ORGANIZATIONAL DESIGN
AND BEHAVIOR
(87139)

Technology and competences in OD

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Office hours
Thursday, 1-2 pm

From the Greek ***tekhné***, which means art, know-how.

Capacity of producing and transforming things and ideas.

Technology
a broad view

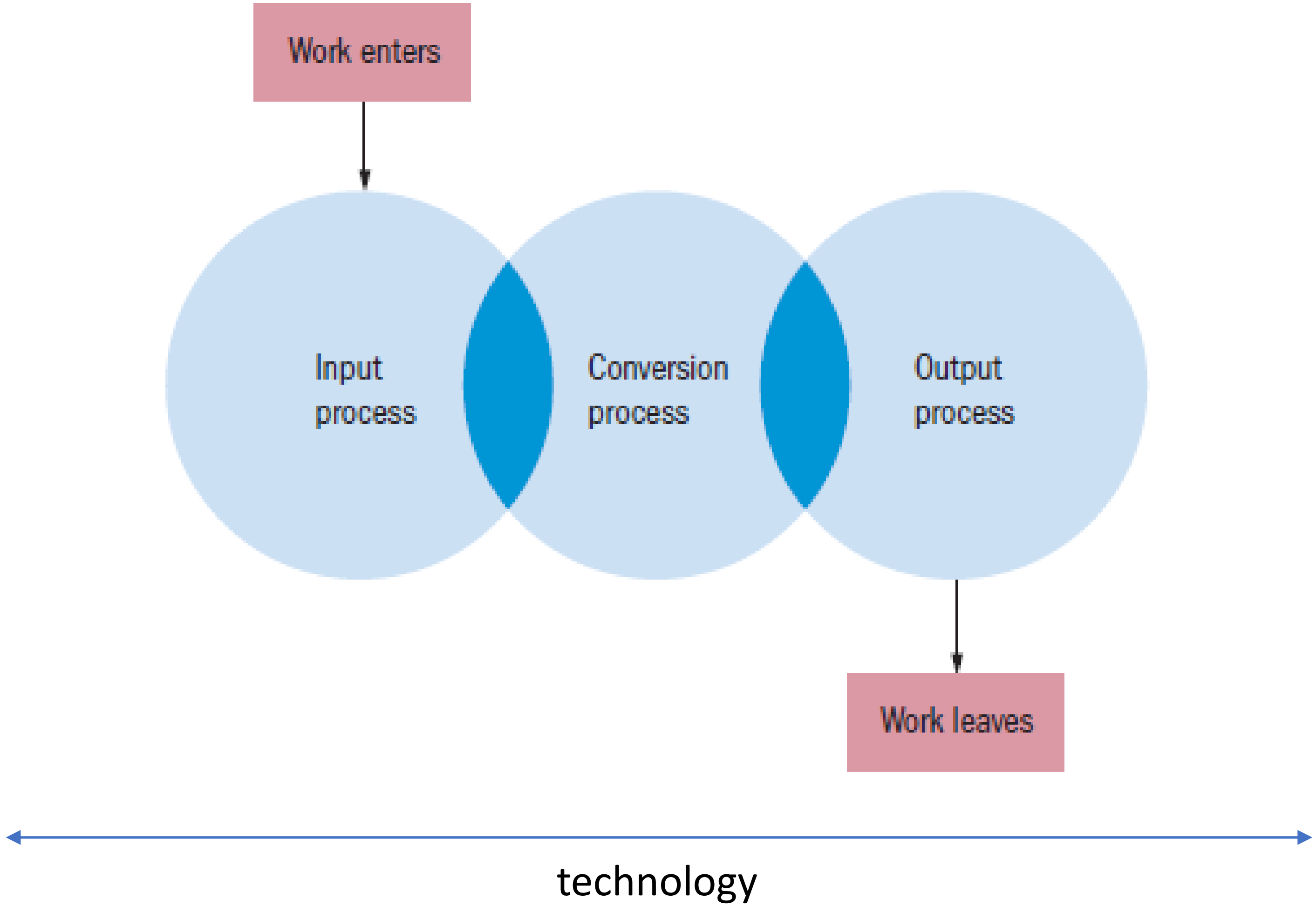
The combination of skills, knowledge, abilities, techniques, materials, machines, computers, tools, and other equipment that people use to convert or change raw materials, problems, and new ideas into valuable goods and services.

Two idealtypes of technology in organizations

Craftwork is the technology that involves groups of skilled workers interacting closely and combining their skills to produce custom-designed products.

Mass production is the organizational technology based on competences in using a standardized, progressive assembly process to manufacture goods.

