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PLANT SURVEYS AND FACTORY PLANNING

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Turning from peace time to war time production involves a series of economic-industrial phenomena certain of which it is practically impossible to measure or evaluate with any reasonable degree of accuracy. Some cannot even be planned for in advance in any great detail because of the ever-present element of change in our economic structure. There is substantial agreement that problems such as these will constitute the major proportion of the agenda put before a future War Industries Board, or whatever you wish to call it.

On the other hand, there are certain aspects or phenomena that are susceptible to very definite treatment and can be planned for in advance in some detail. These constitute the order of work of the procurement function during peace time. Industrial operations and industrial planning today are being carried on with a precision and an exactitude never before achieved. There has evolved a rather definite technique of industrial management with which you, as procurement officers must be familiar before you can effectively control the industrial forces you may some day be called on to utilize for military production.

The determination of how best to utilize industrial capacity for war production is something that lends itself readily to definite treatment. The best utilization of a facility involves, first, its allocation to the production of a class of material for which presumably it is best suited. Secondly, there must be developed a plan that will insure the attainment of maximum productive efficiency in minimum time. The means to these ends are (1) Plant Surveys, and (2) Factory Plans.

In the course of studying and developing these means to the ends sought, sight must never be lost of the fact that all such planning is, or should be, in terms of present knowledge and practice only. It is consequently subject to all the elements of change growing out of our dynamic economic system. Concrete illustrations of what this involves will be given at appropriate points in my remarks.

1. From the standpoint of military procurement, a plant survey involves coordinated knowledge of the capabilities of

a. Six major elements that comprise a plant

A Physical plant
B. Motive power
C. Materials
D. Men
E. Transportation
F. Management control.

b. Management control the element on which all other elements depend for that coordination that yields maximum efficiency.

2. <u>The physical plant.</u>

a. Object

A. Not to discuss machine practice
B. But to indicate important principles that operate in the selection of any capacity for any job

b. Location of the plant
A. Factors of location - primary and secondary

Military Standpoint	Civilian Standpoint
Raw material	Market (critical)
Labor	Raw material
Power	Transportation
Transportation	Labor
Market (Theatre of Operations)	Power

B. Once alike - now different because
(1) Wider markets
(2) Distribution more important than production
(3) Power and labor more easily brought in

C. Future military procurement over a wider area
(1) Big inflexible plants no longer economic
(2) Many smaller ones closer to the market
(3) Study of wide regions heretofore not considered
(4) Utilization of capacity totally out of line with military set-up above
(a) Careful study to adapt to best advantage
(5) Benefits of this diffusion
(a) Reduces congestion at vital centers
(b) Reduces effect of capture or destruction of a portion of industrial capacity.

c. Equipment - two classes
A. Processing equipment
(1) Machinery
(a) Its adaptability to the job for which the plant is being surveyed.
(b) Extent to which it must be supplemented by special equipment.

(c) State of repair (maintenance)
(d) Obsolescence - comparison with latest types and practices.

(2) Tools, jigs, fixtures, and auxiliary equipment
(a) Adequacy of supply - number and design
(b) Conformity with best practice
(c) Maintenance and availability

B. Material handling equipment
(1) Internal transportation means as they
(a) Improve layout
(b) Improve process technique
(c) Permit handling of larger production units
(d) Assist in shipping final product

(2) Handling equipment at the workplaces
(a) Largely from the standpoint of conserving time of skilled labor

C. Age of machinery and equipment
(1) Important because of its bearing on
(a) Maximum capacity of equipment
(b) Degree of precision attainable
(c) Time lost for repairs
(d) Availability of spare parts
(e) Adaptability to several types of operations e.g., chucking machines on turret lathe work that can be switched over to wire feed or bar feed equipment, or gear cutters that will cut spiral, straight, spur and shoulder gears, or do gang arbor work.

(2) Sturdiness to withstand modern tooling
(a) Effect of introducing high speed steel
(b) Now vidia and cemented tungsten carbide cutting metal
Brass 8 1/2 Forged steel 4 1/2
(c) Many machines less than five years old will not hold up under the tooling that research has made available.

