



Aalto University

CIV-E1040 Construction Management: - Role in society & sub-sectors, construction production system, project phases, stakeholders

Lecture Ia

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Agenda

- **Construction sectors and role in society**
- **Special characteristics of construction**
- **Construction project: phases, processes, and stakeholders**

Learning outcomes

- 1. Explain role of construction in society and economy**
- 2. Recognize main phases of a construction project, stakeholders and their tasks**
- 3. Identify construction management terminology**

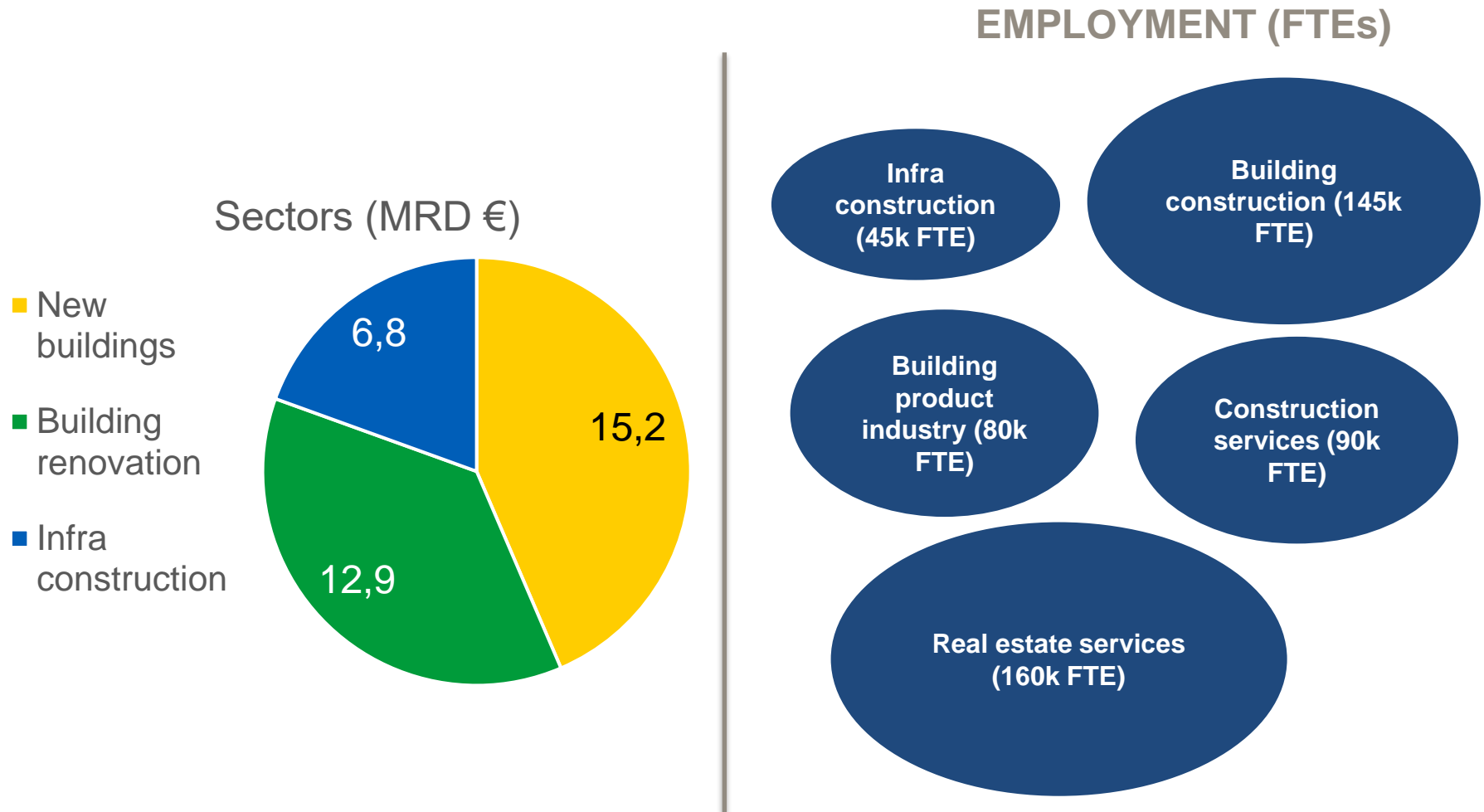
Role of construction in society

- **Built environment in Finland:**
 - 18 % of the yearly GDP
 - 20 % of employed workers
 - 70 % of investments and national wealth
 - 38 % of emissions
 - 42 % of energy consumption
- **We spend 90 % of our time indoors and 99 % in built environment**