Technology in organizational activities



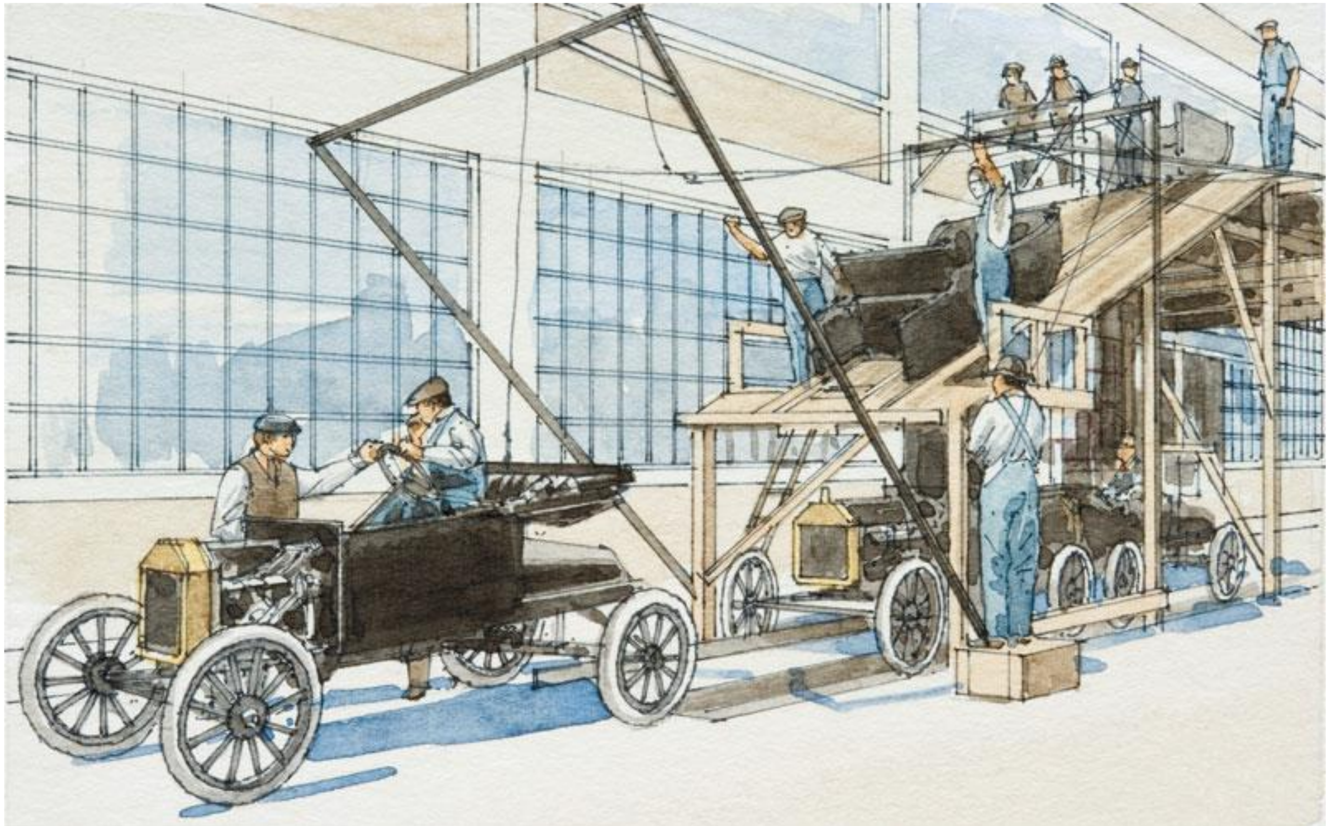
Technology in organizational activities #2

- **input stage:** skills, procedures, techniques, and competences — that allows each organizational function to effectively gather needed resources and manage the relations with the environment;

- **conversion stage:** a combination of machines, techniques, and work procedures that transforms inputs into outputs;

- **output stage:** technology that allows an organization to effectively dispose of finished goods and services to external stakeholders.

