditors, suppliers) during its operation. An overall view of any productive system (whether it manufactures goods or provides services), can be stated by taking the inner working of the system as a black box. This requires identifying resources and inputs into and outputs from the system.

Study the productive system of your practice organization taking an overall view. Sketch the system as a black box identifying its resources, inputs and outputs. Discuss the characteristics of the inputs, resources and the outputs.

Does the firm provide services only for the domestic market? Are there any constraints (or regulations) that prevent the firm from competing with similar services in the foreign market?

Does the firm import raw materials, intermediate goods or any of its resources (in your black box diagram)? If so, list the countries from which imports arrive.

What are the standards and certificates (such as ISO, TSE, EN, EC, etc.) the firm conforms to with regard to its activities? Describe briefly and exemplify any limitations or norms imposed by these standards.

2.2. *In a service organization the product is the "service process". In general there does not exist a clear cut differentiation between a "service" product and a "manufacturing" product, rather a product is a bundle of tangible and intangible components. A product may be positioned in a continuous spectrum of tangible and intangible outputs as in Figure 1. For example, a service such as legal advising may*

have no tangible component, while the services in a restaurant or a gas station combines an intangible component with a physical component.

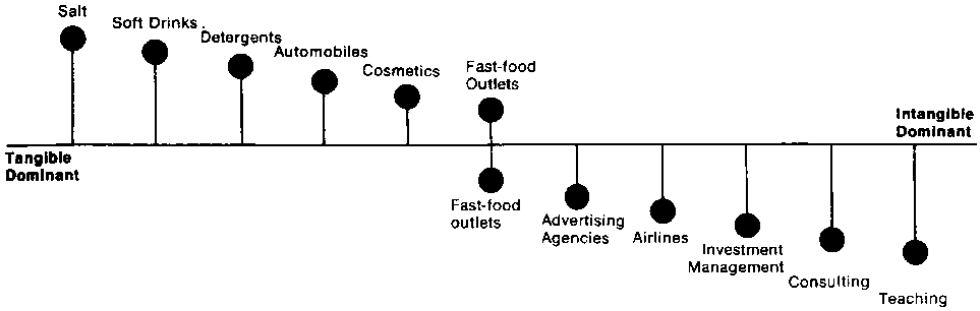


Figure 1. *Spectrum of products by G.L.Shostack (1977), "Breaking free from product marketing", Journal of Marketing, pp. 73-80.*

Furthermore, a "service package" is characterized by the following features:
1. Supporting facility: The physical resources that supports the service (e.g., an airplane, a hospital).
2. Facilitating goods: The material purchased or consumed by the buyer or items provided by the customer (e.g. replacement auto parts, medical supplies).
3. Explicit services: The tangible benefits obtained (e.g. no-delay service of an airline).
4. Implicit services: Psychological, intangible benefits (express check-out option at a retail store).

Describe the tangible and intangible components for the service product provided by your practice company. Evaluate the service product based on the four features stated above.

2.3 *Every organization has a reason for existing and identifies what business it is in. This is its mission. For example, an organization operating a five-star hotel accommodation might have the mission of supplying premium quality service with an elite image. Vision, on the other hand, is the ability to imagine a different and better situation and ways to achieve it. An airline company, for instance, may imagine itself to be among the top three in the world for frequent business travellers.*

State the mission of your practice organization. Are there differences in missions regarding different services offered by the firm? What visions are there with regard to the services and processes performed in your practice organization?

