

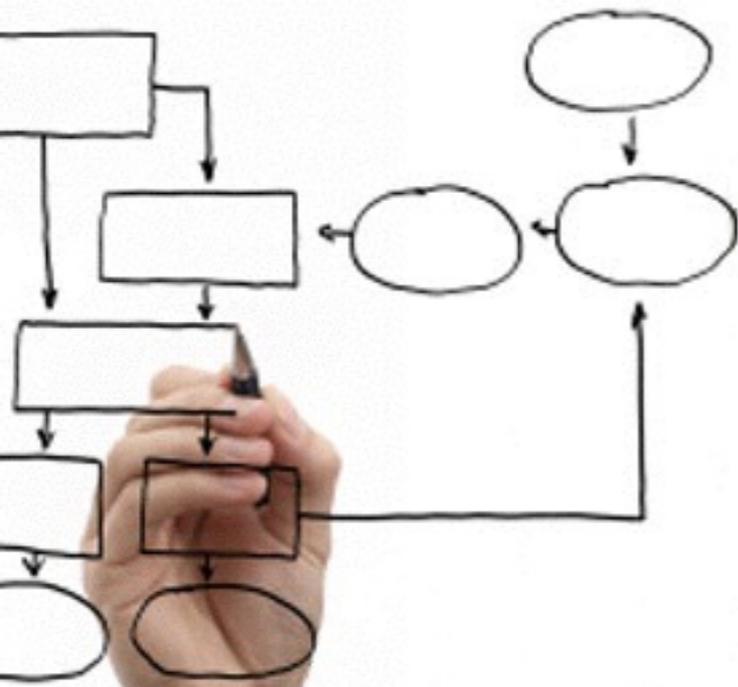
Methods for the specification and verification of business processes

MPB (6 cfu, 295AA)

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02 - Business processes



Classes

Wednesday: 14:00-16:00, [room A](#)

Friday: 11:00-13:00, [room A](#)

Today:

Ch.1 of Workflow Management: Models, Methods, and Systems

Ch.1 of Business Process Management: Concepts, Languages, Architectures

Reference framework

Fix the business management context
(organization)

Model and analyze processes

Process management systems
(IT support)

Terminology

Generic terms, widely applicable to different working situations and companies

We fix preferred terms when possible, but allow one to use synonyms interchangeably

Issues

- Role of work in the society**
- Organizational structures
- Principal-contractor relationship
- Processes and distribution of work
- Process management

Work

People work to live
(or do they live to work?)

We need **products** to live our lives
(food, clothing, house, transportation, fun, health)

We are not capable to produce all we need
(or all we want, or that we are induced to want)
because we cannot be skilled enough

We buy products we cannot make ourselves

Business units

People organize specialized business units

They know how to do some specific product
(limited range of products, highly efficient)

Market

Products are supplied to people via markets
(distribution in exchange of money)

New services

Other work emerge, that would not exist
(trading, banks, advertising, transportation,
regulations, insurance companies, eCommerce)

There are **services** and **products** necessary to
keep the organization operating
(not making a direct contribution to keep us alive)

Complexity

Modern society is too complex for people to see how their work fits in the overall scheme
(alienation can become a major social problem)

The same scheme applies to large companies:
high degree of work specialization
cause big picture be lost by employees
(why do they have to do the things they are told to do?)

Paradigm shift

Alienation from work can have negative effects on
(human life and) productivity

Companies can allow employees to know
they are working for a particular customer
(increase motivation, self-esteem, productivity)

Shift:

from supply-driven economy (scarce means of production)
to **demand-driven** economy (customers are scarce)

ROI = Return on Investment

CUSTOMER SATISFACTION

CUSTOMER

Predict Customer Behavior based on demographics and purchasing habits

PRODUCT

Improve product positioning, identify product associations for promotions, and plan shelf positioning

CHANNEL

Campaign Management, Analysis and Design for different channels

TECHNOLOGY as an enabler to

1. Reaching the pinnacle of customer service
2. Achieving high success rates in adoption of new products
3. Exceeding planned ROI's on every campaign through accurate targeting

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Organizational structure

An **organizational structure** establishes how the work, authorities and responsibilities are divided up amongst its staff
(roles and functions)

A single person can fulfill several roles,
at the same time or at different times

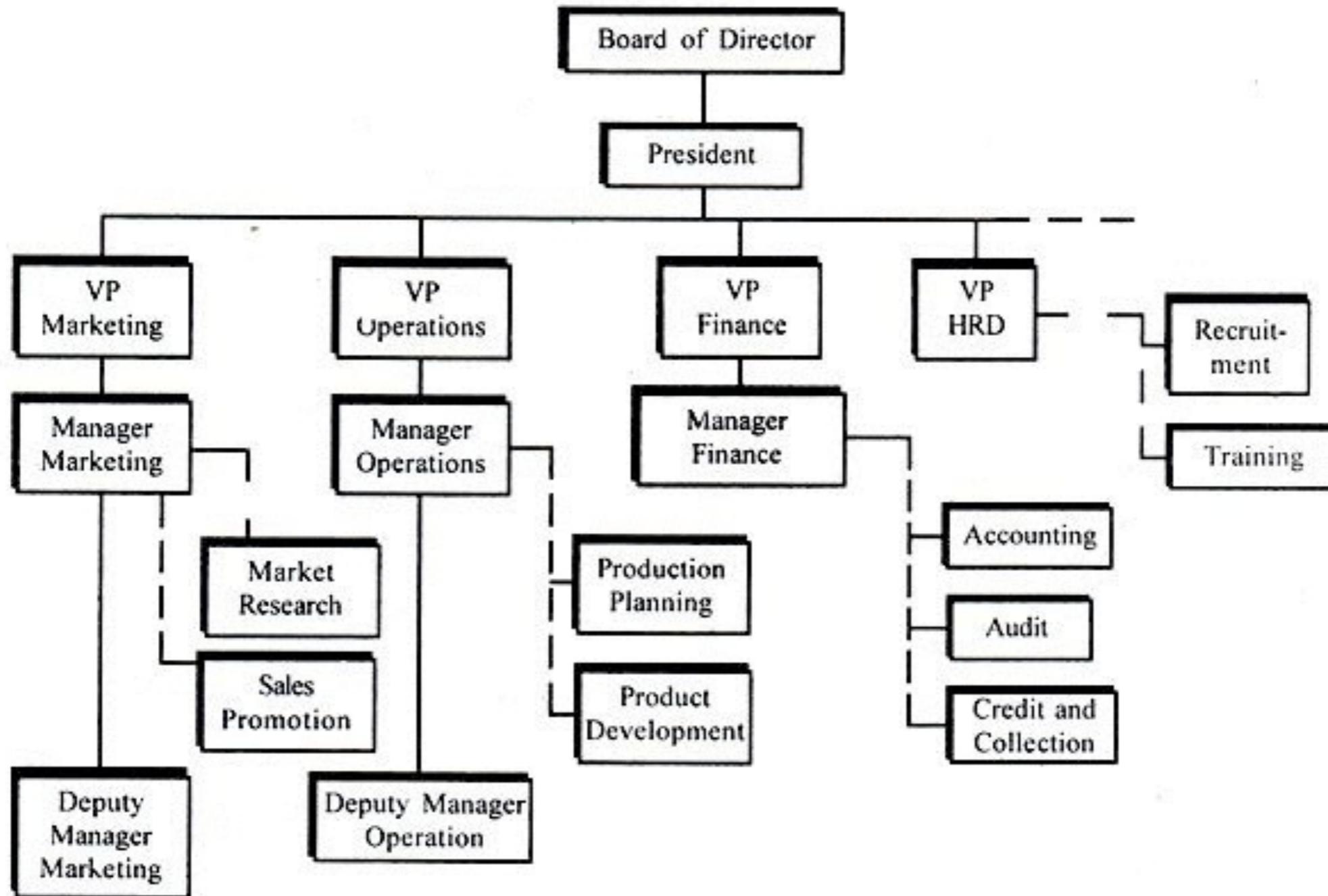


Most relevant forms of organizational structure

Hierarchical:

structured as a tree,
internal nodes are individual roles or functions,
leaves are staff or departments,
branches are authority relationships
(independent of cases)

Hierarchical structure



Legend : — Line Authority

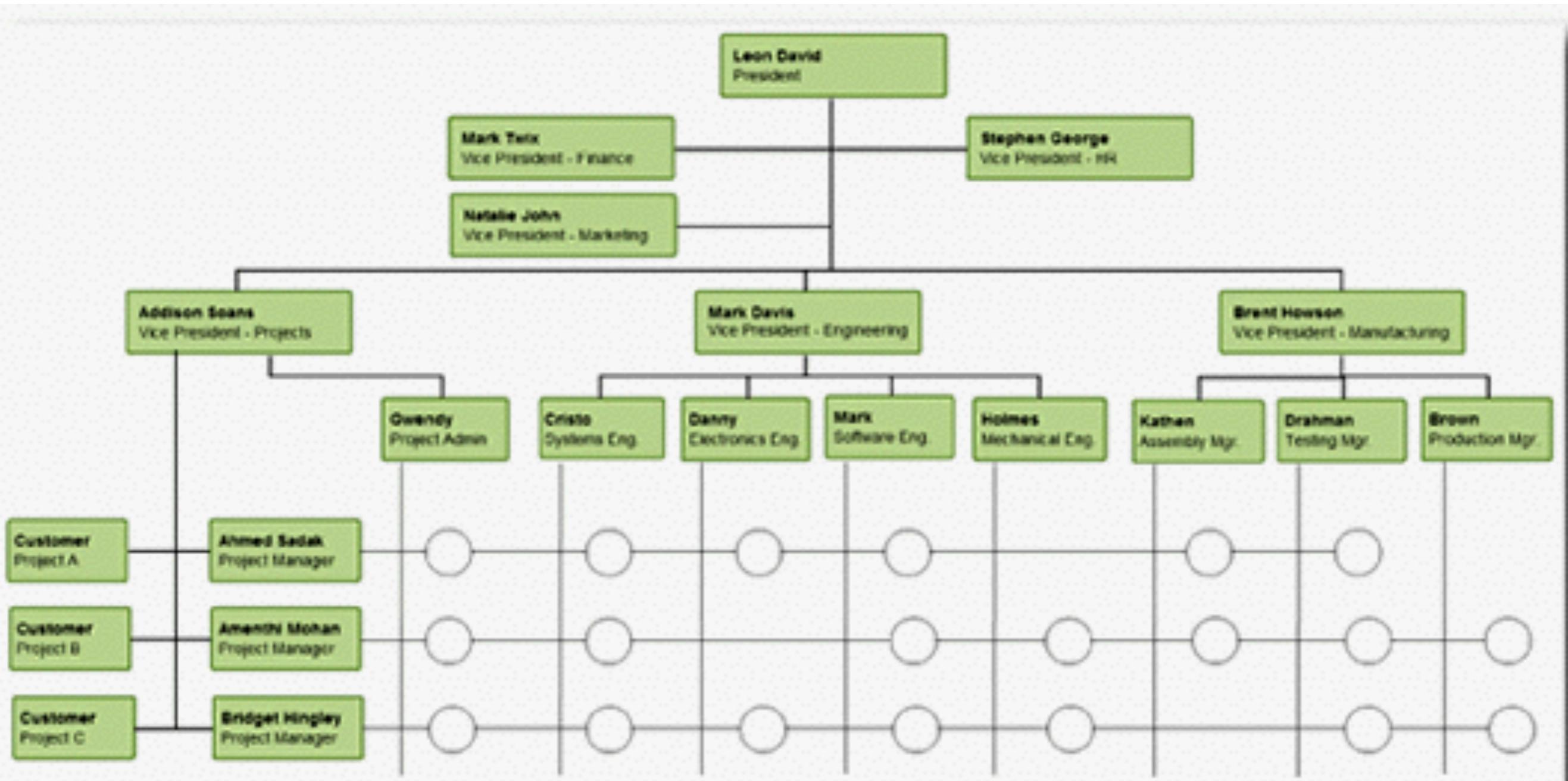
-- Staff Relationship

Most relevant forms of organizational structure

Matrix:

add (dynamic) functional dimension
(each person can have one or more functional bosses, known as project leaders)