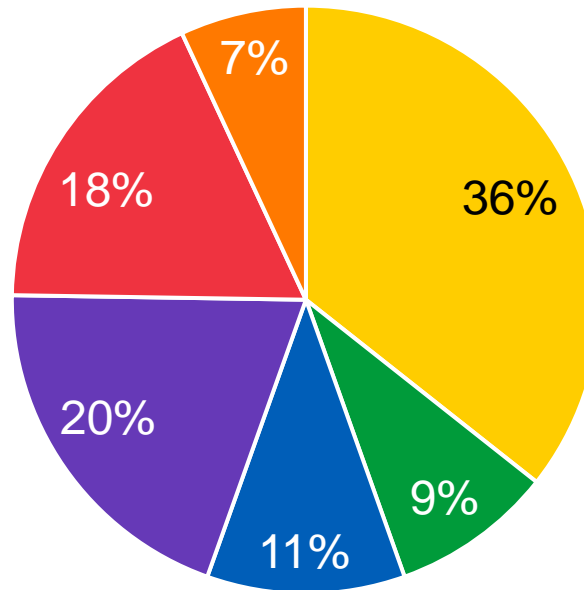
Source: Rakennusteollisuus ry

Construction sectors in Finland



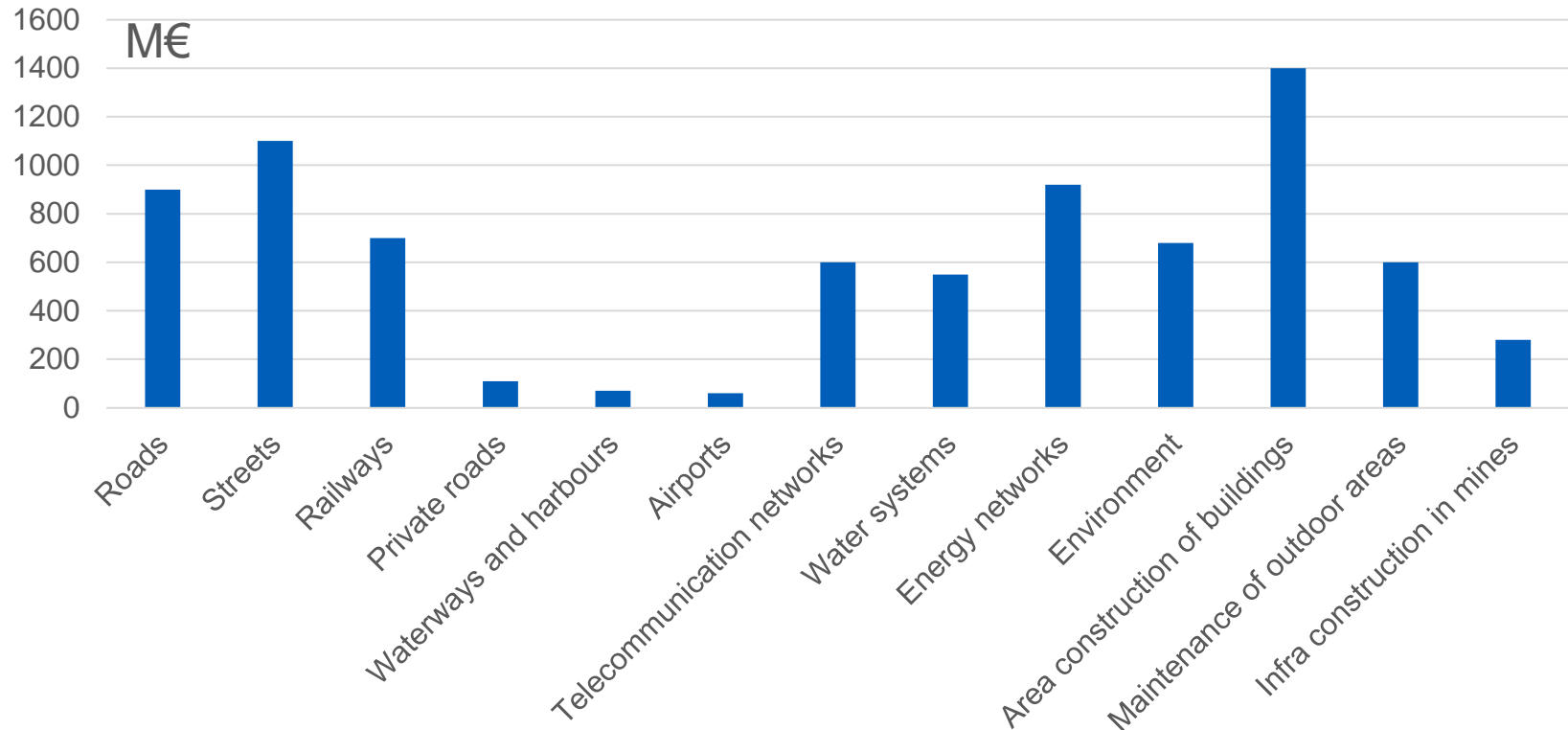
Customers of construction

- Households
- Housing companies