2.4 *When deciding on the location of a facility, there are many factors to be considered.*

a) Customers: Some customers may prefer a certain location, if it is convenient to get service. Service providers such as retail stores, banks, theaters, fast-food restaurants must be closely located to potential customers. However, a discount-store is possibly located outside the city center, since convenience is not the service it claims to provide.

b) Cost: Many firms such as outlets, wholesalers find that operating cost is their dominant factor.

c) Competitors: Some businesses prefer to locate near their competitors to observe, share resources, and draw customers from a distance, e.g., shops in malls, fast-food restaurants. On the other hand, some businesses may prefer to build a barrier to prevent their competitors to enter the market. For example, multiple locations, and dominant presence may serve as a barrier to competition. Holding prime locations before the market has developed can keep the competitors from gaining access to the desirable locations.

d*) Demand management: Firms may prefer certain locations if it helps them to control the quantity, quality and timing of the demand. For example a luxury store may prefer to locate at certain neighborhoods rather than at malls. A pharmacy may prefer to locate near a hospital.*

e) Availability or physical characteristics of resources

f) Characteristics of the services provided

g) Labor availability and quality

h) Transportation needs, traffic, accessibility and parking

i) Environmental factors

j) Laws, taxation, incentives, government politics etc.

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

YOU ARE REQUIRED TO STUDY AT LEAST ONE OF THE QUESTIONS BELOW: 2.5 OR 2.6 OR 2.7 (a and b).

2.5 *The degree of labor-intensity, defined as the ratio of labor cost to capital cost, is a characteristic of the service process. Capital-intensive service providers (such as airlines, trucking, hotels, hospitals) should plan for capital investments, should monitor technological advances, and schedule demand to maintain utilization of the equipment. Labor-intensive businesses (such as schools, retailing, architects, consultancy) should plan for investment on the human capital such as recruitment, training the personnel, or scheduling the workforce.*

If your practice firm is operating in a capital-intensive service business does the top management have plans and proposals for capital investment? If so, state what these investment plans are. If not, explain why top management is not currently considering such plans. What evaluation methods and criteria are (or should be) used to select among several alternative investment proposals? Is there a procedure to take into account the effects of inflation in considering future investments? Provide an example as to how investment alternatives were evaluated in the past. If such a procedure is not used, propose and justify a selection procedure.

If the firm is operating in a labor-intensive business, describe how the recruitments are planned and based on which criteria the recruitments are done. Is there a training program for the personnel?

2.6. *Technology covers all the knowledge (principles, procedures, reasoning etc.) and means (equipment, tools, components) of producing desirable outcomes from various inputs under given conditions. Whether labor-intensive or capital-intensive, service firms invest in new technology to improve or to entirely change the process. Technology may be applied at four different points in the service process: (i) Processing the customer (e.g. medical), (ii) Processing the customer's equipment or material (e.g. money), (iii) Processing information, and (iv) Creating new services.*

How did the firm obtain its know-how and/or technologies? Have there been any improvements, upgrades or renewals in major procedures, processes and technologies? Does the firm use any licensed trademarks, patents, technological know-how, titles, etc.? Describe briefly and exemplify any limitations imposed by the providers of technology or providers of registered trademarks.

2.7.a. *Services can be redefined through innovations. Service innovations may not get as much attention as manufacturing innovations, because most of them depend on social innovations, i.e., innovations that create new types of social behavior. Driving forces that provide a basis for innovation have both internal and external components. For example, Sony walkman combines technology innovation (an internal driver) with new lifestyles (an external driver), ATM combines client participation (an internal driver) with need for efficiency (an external driver).*

How are innovations for new services/processes being done? Is there a unit or activity involved in research and development (R&D) for services/processes in the firm? If so, describe its status regarding its human resources, machinery/equipment, library and budget.