CASE 1
Progressive manufacture at Ford



Three theories about technology in organizations

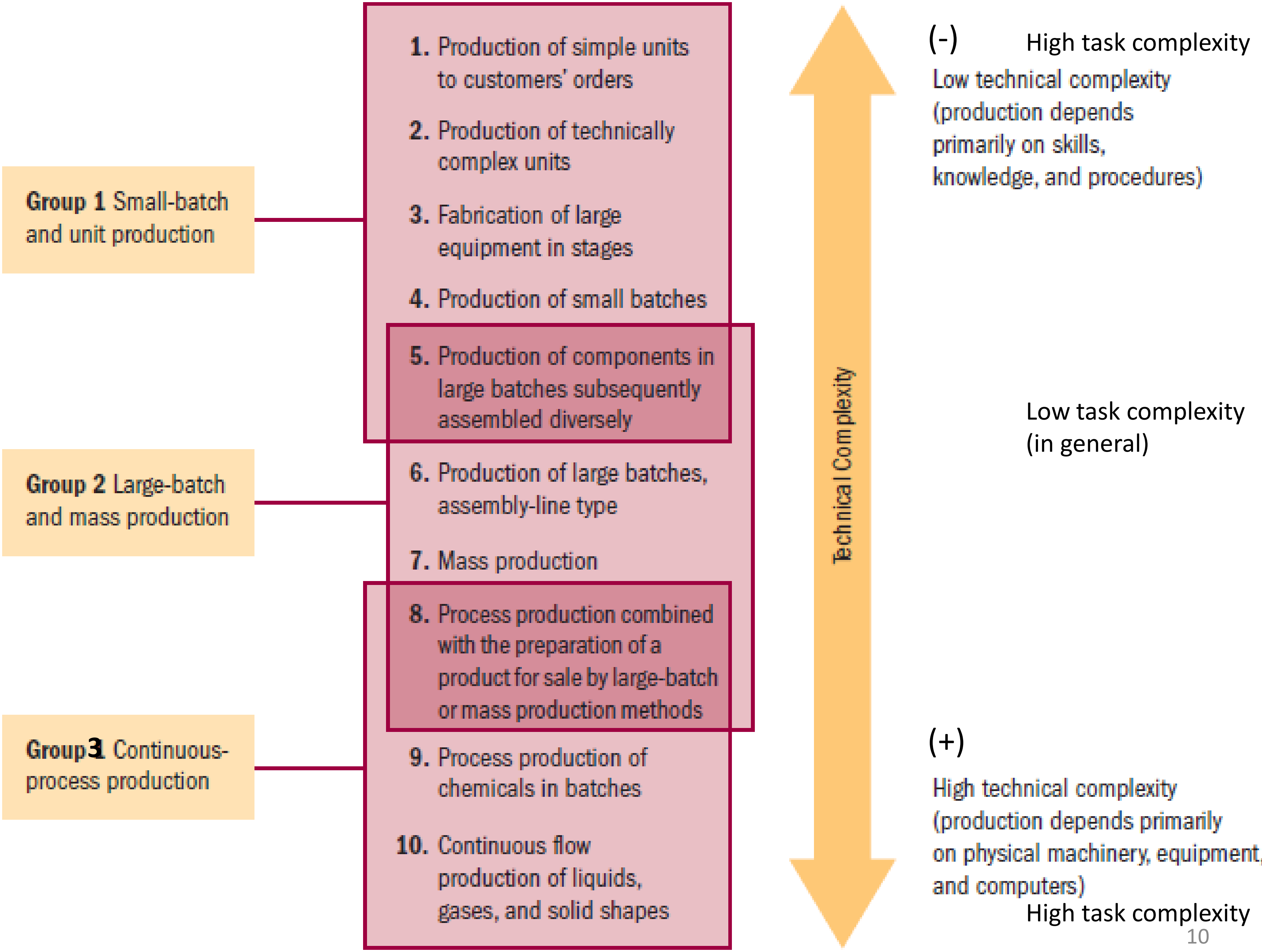
- Joan Woodward’s theory of technical complexity;
- Charles Perrow’s theory of routine and complex tasks;
- James Thompson’s theory of task interdependence.

Woodward's theory of technical complexity (1958)

Technical complexity of a production process is the extent to which it can be programmed through rules and SOPs, so that it can be <u>controlled</u> and made <u>predictable</u>;

High technical complexity --- > full automation of the production process;

Low technical complexity --- > when the conversion process has to rely mainly on people, their knowledge and skills.



Group 1 Small-batch and unit production
Group 2 Large-batch and mass production
Group 3 Continuous-process production
1. Production of simple units to customers' orders
2. Production of technically complex units
3. Fabrication of large equipment in stages
4. Production of small batches
5. Production of components in large batches subsequently assembled diversely
6. Production of large batches, assembly-line type
7. Mass production
8. Process production combined with the preparation of a product for sale by large-batch or mass production methods
9. Process production of chemicals in batches
10. Continuous flow production of liquids, gases, and solid shapes
Technical Complexity
(-)
High task complexity
Low technical complexity (production depends primarily on skills, knowledge, and procedures)
Low task complexity (in general)
(+)
High technical complexity (production depends primarily on physical machinery, equipment, and computers)
High task complexity

Small batch and unit technology

- machines used during the conversion process are less important than people's skills and knowledge;
- flexibility in producing highly customized products and services;
- because the work process is rather unpredictable and necessitate continuous adjustments, it is relatively expensive.