- Property companies
- Other companies
- Municipalities
- Government



**BtoB
&
BtoC**

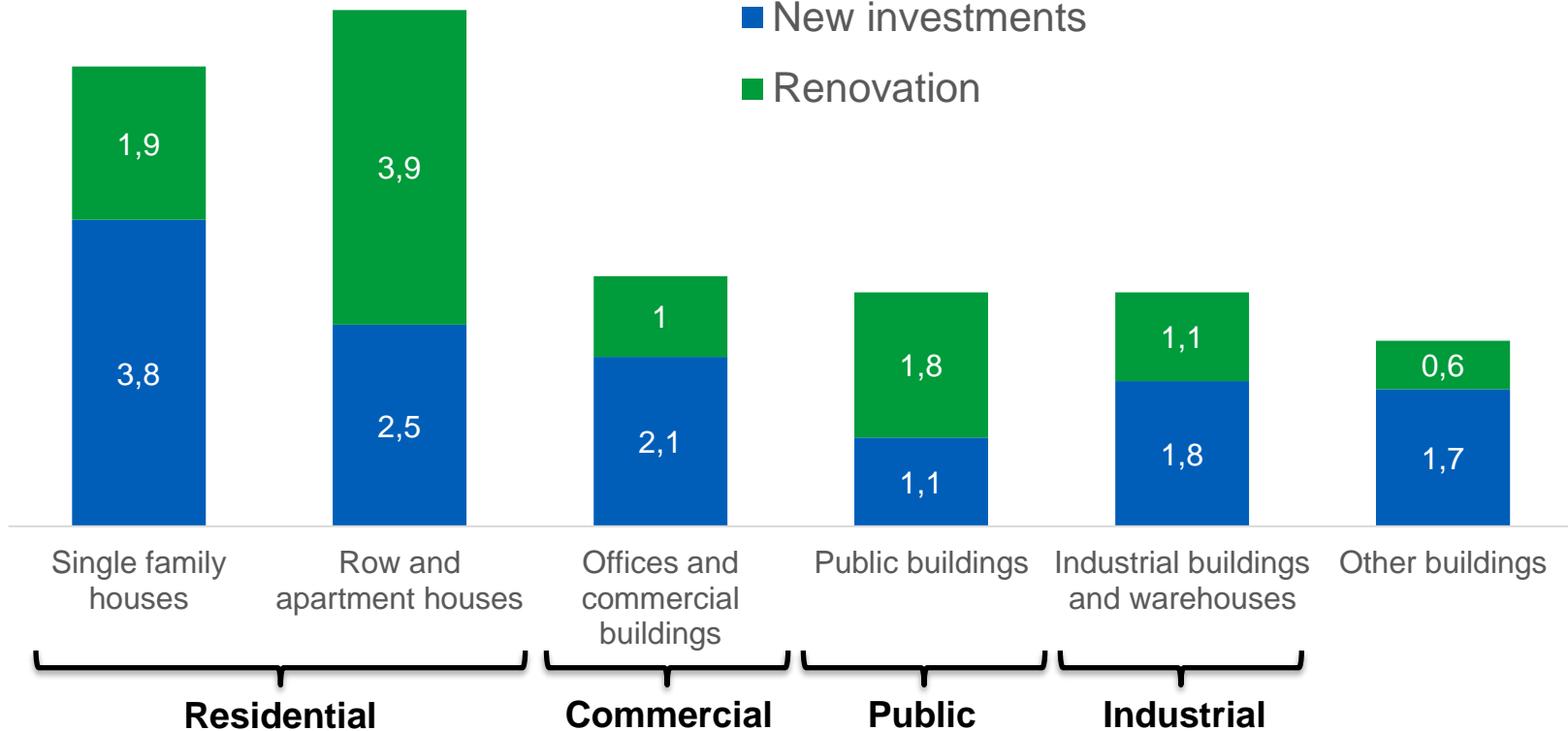
Infra construction and maintenance is not just roads and railways...