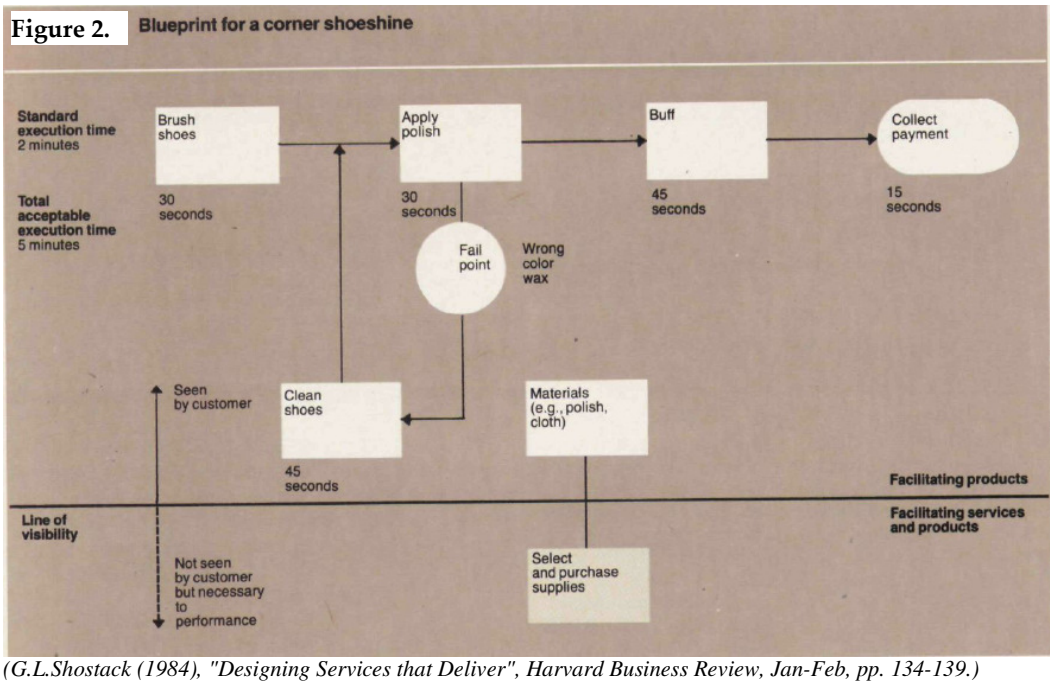
b. *The search for development, adaptation and implementation of technologies is mostly taken as projects in organizations. A project could be defined as a series of related jobs usually directed toward some major outcome, requiring a significant period of time to perform and it often consists of capital investments and/or activating changes in organizational procedures through various stages. Project management can be defined as planning, directing and controlling the resources of people, equipment, material and money to meet the technical, cost and time constraints of the project. PERT/CPM oriented techniques are frequently used for project management.*

How is project management exercised with respect to capital investments or technology adoptions?

3. AN OVERVIEW OF THE SERVICE SYSTEM

3.1 *A productive system takes inputs and transforms them into outputs. The transformation process is, in fact, a flow process of input materials (i.e. resources) and information. A service blueprint describes a service system. It is a flowchart of all transactions that form the service delivery process. A flowchart consists of components such as processing of information, interaction with the client or decision points.*

For some service systems it is possible to differentiate the front office, where customers obtain tangible evidence of service, from the back-office, which is out of customer view. In Figure 2, the service blueprint for a stylized service process is shown. In the figure, the "line of visibility" separates the front-office from the back-office.



(G.L.Shostack (1984), "Designing Services that Deliver", Harvard Business Review, Jan-Feb, pp. 134-139.)

Provide a service blueprint of a part of the service process in your practice company.

3.2 *In a productive system, productivity can be defined as the ratio of outputs to inputs. However in systems where the inputs and outputs are various and intangible it is not meaningful to take that ratio as a productivity measure. Think about a hairdresser, to evaluate operational efficiency, number of customers serviced per hour might be a possible measure. However, each customer would have a different resource requirement and the service provided might differ in terms of time and value. Measures such as profitability or return on investment may not be good indicators for operational efficiency.*

How is the productivity of a service unit is defined and measured in your practice organization? What other measures can you think about?

3.3 *Service processes can be classified based on (i) Divergence (standardized versus customized service) (ii) Customer contact (iii) Nature of the service (continuous delivery versus discrete transactions) and (iv) Labor-intensity (labor- vs equipment-intensive).*

Services with low degree of labor-intensity and low degree of customization are named service factories (airlines, hotels), services with low labor intensity but high customization are named service shops. The analog of service shop in a manufacturing system is job shop, and an example for service shop is auto-repair.

Services with high labor intensity and low customization are named mass services. The analog in a manufacturing system is flowshop, and examples are retailing, education, cafeteria, university registration. Services with high labor intensity and high customization are called professional services. The analog in a manufacturing environment is project shop and examples are consultancy (e.g. lawyers, architects), software development, or preparing for a banquet.