Large batch and mass production

- to increase control over the work process and make it predictable, organizations increase their use of machines and equipment;
- organizations that employ large-batch or mass production technology produce massive volumes of standardized products.

Continuous process technology

- the conversion process is almost entirely automated and mechanized;
- employees generally are not directly involved. Their role in production is to monitor the plant and its machinery and ensure its efficient operation;
- production continues with little variation in output and rarely stops.

Oil refinery in Turkey

Technical complexity and structure

- **Small batch and unit technology:**

limited span of control, small teams, few levels of hierarchy (3 or less), flat structure, high decentralization, face-to-face communication and mutual adjustment;

organic

- **Large batch and mass production:**

higher number of levels (4 to 7), span of control widens (tens of workers), rules and SOPs, decision making centralized, vertical communication to control workers;

mechanistic

- **Continuous process technology:**

limited span of control, strict supervision, tallest hierarchy (6 or more), rules and procedures but also mutual adjustment to react to unexpected situations.

organic-mechanistic

An extreme example: nuclear power plants

Some authors think that their structure is so complex (combination of organic and mechanistic features) that they should be closed, because ultimately they are not controllable.

This debate re-emerge especially in the case of nuclear disasters, such as those of Chernobyl and Fukushima.

Dresden generating station in Morris, Illinois

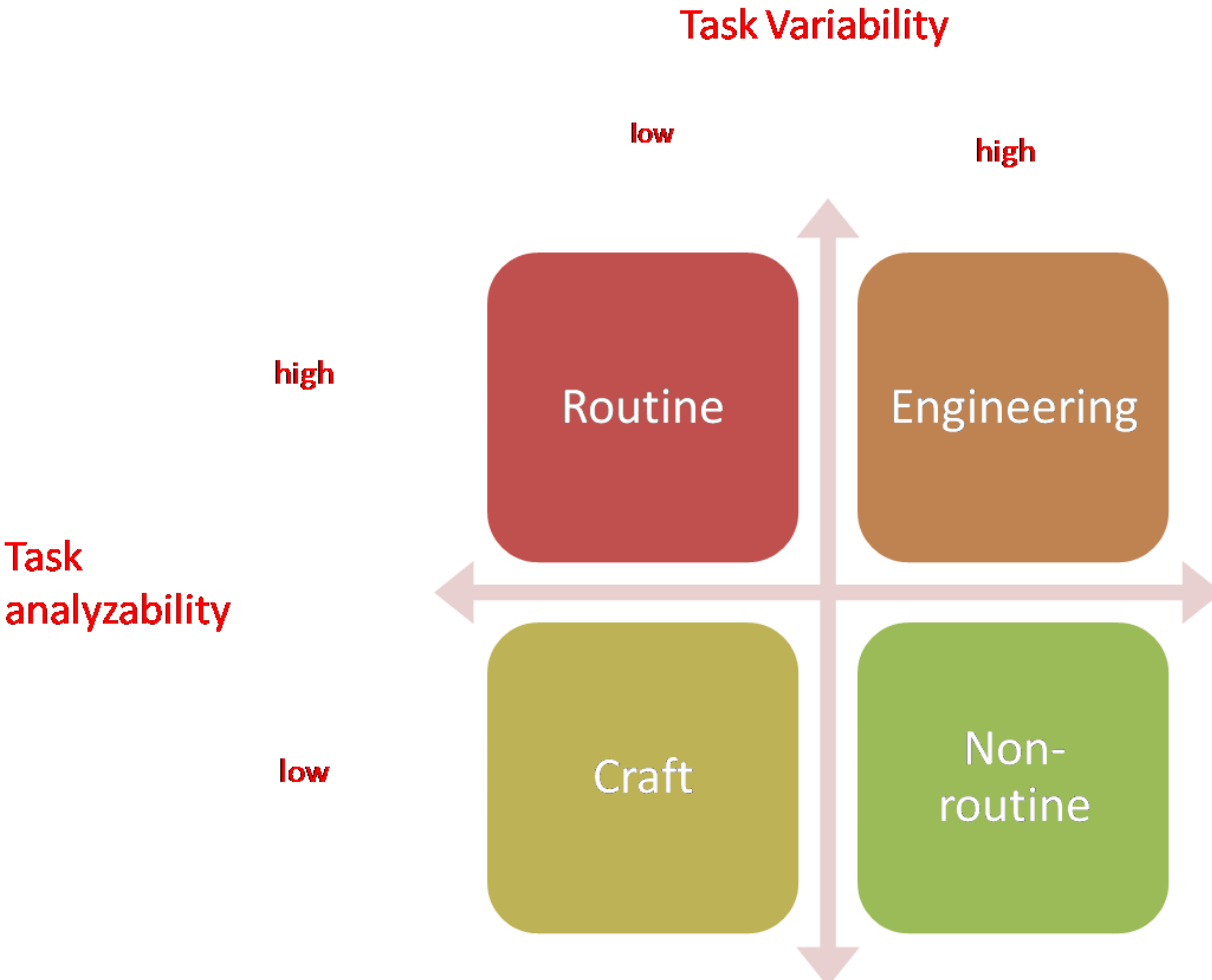
Perrow's theory of routine and complex tasks (1967)