Matrix structure

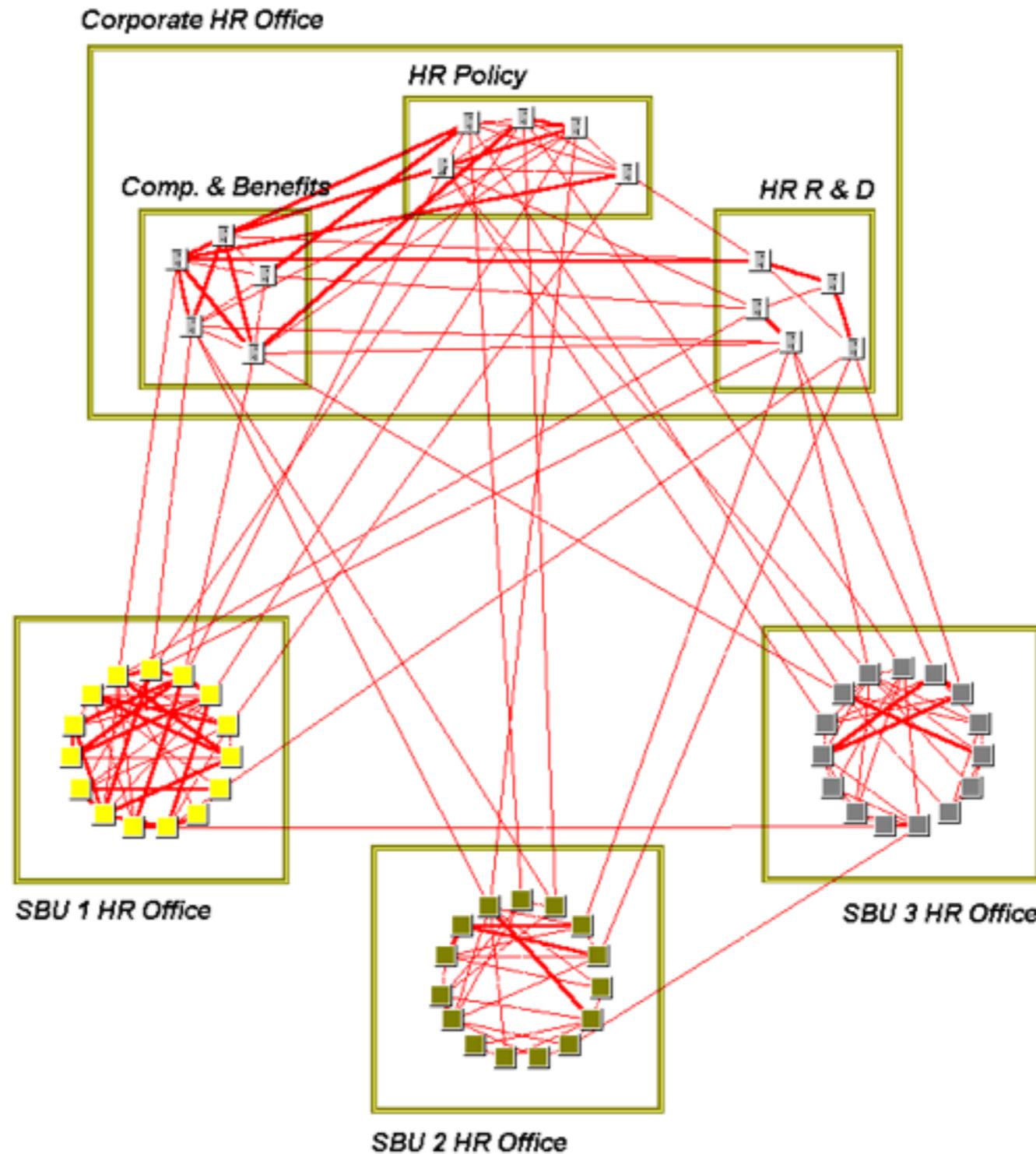


Most relevant forms of organizational structure

Network:

autonomous actors collaborate
to supply products or services

Network structure



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Principal

Most people's work is assigned or outsourced to them by other people: their **principals** (they can be company departments or firms)

We can divide principals in two forms:
boss and **customer**

Assignments ordered by bosses are often related to work for customers

Contractors

A person who is assigned a task is called
contractor, or also **resource**
(assignments can be carried out by machines
and computer applications as well as people)

Actors

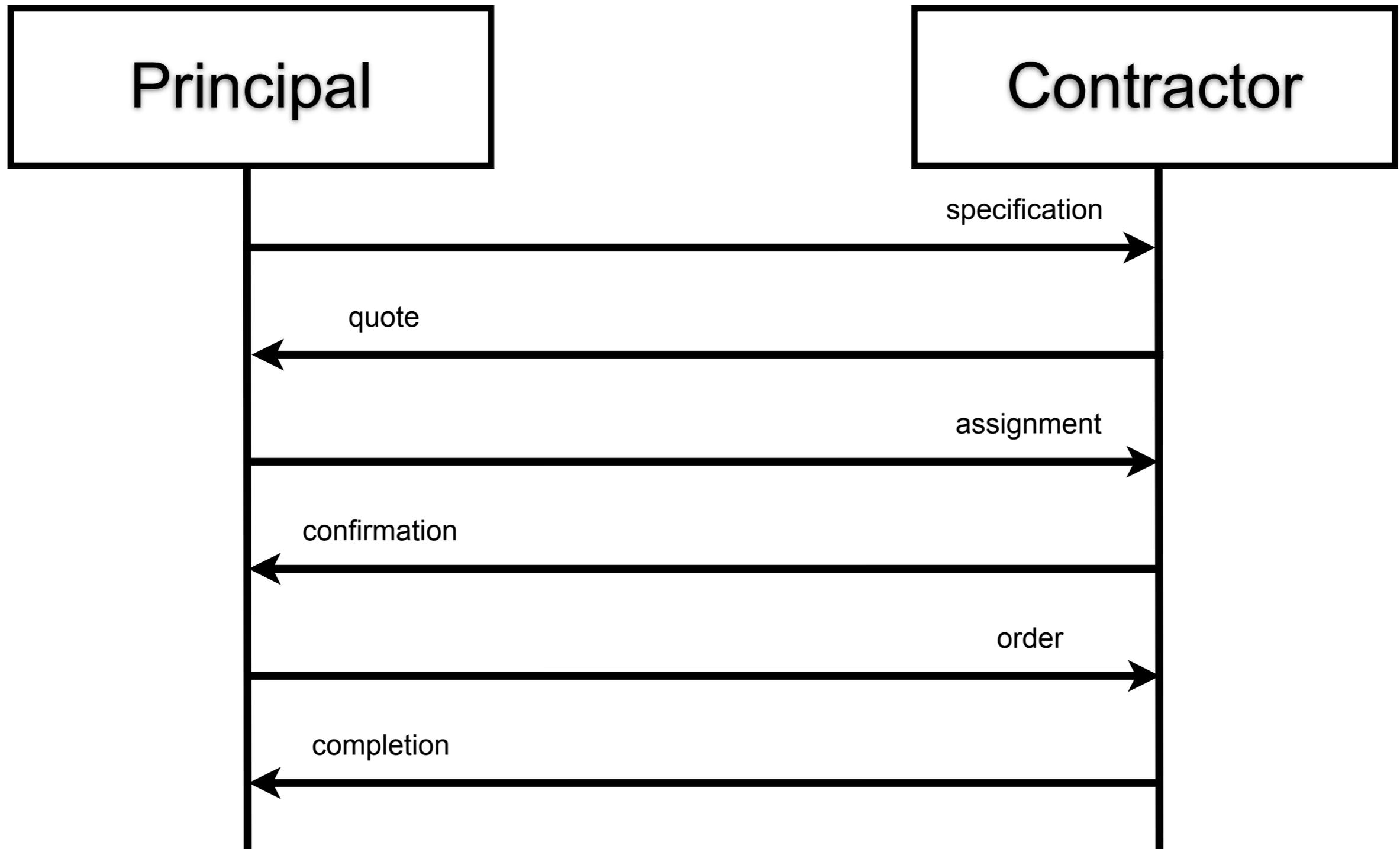
An **actor** can be a principal or a contractor, or
play both roles at the same time
(contractors may redirect work to third parties)