(3) Reduced production from psychological effect that obsolete equipment produces on skilled workers

D. Idle time analysis
   (1) A good check on your observations
   (2) Reveals weaknesses of management control of equipment

d. Layout
   A. Modern principles
      (1) Relate all processes to each other and to the site
      (2) Establish the layout first, then build
      (3) Give due regard to change and flexibility
         (a) This increasing tendency will facilitate future assignment of factories to military production.

   B. Classification of industries according to layout they require
      (1) Continuous All material received at one point from which successive operations turn it into the finished product.
         (a) Analytical Break up - petroleum, sugar, coke, cottonseed oil, etc.
         (b) Synthetic Add together - yarn, paper, explosives, etc.

      (2) Assembly Make various components by different operations and bring them together.
         (a) Similar Similar operations - clothing
         (b) Dissimilar Components are dissimilar and go thru different operation - shoes, automobiles, artillery small arms, ammunition.

   C. The ideals toward which layout should strive
      (1) Proper balance of departments and operations
      (2) Group production centers rather than individual work places.
      (3) Direct line layout wherever possible
      (4) Short moves
      (5) Adequate internal transportation
      (6) Convenient service centers (loss of time)
      (7) Provision for future expansion

   D. How to check for inadequate layout.
      (1) Congestion points
         (a) Too many operations at one point

(b) Inadequate equipment for one or more operations (unbalanced shop)
(c) Inadequate materials - in-process space
(d) Inadequate materials handling equipment

(2) Product recrossing path or backtracking
(a) Certain amount unavoidable in assembly industries, increases with range of products.
(b) Two schools of thought
<u>One</u> Avoid it everywhere - single machines wherever needed - complicates supervision and inspection
<u>Two</u> Group all similar machines regardless of path of product
(c) A degree of compromise must be selected which under careful observation will produce the best results at least cost.

e. Plant working conditions
A. Lighting - get facts and details from N.E.L.A.
(1) Important because of
(a) Social effects
(b) Production effects
(2) Results of defective illumination
(a) Loss of production
(b) High spoilage rate
(c) Present and future capacity of workmen is materially decreased
(d) Accident rate is increased - caution further decreases production
(e) Effect on general character of work cleanliness, health, psychology
(3) Ideals by which good lighting is obtained
(a) Effective use of natural lighting, supplemented by effective artificial lighting wherever necessary.
(b) Correct intensity for each type of operation (tables N.E.L.A.)
(c) Elimination of glare and proper use of reflectors
(d) Proper diffusion (no lights and shadows)
(e) Proper color
(f) Proper arrangement of lighting sources
General, Group, Local — Spacing of outlets; Tables of lumens

B. Plant ventilation and air conditioning
   (1) Atmosphere directly influences production by affecting both worker and process
      (a) Huntingdon "Civilization and Climate"
      (b) Society of Heating and Ventilating Engineers
   (2) Quantity of ventilation
      (a) 3000 cubic feet of air per hour per person
      (b) Change three to five times per hour without draft
   (3) Relation of temperature and humidity to production
      (a) Insufficient humidity increases heating costs, drys the tissues and increases the possibility of colds in winter.
      (b) Proper humidity counteracts these.
      (c) Tables of optimums of temperature and humidity have been developed for various classes of factory work.
   (4) Modern industrial air conditioning a mechanical process designed to
      (a) Overcome outside weather conditions
      (b) Compensate for process conditions
         (A) Dye house
         (b) Forge shop
      (c) Operate by thermostats controlled by wet and dry bulb thermometers

C. Safety, sanitation and health protection
   (1) Publications and work - National Safety Council
   (2) State codes - American Standards Association
   (3) Sub-course on industrial health and sanitation

3. Motive Power - bare outline of checking points

   a. Make or buy - depends on
      A. Load factor - ration average power used to peak power used
      B. Power factor- ratio power apparently developed to power actually developed.
      C Existence of stand-by facilities

   b. Maximum present capacity in either case

   c. Future increases in capacity - are they readily possible?

   d. What is the likelihood of other war time demands for power in that area and will maximum potential capacity take care of it?

e. Fuel or water supply that generates power
   A. Adequacy
   B. Protection from capture or destruction

f. Undeveloped hydroelectric or minemouth possibilities

g. Power transmission and utilization within the plant
   A. Three methods
      (1) Single motor main drive
      (2) Group drive
      (3) Individual motor drive
      No hard and fast rules for application or choice

   B. Maintenance work important to check losses
      (1) Development of a routine inspection to check
         (a) Boilers and furnaces
         (b) Valves, glands, and bearings
         (c) Shaft alignment
         (d) Belt wear and tension
         (e) Worn gearing
      (2) Such a routine will pay for itself many times over because preventive repairs are always less expensive than breakdown repairs.