- ***Task variability*** is the number of exceptions—new or unexpected situations—that a person encounters while performing a task;

Task variability is low when a task is highly standardized or repetitious so workers encounter the same situation time and time again.

- ***Task analyzability*** is the degree to which search and information-gathering activity is required to solve a task-related problem;

Task analyzability is high when a task requires a limited search activity, whereas it is low when the worker needs to gather a lot of information to perform a task.



Based on Perrow(1967)

Perrow's 4 types of technology

routine tasks

- ***Routine manufacturing*** (low v. & high a.) > mass production settings e.g., car manufacturig;
- ***Craftwork*** (low v., few exceptions, low a., lot of info) > for producing customized products and services e.g. a tailored suit, a personalized piece of furniture or a portrait;
- ***Engineering production*** (high v., high a.) > high variability, but all codified and translated in procedures and rules e.g. a civil engineering group that builds bridges, airports, dams…;
- ***Nonroutine technology*** (high v., low a.) > those used in advanced technical and scientific fields e.g. those working in the R&D of a high-tech company, or scientists searching the vaccine for HIV.

nonroutine tasks

Routine and nonroutine tasks and organizational structure

TABLE 9.1 Routine and Nonroutine Tasks and Organizational Design

Structural Characteristic	Nature of Technology	
	Routine Tasks	**Nonroutine Tasks**
Standardization	High	Low
Mutual adjustment	Low	High
Specialization	Individual	Joint
Formalization	High	Low
Hierarchy of authority	Tall	Flat
Decision-making authority	Centralized	Decentralized
Overall structure	Mechanistic	Organic

Thompson's theory of task interdependence (1967)

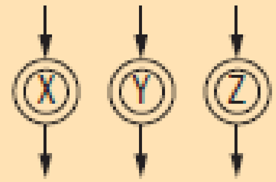
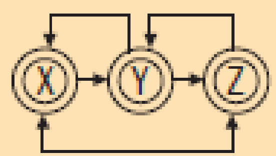
Task interdependence is the manner in which different organizational tasks are related to one another.

Low task interdependence → mediating technology;

Sequential (medium) task interdependence → long linked technology;

High (reciprocal) task interdependence → intensive technology.

it focuses on the inputs and outputs, more than on the conversion process!

Type of technology	Form of task interdependence	Main type of coordination	Strategy for reducing uncertainty	Cost of coordination
Mediating	Pooled  *(e.g., piecework or franchise)*	Standardization	Increase in the number of customers served	Low
Long linked	Sequential  *(e.g., assembly-line or continuous-process plant)*	Planning and scheduling	Slack resources Vertical integration	Medium
Intensive	Reciprocal  *(e.g., general hospital or research and development laboratory)*	Mutual adjustment	Specialism of task activities	High

Thompson's 3 types of technology

- ***Mediating technology (pooled i.):*** when the performance of one operator is independent from the performance of the others e.g. sales department, hairdressing salon, consulting firm, franchising shops;

- ***Long-linked technology (sequential i.):*** a work process where input, conversion, and output activities are performed in series e.g. classic mass production or an oil refinery in which oil has to go through different stages of refining;

- ***Intensive technology (reciprocal i.):*** a work process where input, conversion, and output activities are inseparable – difficult to program and coordinate tasks e.g. hospital operating theatre, soccer teams, R&D depts, research laboratories;

Specialism as a strategy for intensive technology firms

To reduce the coordination costs associated with intensive technology, an organization can decide to produce only a narrow range of outputs

e.g. an hospital specialized in cancer treatment or heart diseases…
a pharmaceutical company that <u>focuses</u> on antipyretic drugs…