Contract

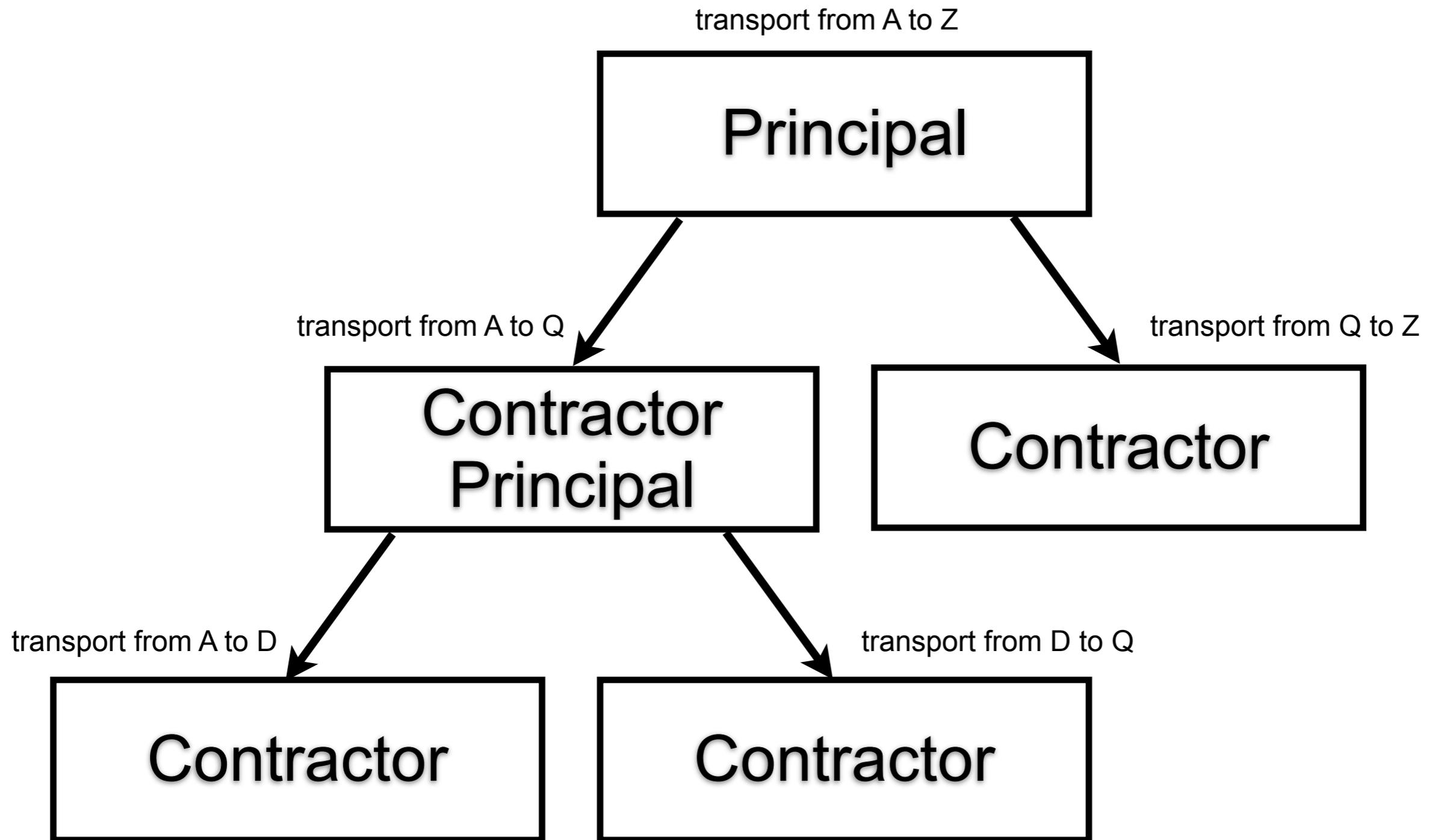
A **contract** exists between a principal and a contractor about the case to be performed (deadline for completion, price to be paid)

A **communication** protocol can be established between a principal and a contractor to exchange information

Protocol example



Contract tree example



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Case

Many different types of work exist
(baking bread, making furniture, design a building,
collect surveys to compile a statistic)

They have in common the **case**:
one tangible thing produced or modified
(bread, furniture, house, diagram)
but more abstract cases are also possible
(a lawsuit, an insurance claim, digital data)

Synonyms: work, job, product, service, item

Procedure

Working on a case is typically discrete in nature

Every case has a beginning and an end

Each case can be distinguished from any other case

Each case involves a **procedure** being performed:
the tasks to be carried out and the conditions that
determine the order of the tasks

Synonyms: process, project

Task

A **task** is a logical unit of work that is carried out as a single whole

Example: Make a Pizza

1. Check ingredients
2. Check tools
3. Make the dough balls
4. Prepare toppings (while dough rises)
5. Shape dough balls into pizza
6. Top it
7. Cook it

Tasks?
Procedures?
Cases?



Knowledge

Some tasks can be performed by a computer without human intervention

Executing some tasks may require human intelligence: a judgement or a decision
(a bank employee decides about a loan request)

Persons need **knowledge** to execute tasks
(their past experience, company guidelines)

Resource

A **resource** is the generic name for a person, machine or group of persons or machines that is responsible for a task

Activity

An **activity** is
the performance of a task by a resource

Various cases may share the same procedure, but each case may involve different activities to be carried out, depending on case **attributes** (one insurance claim may involve objections and another one may not)

Example: Make a Pizza

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Knowledge?
Resources?
Activities?



Example: Make a Pizza

Knowing the procedure is essential, but

Not all recipes are the same

Not all pizzas taste the same

Execution is important

Training is important



Cases vs procedures

The number of procedures in a company is (generally) finite and far smaller than the number of cases to be handled

Example: it is easier to make one hundred skirts with the same pattern than one hundred skirts using different patterns

Example: off-the-rack is cheaper than made-to-measure

Economy of scale

The cost per case fall as the number of cases increases

Strategy: keep the number of procedures small and make the number of cases that each can perform as high as possible

Profit, after all, is the ultimate objective
(not necessarily the best one)

Example

Insurance companies want to keep the number of claims as low as possible, but this is generally a factor they cannot control

They can try to **keep low the number of procedures**, but the risk is to make them too much complex (a unique procedure to handle all cases is possible in principle, but inefficient in practice)

Ideal situation: a small number of good procedures, with a lot of cases to be handled by each of them

Counter-examples?

What about tailor-made suits?
one case per process?

What about architects and houses?
design from scratch for each case?

Not so different?

Tailors and architects can exploit standard approaches for each case

Tailor process:
take customer's measurement,
show a number of patterns,
modify the chosen pattern,
choose the fabric,
draw the pattern

Observation:
tasks can be highly dependent on cases

One-of-a-kind processes

The first stage in tackling the case is the design of its specific process

Even in this case, standard tasks can be frequently found that are used to compile many specific processes

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What is all about

Each **product** that a company provides to the market is the outcome of a number of **tasks** performed

Business processes are about activities **understanding, correlation, organization and improvement**

Awareness

Process management systems
support and encourage
communication between employees
and make their activities more controllable