4. Materials

a. Sources
   A. Effect of a war on
      (1) Continued supply
      (2) Availability of transport
   B. Availability of substitutes
   C. Possibility of priority preference in war program

b. Storage
   A. Three types of storage
      (1) Raw materials (true stores)
      (2) Partly processed materials
      (3) Finished materials
   B. Problems of the storeroom
      (1) Location (a service center)
      (2) Layout
      (3) Arrangement of material in storeroom
         (a) By classification
         (b) By index
      (4) Bin construction
         (a) Flexibility
         (b) Taylor bins - certain good points

   C. Stores paper procedure
      (1) Bin tags - perpetual inventory
      (2) Balance of stores sheets
      (3) Handling receipts, issues, and returns
      (4) Relation to inventory control

5. Men
   a. The personnel function
      A. The centralized employment office has passed the debating stage
      B. Labor supply (number and quality)
         (1) Quantities according to age, sex, skill, etc.
         (2) Other sources that can be trained to the work
         (3) Adequacy of local transportation
         (4) Adequacy of housing to care for large influx
         (5) Livability - social and cultural advantages
      C. Employee training
         (1) Vestibule schools
         (2) Training in the shop
         (3) Training for promotion
         (4) Training minor executives and supervisors
         (5) Supervision of training should be centralized
      D. Employee service work
         (1) Welfare work taboo
         (2) Locker, wash and rest room facilities - meals
         (3) Health Service
         (4) Recreation

   b. Industrial organization today
      A. Fundamentals of organization
         (1) Primary
            (a) Regard for the aim of the enterprise
            (b) Definite lines of supervision
            (c) Fixed responsibility
            (d) Regard for the personal equation
         (2) Operating
            (a) Development of an adequate system (except)
            (b) Establishment of adequate records
            (c) Proper operating rules and regulations
            (d) Exercise of effective leadership

      B. Organization types
         (1) Military
         (2) Functional
         (3) Line-and-staff - along with
            (a) Committee idea
            (b) Advisory free lance
            (c) Military idea in some departments where quick results are necessary and you can find a man to carry the load

c. Standard practice instructions
   A. Advantages
      (1) Not easily misunderstood
      (2) Less likely to be forgotten
      (3) Fix responsibility for mistakes
      (4) Clarify ideas and insure careful thought
      (5) Changes usually bring improvements
      (6) Expedite routine to be followed
      (7) Ready reference for executive decisions

   B. Why they sometimes fail
      (1) Too many issued-wave during war
      (2) Not enough care in preparation
      (3) Preparation delegated too far down the line

d. Morale building versus morale destroying
   A. Too fine a division of authority or responsibility
   B. Too many supervisors
   C. Improper selection of personnel
   D. Over-reliance on organization charts
   E. Too few real executives

6. Transportation
   a. Dependency on one or more lines of communication

   b. Types of transportation available readily
      A Rail - steam, express, electric
      B. Water - river, bay, ocean, canal, lake
      C. Highway
      D. Air

7. Management Control

   a. Budgetary control

   b. Control of sales

   c. Control of inventories
      A. stores control
      B. Finished stock control
      C. Purchasing Department control

   Technique of co-ordinating, sales, purchases, and production

   d. Control of production
      A. Routing
      B. Scheduling
      C. Order of work and despatching

   e. Setting and maintaining standards
      A. Product (simplification)
      B. Raw material
      C. Equipment

D. Jobs
   (1) Time and motion studies
   (2) Setting standard times
E. Wage rates
   (1) On basis of time study data

DEFINITION OF MANAGEMENT - to leave the thought with you

Management is the correlation of details of operation of an enterprise so that it will work as a harmonious whole toward the desired goal.