Case 2
IBM and Accenture Use Technology to Create Virtual Organizations

The OD part:
aligning technology, strategy and structure

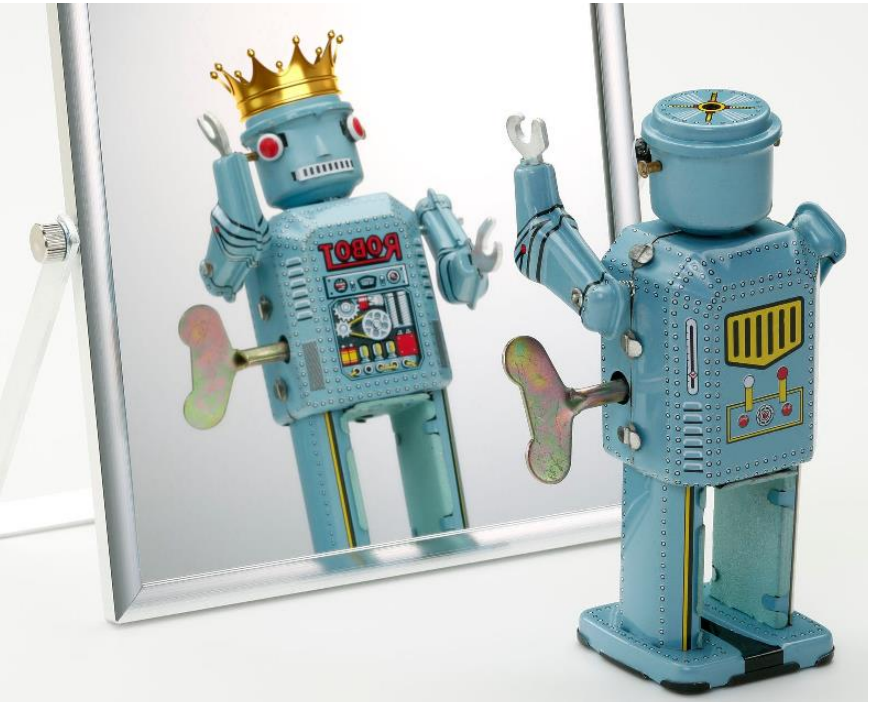
I. Identify Woodward's level of technical complexity (1-10) in an organization;

II. Identify the type of task complexity according to Perrow's model;

III. Identify the degree of task interdependence following Thompson's categorization;

→ Analyze fits and misfits with the company structure and strategy and change or adjust them.

Technological determinism (?)



In the 1970s, Aston University researchers have found that technology has a strong influence on structure and culture, especially in small firms;

In large firms, other factors have a strong influence on company structure e.g. product differentiation, degree of internationalization… **strategy**!

At the operative level, it is always better to opt for a participatory design of technological solutions involving users, or for a joint optimization of the human-technological component.

Latest trends in technological development

Figure 9.4 A. The Work Flow in Mass Production

Input Stage

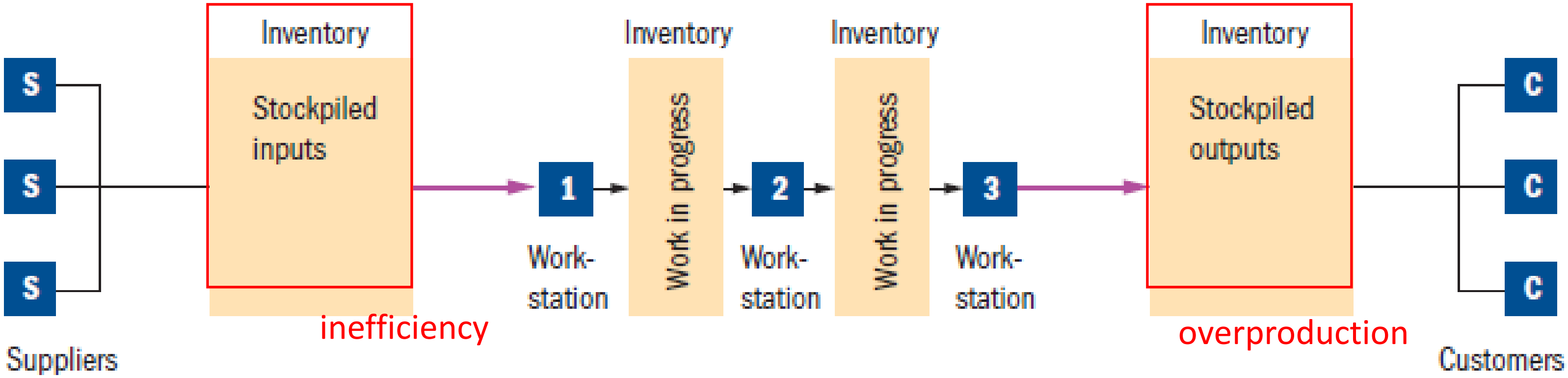
Inputs come from suppliers in advance and are stockpiled until they are needed.