Narrowing the gap

Organizational business aspects



Information technology

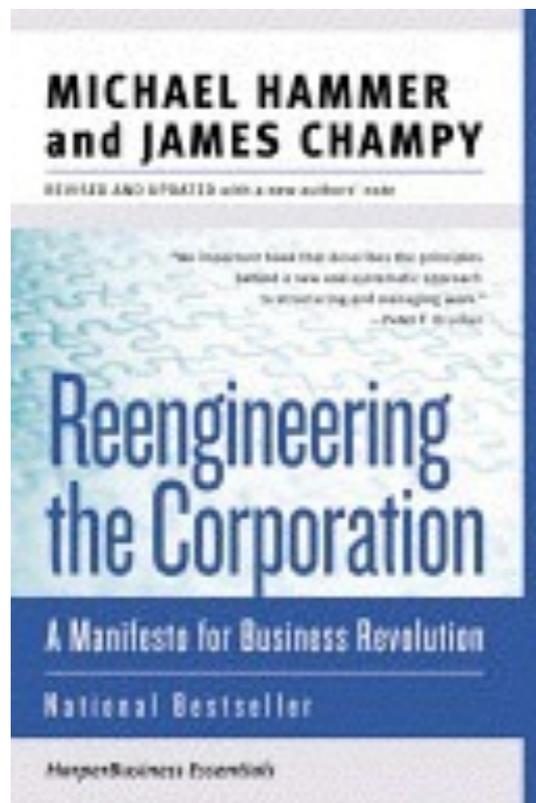
Enactment

Activities can be performed by employees **manually** or by the help of information systems

Other activities can be enacted **automatically** by information systems

Some activities can **trigger** or **inhibit** other activities

Process orientation roots (1990's)



Seminal book advocating the radical redesign of the business process of a company as opposed to evolutionary improvements

A **business process** is a **collection of activities** that take one or more kinds of **input** and create an **output** that is of value to the customer

- Hammer & Champy (1993)

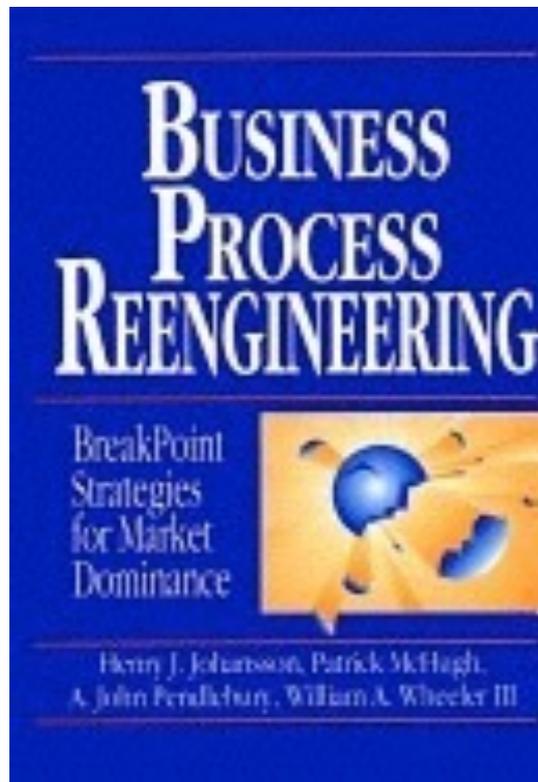
Keywords

Hammer & Champy: **collection, input, output**

How vs What

The main innovation is the shift of focus on the business logic of the process (**how work is done**), instead of the product perspective (**what is done**)

Process orientation roots (1990's)



The transformation that occurs in the process should add value to the input and create an output that is more useful and effective to the **recipient**

A process is a set of **linked** activities that take an input and transform it to create an output.

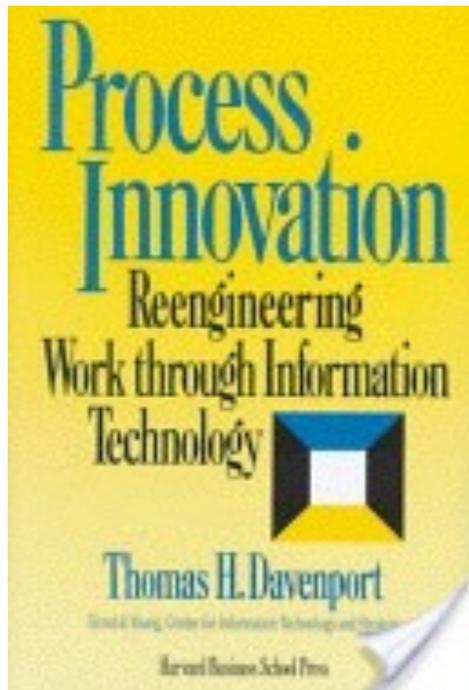
- *Johansson et al. (1993)*

Keywords

Hammer & Champy: **collection, input, output**

Johansson et al.: **recipient, linked**

Process orientation roots (1990's)



Processes as **structured** sets of activities designed to produce a specific output for a particular market

A **process** is a specific **ordering** of work activities across **time** and **space**, with a **beginning** and an **end**, and clearly defined **inputs** and **outputs**: a structure for action.

- Davenport (1993)

Keywords

Hammer & Champy: **collection, input, output**

Johansson et al.: **recipient, linked**

Davenport: **structure, ordering, time, space, begin, end**

More from Davenport

Unless designers or participants can agree on the way work is and should be **structured**, it will be very difficult to systematically improve, or effect innovation in, that work

Whereas an organization's hierarchical structure is typically a slice-in-time view of responsibilities and reporting relationships, its process structure is a **dynamic view** of how the organization delivers value

More from Davenport

Furthermore, while we cannot measure or improve hierarchical structure in any absolute sense, processes that are clearly structured are amenable to **measurement** in a variety of dimensions have cost, time, output quality, and customer satisfaction

When we reduce cost or increase customer satisfaction, we have bettered the process itself

More from Davenport

Processes also need clearly defined **owners** to be responsible for design and execution.

Process ownership must be seen as an additional or alternative dimension of the formal organizational structure that, during periods of radical process change, **takes precedence** over other dimensions of structure.

Otherwise process owners will not have the power or legitimacy needed to implement process designs that violate organizational charts and norms

More from Davenport

In service industries it is nearly impossible to distinguish between innovative new services offered to the customers and the **innovative processes** that enable them

Following a structured process is generally a good thing, and there is nothing inherently slow or inefficient about acting along process lines

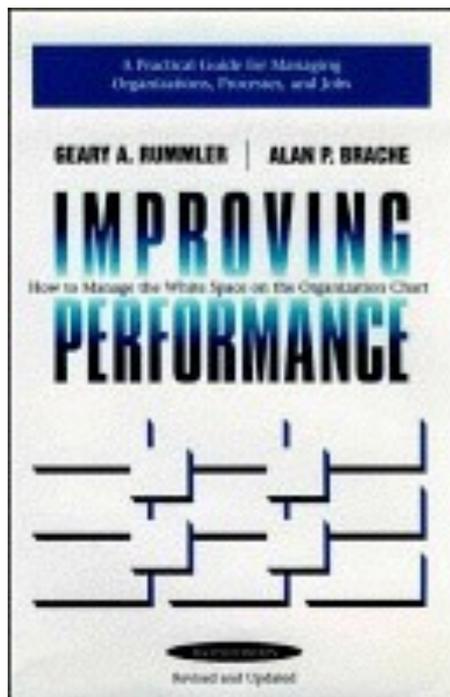
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Hammer & Champy: **collection, input, output**

Johansson et al.: **recipient, linked**

Davenport: **structure, ordering, time, space, begin, end, dynamic, measurement, owner, precedence of process view, innovation enabling**

Process orientation roots (1990's)



Most processes are **cross-functional**, spanning the ‘white space’ between the boxes on the organization chart. Some processes result in a product or service that is received by an organization's external customer. We call these **production** processes.