Services might be continuously delivered (police or fire protection, insurance) or discretely transacted (mail service, movie theater). The analog in a manufacturing system is continuous processes (such as steel, cement, sugar) versus discrete-part or assembly manufacturing (such as automotive).

Usually one would expect a highly customized service to require high customer contact. However, there are some service types that might be customized but do not require any customer contact (auto-repair), or that are standardized but require direct customer contact (giving a lecture, withdrawing cash from ATM).

Explain the type (combination of types) of services in your practice organization.

3.4 *The types of layouts in a service system can be as follows:*

In fixed-position layout, the customer or item stays in one place while the material and equipment are brought to that place. Examples are a house to be decorated, a roof to be repaired, or a surgery operation. Sometimes the nature of the equipment does not allow for mobility, for example heavy, expensive hospital equipment for kidney dialysis requires the patients to a fixed location. Another type of layout is process layout where the equipment with similar functionality are grouped at one place. Examples are hospitals, beauty parlors. Retail stores group all similar products such as hardware, sporting goods, and photographic equipment in separate departments for ease of supervision and access by customer. In a product layout the number of services provided is limited. The services are sequenced so that a smooth flow of the customers through the stations is maintained, and bottlenecks can be avoided by balancing the time required to receive each piece of service. An example is the student cafeteria where several food stations and a cashier form the sequence of services. Fixed-position layout, process and product layouts exist in manufacturing systems as well. Several other layout types that are specific to service systems are office layout, retail stores and warehouses.

Discuss the type or combinations of the types of layout you have observed in your practice organization. Draw a block plan of your practice organization.

3.5 *Based on the determination of standard times for each service, unit-service costs can be estimated. There are three basic cost elements: direct material cost, direct labor cost and overhead cost. Unit-service cost can be calculated as:*

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

Are unit-service 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 services. What difficulties exist for estimating the cost of customized services?

3.6 *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.

4. PLANNING AND CONTROL SYSTEM

(YOU HAVE TO REPORT ON AT LEAST THREE QUESTIONS OF CHAPTER 4.)

Planning and control can be viewed as a system. It contributes to the overall objectives of the organization through its impact on the cost, volume, quality and timeliness of service operations.

Planning and control consists of interrelated and interacting subsystems. They need to operate and behave in harmony so that the overall planning and control system is more than just the total of their outcomes. Some of the subsystems that can be found in most planning and control systems are:

- *forecasting*
- *aggregate planning*
- *inventory planning and control*
- *detailed scheduling*

4.1 *Forecasting is a basic element of management decision making. Indeed, virtually every significant management decision is predicated on some forecast of the future. At the corporate level, forecasting forms the essence of long range planning. Within the functional areas, finance and accounting rely on forecasts of demand for budgetary planning and cost control. Operations management uses forecasts in making decisions regarding facility layout, demand smoothing, capacity planning, inventory management or scheduling.*

In a service environment forecasting the demand may not be easy, especially if the service is highly customized. In that case it might be necessary to forecast several variables such as the number of customers requesting service, the amount of workload in the service, the variety of services provided, or the units of product supplied. For example, in a retail store each customer purchases a bundle of goods with possibly different size and mix, therefore it would be useful to forecast a variety of variables such as demand for each product (per unit time), the number of customers visiting the store (per unit time), size and mix of the bundles (per customer), etc. These forecasts help making decisions regarding the layout of the front- and back-stores, inventory management of the products, or replenishment quantity and frequency of the shelves.

Discuss the forecasting activities of the firm. Identify purposes of forecasts. Provide the forecasting methods that the firm uses. Choose an example of forecasting activities and specify factors such as: the need for forecasting, sources of data or method of collecting opinions, any model used, forecast accuracy measurement and computer support in forecasting. If there does not exist any forecasting activities, identify the variables that you think should be forecasted. Also suggest a method for forecasting and discuss how these forecasts would support decision making. Be specific in your suggestions.