Value of end-product types in building construction and renovation

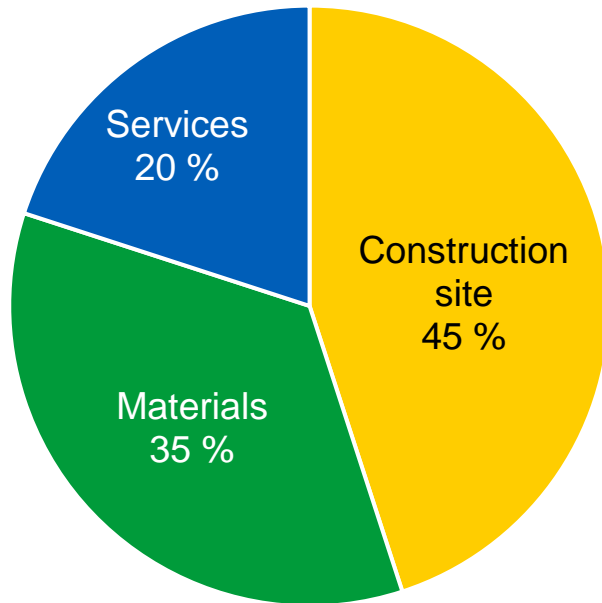
M€ (2011)

■ New investments
■ Renovation

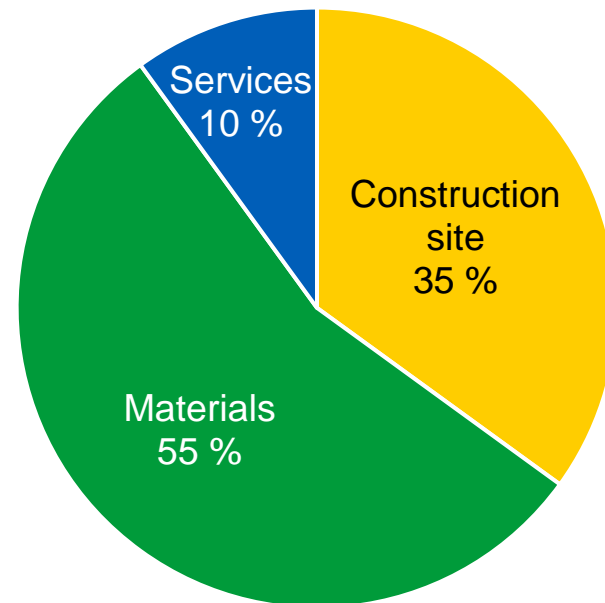


What resources are used and managed in construction?

Costs of infra construction



Costs of building construction



“Construction as a production system to transform many inputs into an integrated and unique output by managing and coordinating several production modes from processes to project”

Levels of Construction Management

1. On-site production

- Physical production phase, on-site management

2. Project

- Delivery of project, need-design-production-use, stakeholder management, information management

3. Business / Enterprise

- Project portfolio, business strategies, production strategies, financing, R&D, human resource management, procurement, marketing

4. Industry

- Practices, values, culture, education, laws

Special characteristics of construction

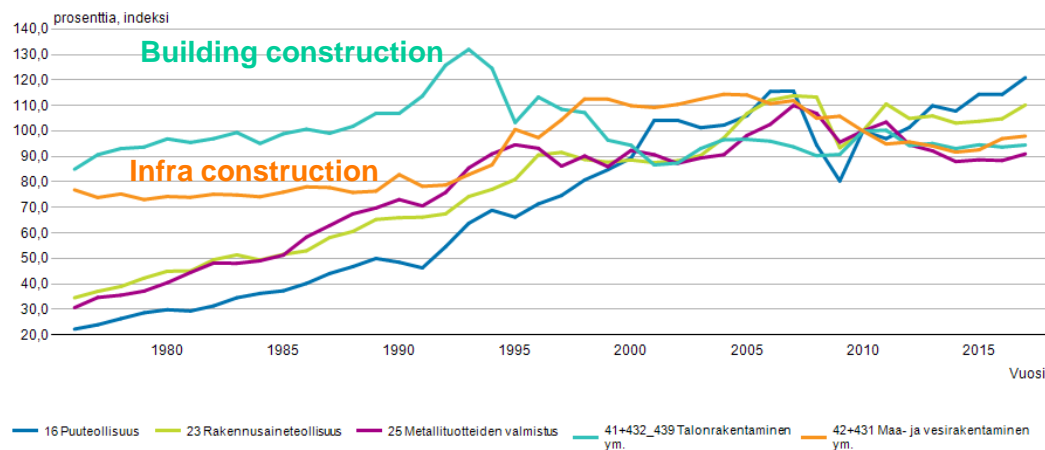
- End-products are typically large
 - End-products have long life-cycle
 - Aimed outcome unique in terms of technical, functional and/or aesthetical features
 - Site-dependency: Every site is somewhat unique as a location and conditions