Other processes produce products that are invisible to the external customer but essential to the effective management of the business.

We call these **support** processes

Typical processes in manufacturing firms

Operational: product development, customer acquisition, customer requirements identification, manufacturing, integrated logistics, order management, post-sales service

Management: performance monitoring, information management, asset management, human resource management, planning and resource allocation

Primary process

Produce company's products
(**production** processes)

Customer-oriented, even if sometimes the customer is not known in advance

Generate income for the company

Examples: raw materials purchase, service sale, design and engineering, distribution

Secondary process

Support primary processes
(**support** processes)

Examples: machinery purchase and maintenance, personnel management (recruitment and selection, training, work appraisal, payrolls, dismissal), financial administration, marketing

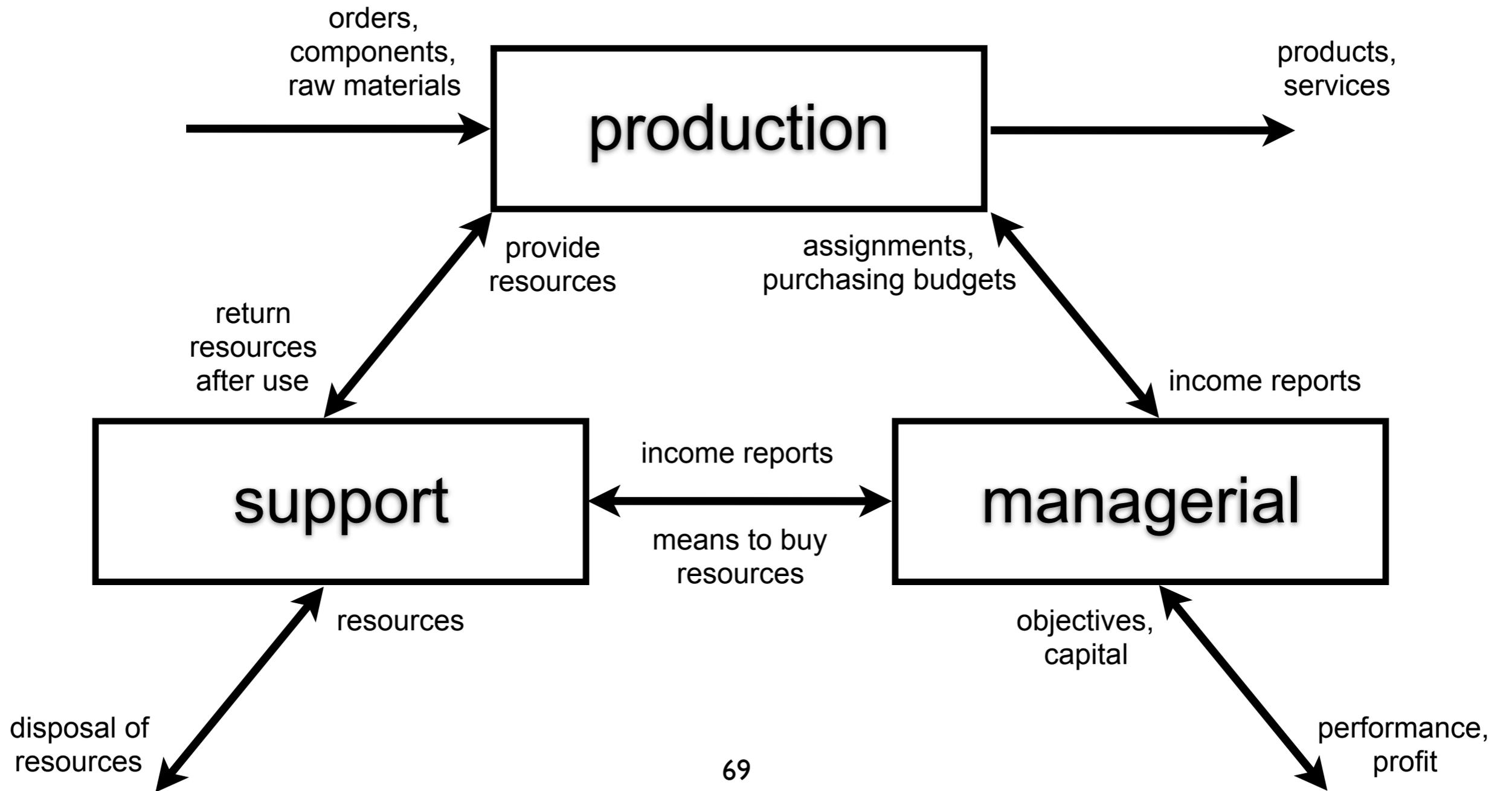
Tertiary process

Direct and coordinate primary and secondary ones
(**managerial** processes)

Fix objectives, allocated resources and
preconditions for the managers of other processes

Examples: maintenance of contracts with
financiers and other stakeholders

1, 2, 3



Keywords

Hammer & Champy: **collection, input, output**

Johansson et al.: **recipient, linked**

Davenport: **structure, ordering, time, space, begin, end, dynamic, measurement, owner, precedence of process view, innovation enabling**