4.2 *In service systems, matching capacity and demand is a challenging task. The reason is service is a customized product which cannot be stored, and demand is highly variable and hard to predict in nature and cannot be backordered for a long time. It is important to manage service capacity by defining appropriate operations strategies, and to smooth and manage demand by designing marketing strategies.*

a. *Demand management: In service industries, demand can be manipulated by strategies such as promotions and price incentives, yield management, postponement, or design of complementary services (to generate demand). For example, under certain utility tariffs, a high price is charged for electricity for peak-load hours and low price is charged for off-peak hours of the day, which helps to smooth demand. Yield management is a practice first adopted by firms with constrained capacity (such as airlines). The aim is to dynamically set the prices over time and with respect to customer segments, to manipulate demand and to increase revenues. Reservation (which is practiced by hotels, travel agencies) decreases the randomness in demand and enables postponing the demand to available time slots. Designing complementary services, such as adding bar in a restaurant, or adding a fast-food corner in a retail store helps generating demand and prevents loss of customers due to temporarily insufficient capacity.*

How variable is demand in your practice company? What are the causes of fluctuations in demand? What are the situations that lead to insufficient capacity? Describe how demand is managed and what kind of tools are (or should be) used to smooth demand. How does it help to match demand with service capacity?

b. *Control of service: Operations strategy defines ways to increase capacity utilization by controlling the service supply. In service systems, to meet surge demand the capacity level is changed by changing the workforce level rather than investment in equipment. Firms may prefer using adjustable, part-time and/or cross-trained*

workforce for that purpose. In analogy to cross-trained workforce, a portion of capacity might be made variable. For example, airlines move the partition between first-class and economy to meet the changing mix of classes. Other ways to increase capacity utilization is to share the capacity with other companies (for example airlines form alliances to share flight capacity), and to increase customer participation in service process (designing self-service systems such as ATMs, to eliminate personnel who serves food in fast-food restaurants). Customer participation creates service capacity at the moment it is required.

Describe the operations strategy in the company regarding the control of service capacity. Discuss the advantages and disadvantages of these strategies.

4.3 *In service systems inventory might be kept for several purposes: Many service processes use certain input materials which should be inventoried to match demand with supply. For example a hospital must stock items such as syringes, bandages, or medicine. Some services may supply a tangible product besides the intangible product, which could be inventoried. For example, in a restaurant some amount of output must be kept in stock to provide prompt service. In knowledge industry the service process involves production of information which must be stored. For example a publisher uses ink and paper as input materials (i.e resources) and the output is books or newspapers. A consultancy firm produces outputs in the form of reports. In service industries often times the inventory is perishable.*

a. *Inventory of input materials is managed through an inventory control policy. In a continuous review inventory control policy, the inventory position is monitored after every transaction, and stock replenishment decisions are not necessarily regularly scheduled. In the periodic review policy, replenishments are done at equally spaced points in time (although the inventory could possibly be monitored continuously).*

Define major items of input material and output inventories by their functions. Explain reasons (uncertainty, seasonal fluctuations, cycle stocks, quantity discounts, pipeline effect, etc.) for holding these items. Justify any one of the items' inventory, stating what would happen (cost, time losses, faulty processing, transportation difficulties, etc.) if that inventory were not carried. Discuss the inventory control policies exercised in your practice organization for the major input materials you specified above. How would you measure the performance in managing these inventories? Propose and compute the value(s) for at least one such measure.

b. *In a manufacturing system, the output inventory serves as a buffer between the production and demand and absorbs the fluctuations in demand. In a service system excess capacity serves the same purpose. However, keeping buffer capacity is a costly option and sometimes customer waiting is a more preferred choice. When managing the service system the firm must carefully balance the cost of buffer (idle) capacity and the cost of customer waiting.*

Explain how the decisions regarding keeping buffer capacity and customer waiting are given in the company. Does the firm allow for customer waiting? Under which conditions does customer waiting occur?