Conversion Stage

Inputs are assembled into subassemblies and are put in inventory for use by the next workstation.

Output Stage

Finished products are stockpiled until they are needed. They eventually are shipped to customers.



A. The Work Flow in Mass Production. Inventory is used to protect the conversion process and to prevent slowdowns or stoppages in production.

Input Stage

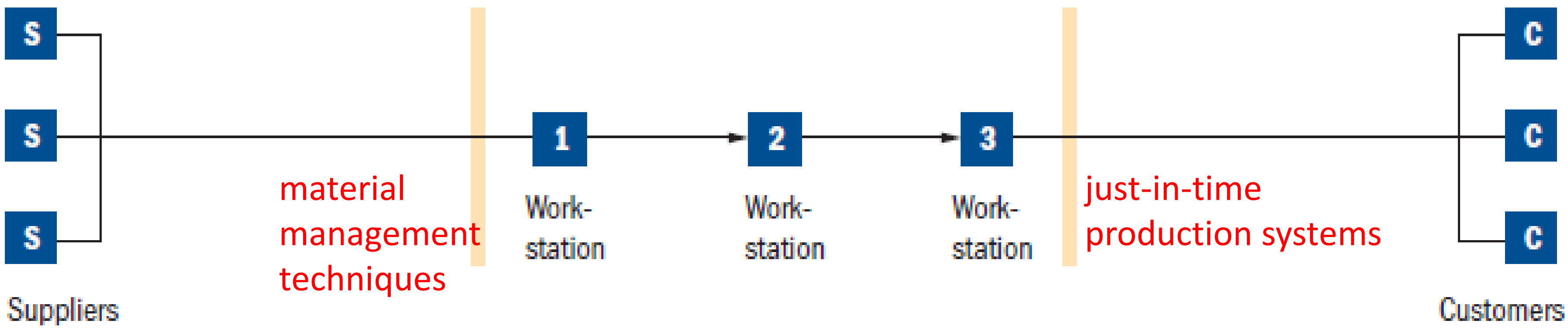
Inputs come from suppliers as they are needed.

Conversion Stage

Inputs are assembled into subassemblies, which are used at once by the next workstation.

Output Stage

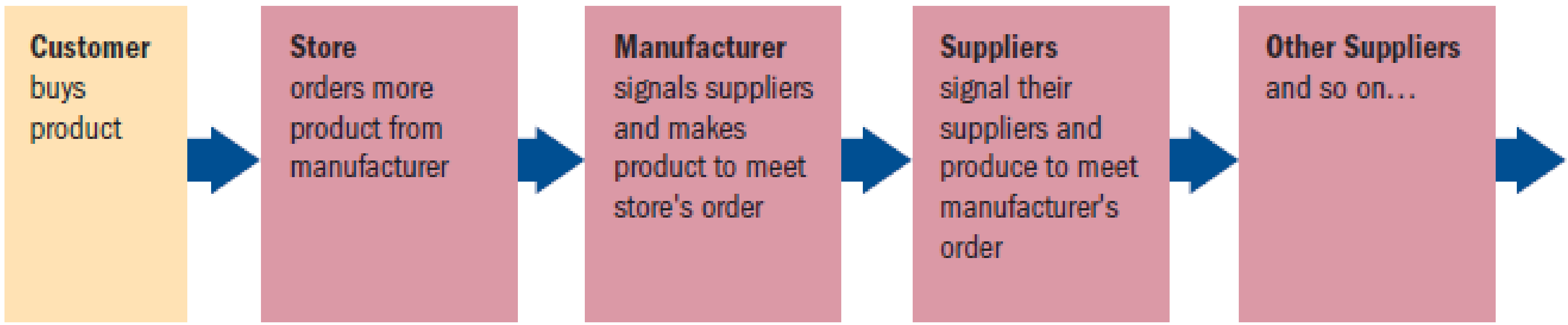
Finished products are sent immediately to customers as ordered.



B. The Work Flow with Advanced Manufacturing Technology. No inventory buffers are used between workstations.

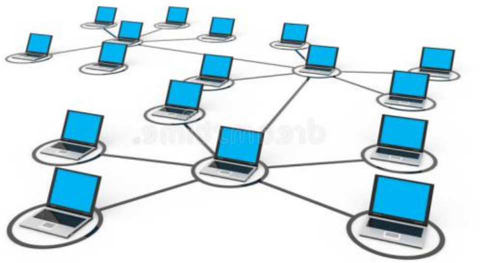
Figure 9.5 Just-in-Time Inventory System

The system is activated by customers making purchases.