Rummler & Brache: **production, support, managerial**

Summing up

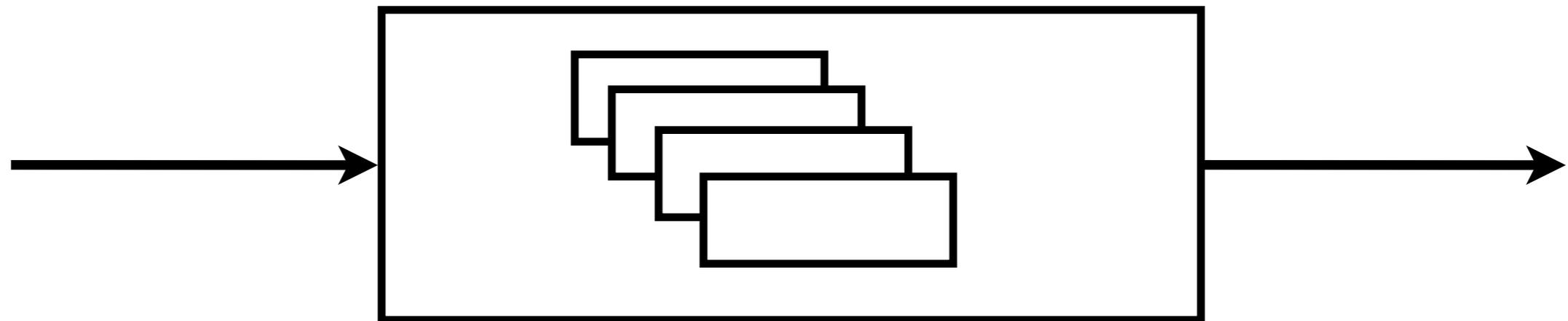
Definability

Processes must have clearly defined boundaries, input and output



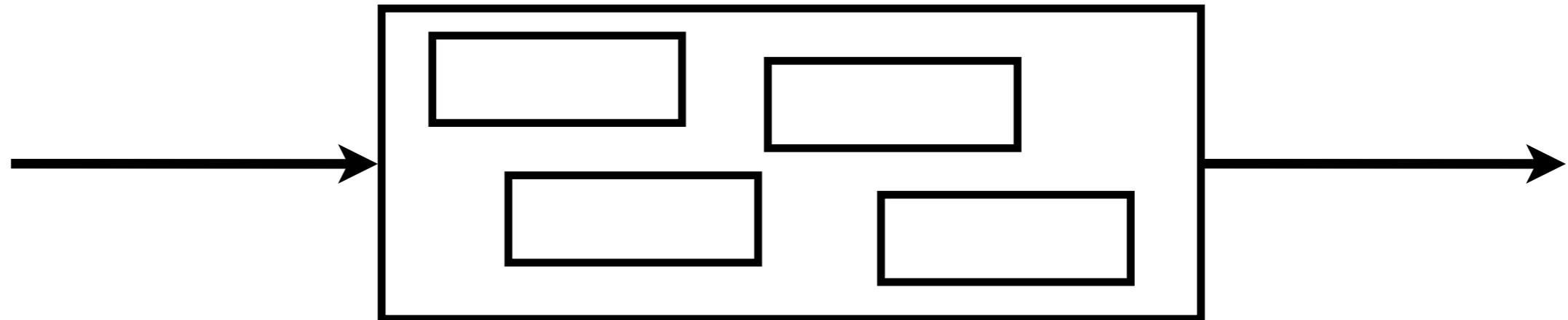
Structured

Processes wrap up a collection of tasks



Ordered

Process tasks are ordered according to their position in time and space



Digression

What is a **partial order**?

- (S, \sqsubseteq) S is a set
- \sqsubseteq is a binary relation included in $S \times S$
- \sqsubseteq is reflexive
- $\forall x \in S$ we have $x \sqsubseteq x$
- \sqsubseteq is transitive
- $\forall x, y, z \in S$, if $x \sqsubseteq y$ and $y \sqsubseteq z$, then $x \sqsubseteq z$
- \sqsubseteq is anti-symmetric
- $\forall x, y \in S$, if $x \sqsubseteq y$ and $y \sqsubseteq x$, then $x = y$

Digression

What is a **total order**?

(S, \sqsubseteq) is a partial order and

$\forall x, y \in S$ we have $x \sqsubseteq y$ or $y \sqsubseteq x$

Exercises

Are the following pairs partial / total orders?

$(\mathbf{Nat}, <)$ (\mathbf{Nat}, \leq) (\mathbf{Int}, \geq)

$(\mathbf{Nat}, \emptyset)$ $(\mathbf{Nat}, \mathbf{Nat} \times \mathbf{Nat})$

$(\wp(\mathbf{Nat}), \subseteq)$ $(\mathbf{Nat}, \{(x, x) \mid x \in \mathbf{Nat}\})$

Digression

What is a **linear extension** of a partial order?

Let (S, \sqsubseteq) be a partial order and (S, \preceq) a total order

(S, \preceq) is a linear extension of (S, \sqsubseteq) if

$\forall x, y \in S$ we have that $x \sqsubseteq y$ implies $x \preceq y$

(or equivalently, \sqsubseteq is included in \preceq)

Exercises

$$S = \{a, b, c, d, e, f\}$$

$$a \sqsubseteq b \sqsubseteq d \sqsubseteq f \quad a \sqsubseteq c \sqsubseteq e \sqsubseteq f \quad c \sqsubseteq d$$

Which of the following are linear extensions?

(we write, e.g., abc for $a \preceq b \preceq c$)