4.4 *A recent trend in manufacturing management that also started to find some implementation in services is the application of Just-in-Time (JIT) philosophy. The objective of JIT is to work towards reducing organizational slacks carried to assure a smooth operation (for instance, large inventories, extra allowances for scraps, buffers among machinery, promising extended delivery dates, excessive supervision, redundancies in record keeping, etc.) ideally to a zero level in all activities. This is to be achieved in gradual steps through the process of <u>continuous improvement</u>.*

Are there organized and focused studies for the purpose of reducing such undesired "slack"? If yes, describe an example. If no, state an example of allowance or slack you have observed, that is used in the organization to assure safe (uninterrupted) operation. What do you think has caused the need for such an assurance?

5. QUALITY PLANNING AND CONTROL SYSTEM

5.1 *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. Quality can be defined as a dynamic state associated with products, services, processes, environments and people, that meets or exceeds expectations.*

According to research (Parasuraman et.al, 1985), the consumers assess the quality of a service based on characteristics such as reliability, responsiveness, competence, empathy and tangibles. Reliability involves consistency and dependability of a service (for example in a restaurant the billing must be accurate). Responsiveness concerns the timeliness of the service. Competence is about the knowledgeability and skill of the

personnel that provides service. Empathy includes attributes such as approachability of the personnel and how concerned the personnel is about the problems of the customers. Tangibles are related with the physical environment, such as the facilities or appearance of the personnel.

Measuring the quality of a service is not easy due to the dominance of intangible (and psychological) factors. The customers have an expected level of service. Even if a company is able to perfectly identify the "expected service", in the process of service delivery discrepancies may occur, which may result in a gap between the perceived service and the expected service. This gap may also occur due to company's (mis)perception of the customer expectations, not being able to translate the perceptions into quality specifications, or not being able to communicate the specifications well. For example, if a company creates an image that increases the customer expectations, quality ratings would be low even if the company meets the internal quality specifications.

Explain how the organization defines quality of a service it provides. How are customer requirements translated into product or service specifications (or characteristics)? Provide examples.

5.2 *In service systems quality control uses tools such as histograms, process flowcharts (similar to service blueprints), Pareto charts, fishbone diagrams or process control charts. Recent trends in quality management focus on quality assurance that emphasizes the preventive aspects of quality management (such as identifying the customer expectations and designing the service to meet those expectations). Quality is viewed as the job of everyone, and continuous improvement towards the eventual goal of meeting and exceeding customer expectations is a basic principle of the modern quality management approach.*

Describe the quality control activities that take place throughout the life cycle of a service. If the firm does not employ any quality control methods make suggestions on how to monitor the quality of the service. Describe and discuss how responsibility of quality is shared in the firm (quality organization).

6. MANAGEMENT INFORMATION SYSTEM

YOU HAVE TO REPORT ON AT LEAST TWO QUESTIONS: 6.1 AND EITHER 6.2 OR 6.3.

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

a) Strategic level decisions (e.g. plant expansion, determination of service mix, mergers, diversification, capital expenditures, etc.).
b) Tactical level - implementation of plans (e.g. allocation of resources through scheduling, formulation of budgets, funds flow analysis, layout decisions, personnel problems).
c) Operational level, day-to-day routine operations (e.g. scheduling, inventory 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. Explain how data is used (i.e. gathered, recorded, organized and processed) to support decision making for each of the examples you provided.

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

Identify the computer system (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. Take a particular division or department that has access to a computer (as a system, as connected to a network or as a stand-alone computing facility). Itemize types of data recorded and processed.

6.3 *The effectiveness of a computer and the ease with which it can be utilized depends upon a number of factors such as the mode of operation of the computer system,*

availability of high level language compilers, application programs (utility programs, file handling software, database management system software) and so on.

Identify the software used in the firm. Name a few application programs available in the organization for enterprise wide application (Enterprise Resource Planning (ERP), reservation system, stock keeping, accounting etc.) except standard office programs (word processors, spreadsheets, presentation organizers). Discuss the level of decision supported in light of section 6.1. Give an example of what is performed based on that specified software.

7. WORK STUDY

YOU HAVE TO REPORT ON AT LEAST ONE QUESTION: 7.1 OR 7.2.