Further developments

Computer-integrated manufacturing (CIM) is an advanced manufacturing technique that controls the changeover from one operation to another by means of the commands given to the machines through computer software;

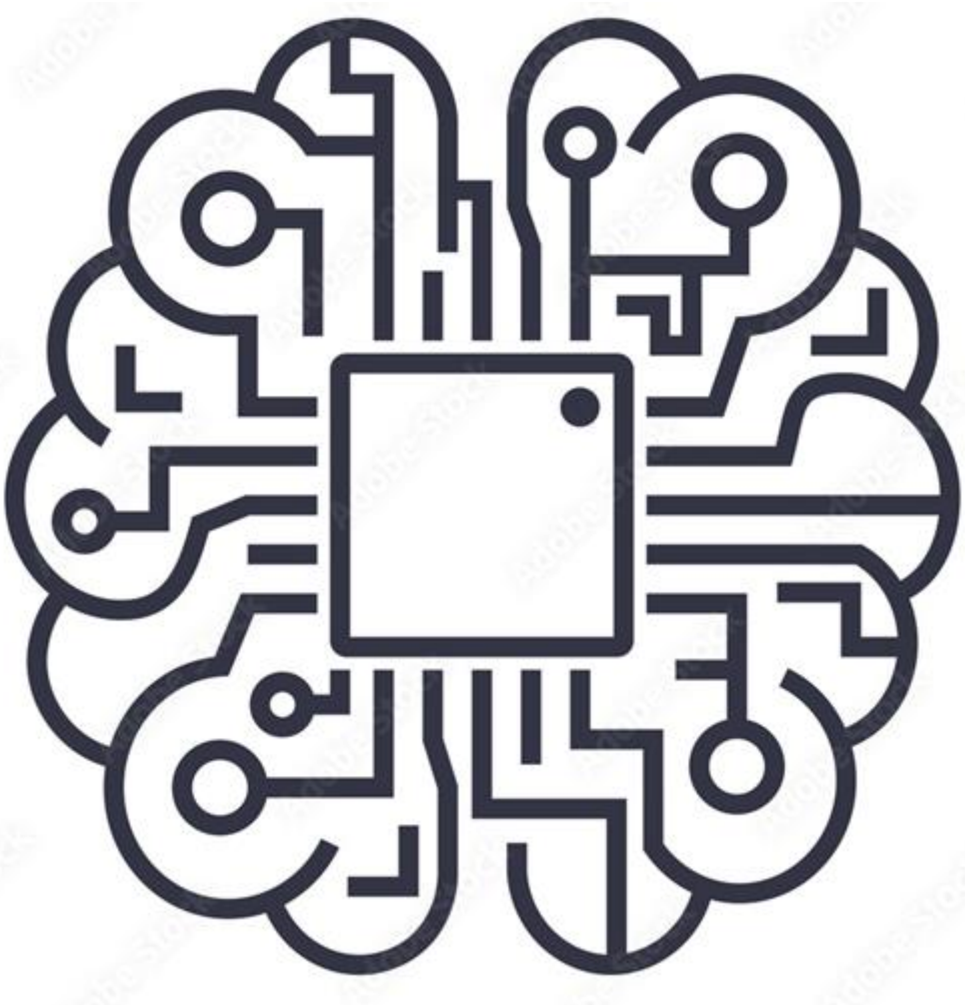


Traditional mass manufacturing technology uses dedicated machines, which perform only one operation at a time. **Flexible manufacturing technology**, by contrast, allows the production of many kinds of components at little or no extra cost on the same machine.

Perpetual communication via Internet that allows a continuous interaction and exchange of information not only between humans (C2C) and human and machine (C2M) but also between the machines themselves (M2M).

What is the role of humans in the video?

What’s next?



Artificial intelligence

Open questions:

1) What is the future role of human labor, especially deskilled human labor?
2) Is all this applicable to services and knowledge work as well and at which costs?
3) What are the consequences at the organizational level (e.g. strategy, structure, culture, orgl ethics)?
4) And what is the impact in the social and natural environment of organizations?

Additional resources

- Bodrožić, Z., & Adler, P. S. (2018). The evolution of management models: A neo-Schumpeterian theory. *Administrative Science Quarterly*, *63*(1), 85-129.

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- Bodrožić, Z., & S. Adler, P. (2022). Alternative futures for the digital transformation: A macro-level Schumpeterian perspective. *Organization Science*, *33*(1), 105-125.

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Bye…
and see you on Wednesday!