abcdef

abcedf

abdcef

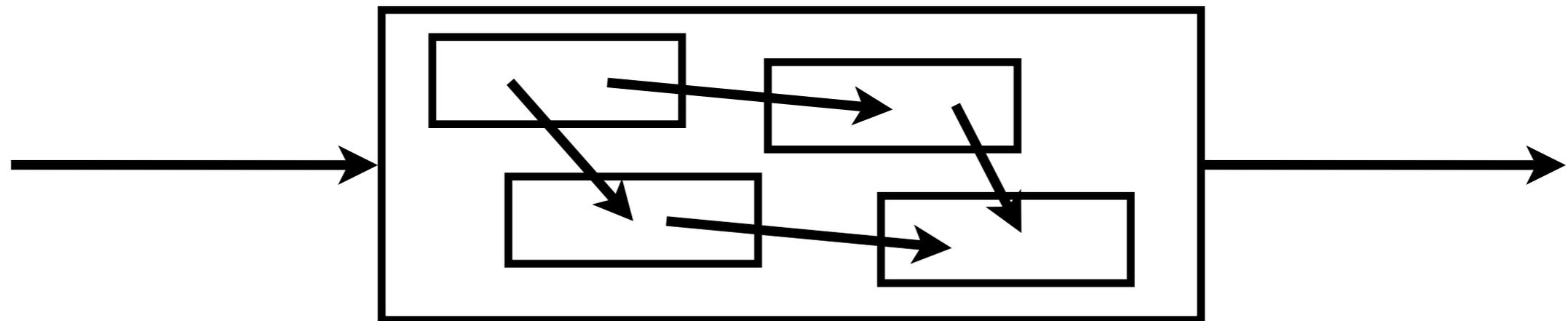
acebdf

acbedf

acefbd

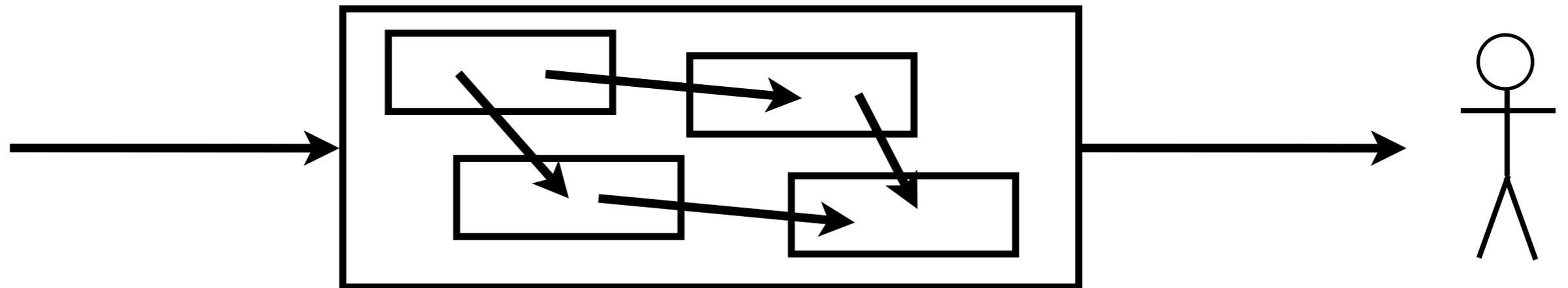
Linked

Process activities are linked along a value-added chain



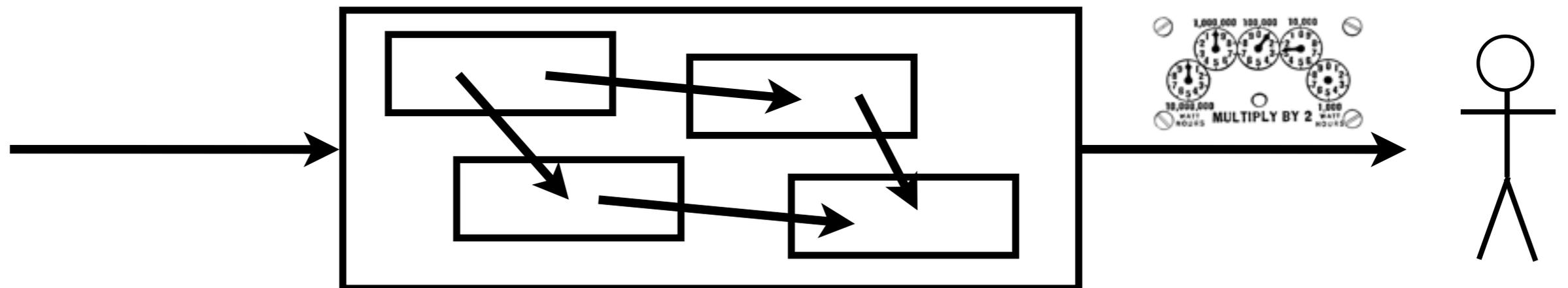
Customer

The process output has a recipient



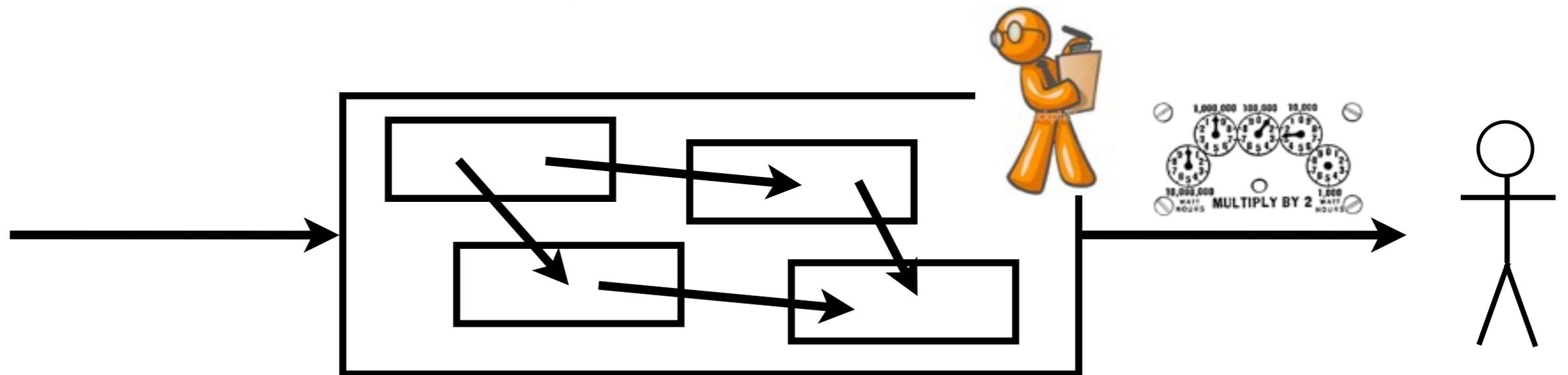
Measurability

The process output can be evaluated



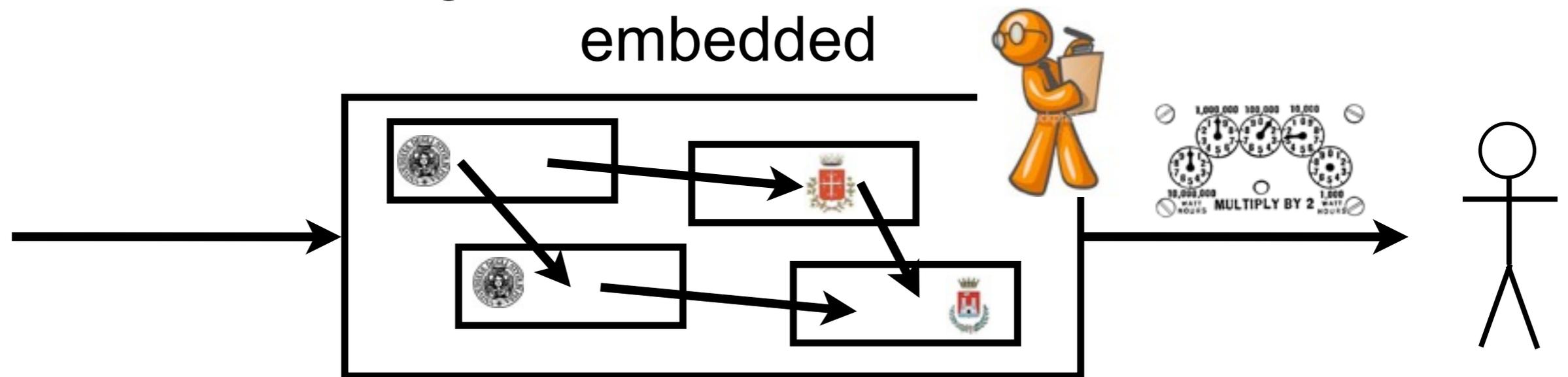
Ownership

There is one responsible for the performance and continuous improvement of the process



Cross-functionality

A process can span several functions within and across the organizational structure in which it is embedded



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Some definitions

Business process

Definition: a **business process** consists of a set of activities that are performed in coordination in an organizational and technical environment.

These activities jointly realize a business goal.

Each business process is enacted by a single organization, but it may interact with business processes performed by other organizations.

- *Weske*

Business process management

Definition: **business process management**

includes concepts, methods, and techniques to support the design, administration, configuration, enactment, and analysis of business processes.

- *Weske*

Business process management

The basis of business process management is the **explicit representation** of business processes with their **activities** and the **execution constraints** between them

Business processes can then be subject to **analysis, improvement, and enactment**

Business process management system

Definition: **business process management system** is a generic software system that is driven by explicit process representations to coordinate the enactment of business processes.

- *Weske*

Business process model

Definition: **business process model** consists of a set of activity models and execution constraints between them.

- *Weske*

Business process instance

Definition: **business process instance**

represents a concrete case in the operational business of a company, consisting of activity instances.

- *Weske*

Model and instances

Each activity model acts as a blueprint for a set of activity instances

Each business process model acts as a blueprint for a set of business process instances



Abuse of notation

If no confusion is possible,
the term activity is used to refer to
either activity models or activity instances

Analogously, the term business process is used to
refer to either business process models or
business process instances

Process-driven software

Business process models are the main artifact for implementing business processes

This implementation can be done by organizational rules and policies, but it can also be done by business process management (software) system

In this case the software system is driven by explicit process representations

Process representations

Visual representations: diagrams and charts
understandable by humans
(few conventions, intuitive)

Languages: precise syntax
understandable by machines
(process dialects, XML)

Models: precise semantics
understandable by scientists
(Petri nets, YAWL)