7.1 *Work Study is a term used for those techniques, particularly method study and work measurement, that are used in the examination of human work in all its context and lead systematically to the investigation of all the factors which affect the efficiency and economy of the situation being reviewed in order to bring improvement.*

Method study is the systematic recording and critical examination of existing and proposed ways of doing work as a means of developing and implementing easier and more effective methods and reducing costs.

Work measurement is the application of techniques designed to determine the time needed by a qualified worker to carry out a specified job at a given performance level.

Work Study is mostly used to increase production using a given quantity of resources with little or no further capital investment. In other words, it deals with increasing the productivity. Through the tools and techniques of work study, basic standards and operation routings are developed that will improve planning and control.

Apply two of the work measurement techniques (stopwatch, predetermined time standards or work sampling, etc.) to a worker or a member of the office staff that works on repetitive tasks and evaluate the results.

Apply method study to define more effective methods.

7.2 *Jobs within an organization are not all alike. Some are more demanding physically, some require unusual mental skill; some must be performed under unfavorable working conditions. 'Job Evaluation' is a systematic procedure for establishing a hierarchy of jobs. A 'Job Description' gives a brief definition of the job and presents a detailed account of the job content based on the results of job analysis. A 'Job Specification' describes the skills involved in the job and other mental, physical, educational requirements that the job demands from the worker.*

Job Evaluation studies are used in classifying workers and staff into 'wage groups'. Since the requirements of each job are described in detail, the findings are also taken into consideration in the execution of employment and training activities of the firm.

Has there been any 'Job Evaluation' study in the firm? If so, discuss briefly the method and the current implementation of the findings of the study. If not, explain how the wage differentiation among the personnel is determined.

8. CONCLUSION

8.1 *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, 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. What was the most difficult part in your study of a potential IE problem?

If you had another four weeks 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.

8.2 *You are required to fill out the 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.*

APPENDIX A

A NOTE ON THE DEFINITION AND FORMULATION OF INDUSTRIAL ENGINEERING PROBLEMS

You are required to identify, define and formulate an industrial engineering problem. The problem may be related to one or more areas of interest in industrial engineering. The problem has to be examined with its specifics for your practice organization.

You are advised to take the view outlined below (an excerpt from "Notes on System Design" by Prof. Dr. Çağlar Güven, February 1998) in identifying and describing a problem:

Engineers are expected to 'solve problems'.. To see what this means we can adopt a simplified view: a problem is something that needs a solution but does not have one. At first sight the difficulty seems to be finding a solution but as far as IEs are concerned, often that's not even half the difficulty. Forget about well-defined textbook problems and solutions. Real-life problems have a bothersome habit: they don't come singly. They stick firmly together and often we cannot tell one from the other. Instead we observe a tangled web, and as we do so, we have to try hard to catch glimpses of individual problems. The usual inclination is to forget about the other problems in the web once we believe we have identified one. We shall say more of this later; for the moment let me put it like this: it may very well be better to spend more of your time trying to identify and structure issues than trying to solve problems. In any given problem situation there will always be more than one issue involved. Consider for example, the design of a fast-food outlet: Forecasting the demand for food ingredients, scheduling the staff, pricing the foods, capacity planning, planning daily purchases, selecting a location, training the staff and several other aspects similar to these are the issues you have to consider. Which ones are you going to address? Structuring an issue means studying and selecting one for further analysis using models within a systemic framework. The reason why structuring issues is at least as important as solving problems can be explained as follows: We do not really know what we mean by a solution. When we talk about a problem we imply that there exists a set of conditions that is less than satisfactory and needs improvement. The nature of the improvement however is often not clear at all and the dynamics of the improvement process is equally complicated. The end result is obtained one way or another and is likely to be the product of the joint effort of many people. One

might say then that suggesting questions can be more important, potentially more originative, than suggesting answers. In this way issues will be unfolded that might otherwise have gone unnoticed. It all comes to this: an IE will perhaps be most useful if she can point out meaningful problem areas and if she can structure them; the rest will be collectively taken care of by the organization, one way or another. But even so, this does not mean that you can forget about looking for solutions altogether; for you see, looking for solutions is in fact part of looking for problems.

1. Identification and Definition of the Problem

Various industrial engineering problems exist in a production environment as interwoven with each other. Deficiencies occurring in production planning may be the consequence of ill-structured forecasting done by the marketing department. The problems encountered, say in raw material inventory holding, may be the result of economic crisis experienced in the sectors providing the raw material. The low utilization of machinery may be due to high level of absenteeism among workers for which the major reason could be poor industrial relations. Deficiencies in production planning, problems in raw material inventory holding, and low utilization of machinery are all symptoms of the problems.

Problems are identified by observing such symptoms through a careful analysis of the existing system. A trouble-shooting exercise is essential in order to define an industrial engineering problem. Possible causes of the symptoms should be studied. Observations of symptoms should be validated by objective measurements (e.g.: low utilization of machinery should be proven by data collected on utilization rates). 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 an industrial engineering problem. In studying the problem situation you may use the following analysis tools:

- cause-effect diagrams (fish bone diagrams)
- pareto analysis
- relations diagram
- logic tree analyses
- flowcharts
- check sheets

- rich pictures
- brainstorming
- run charts
- influence diagrams
- multivoting
- nominal group technique
- stratification
- affinity diagrams
- precedence diagrams

2. Formulation of the Problem

At the end of the first step, you should have identified the virtues or benefits, pitfalls, shortcomings or disadvantages of existing practices pinpointing functions that are partially or completely lacking. Such an evaluation forms the basis for the redesign and improvement of the existing system.

A clear formulation of a problem starts with:

- an exact description of the decision maker (owner of the problem),
- the goal or the objective (direction of and satisfactory amount of improvement) of the decision maker,
- performance criteria (to be used in evaluating goodness of a solution in achieving the objective),
- an identification of alternative courses of action (to achieve the objectives), and
- a clear recognition of the limitations, restrictions and requirements of the system. An analysis of the interactions of the problem with various subsystems in the firm can also be carried out during this phase.

You are encouraged in this formulation stage to think and comment about specific modelling approaches appropriate for the problem you defined.

APPENDIX B

A NOTE ON REPORTING ABOUT A PARTICIPATED PROJECT DURING THE SUMMER PRACTICE

You may have taken a role within the scope of industrial engineering on an ongoing project in your practice organization. Instead of identifying and formulating a separate problem, you may report on this project and your specific part in it. However, you are required to verify that the project is in a relevant area of interest with regard to industrial engineering and that a well identified problem had initiated the project work.

If the project you participated in is completed, you are required to submit a report consisting of at least the following sections:

- Introduction (Products/Services/Manufacturing/Service Provision processes addressed in the project, context of the problem, composition of the project team)
- Problem statement (Description of what issue was tried to be solved/improved/implemented, its relevance as an IE problem)
- Approach Taken (what stages were initially planned for the project, why and how were they modified during the work on the project, your role specific within the approach)
- Summary of Work Done (a sample list of data gathered or facts collected and analyzed, methods used in these, typical results of calculations/experiments/ estimations etc.)
- Conclusions and Recommendations (Outcomes of the project, Suggestions made, initiated actions, extensions of the results, your evaluation of the outcomes)

If the project you participated in was still in progress at the end of your practice period, you are required to submit a report consisting of at least the following sections:

- Introduction (Products/Services/Manufacturing/Service Provision processes addressed in the project, context of the problem, composition of the project team)

- Problem statement (Description of what issue was tried to be solved/improved/implemented, its relevance as an IE problem)
- Approach Taken (what stages were initially planned for the project, your specific role within the approach)
- Project Schedule (a project activity network or a Gantt chart)
- Work Done To Date (a sample list of data gathered or facts collected and analyzed until the time you quit the organization, methods used in these, typical results of calculations/experiments/ estimations etc. done that far in time)
- Expectations of the Outcomes (Prospective benefits, your evaluation of the outcomes)

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