 - National and local requirements for buildings vary

 - Multi-professional and multi-firm organization used, changing from project to project
 - Majority of production and assembly happens outside with varying and uncertain weather conditions
 - Site and incomplete building (=product) work as "a factory space"
 - Use of automated processes is rather low
-

Productivity in Finnish construction sector

Työn tuottavuus toimialoittain muuttujina Toimiala, Sektori, Taloustoimi, Tiedot ja Vuosi



Lähde: Tilastokeskus, Kansantalouden tilinpito

Productivity growth=

Technical development + efficiency increase + quality of inputs + management + logistics + organizational development

Productivity = Output / input

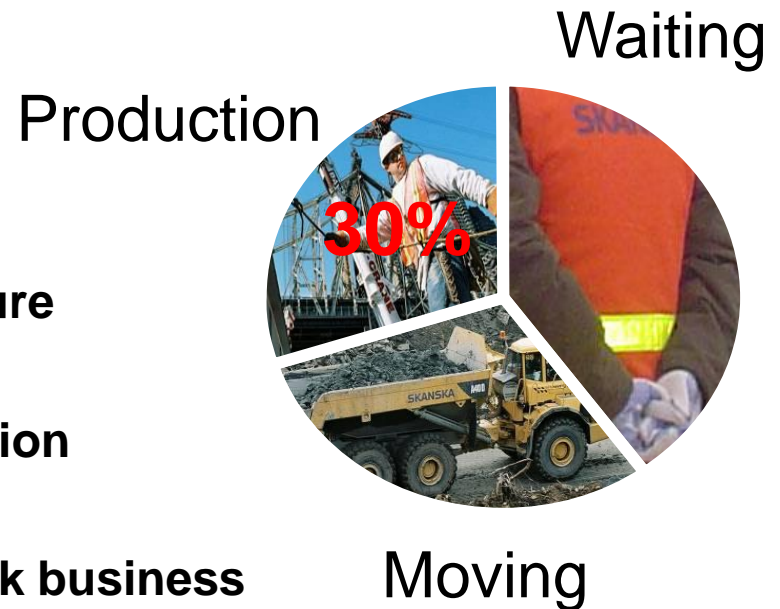
Output = Added value (€) or standard price of products

Input = working hours or working hours + capital (R&D, ICT, machinery, equipment)

Construction sector's output doesn't include purchased materials and services from other sectors!

Construction Industry Features

1. Low productivity
2. Decentralized business
3. Project driven business and culture
4. Local rather than global competition
5. Easy entry, low margin & high-risk business
6. The Game - to solve problems and avoid risks to materialize



Plenty of opportunities for disruptive innovations

1. **Big data, situational awareness, algorithmic design and engineering**
2. **Sustainability as competitive advantage**
3. **New materials and production methods**
4. **Platform-based business models**
5. **Integrating science with human and knowledge management**



How about car **construction**...



...instead of car **manufacturing**?

Project vs. Process as a production system



Project

High

- Unique design
- Installation on site

- Pre-fabricated modules (e.g. bathroom)

Job shops

Batch processing

- Delivery of materials, e.g. plasterboards

- Manufacture of windows, doors, elements

Production line

Continuous process

- Producing concrete

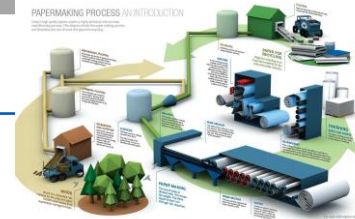
**Variation
Case-specific tailoring**

Low

Low

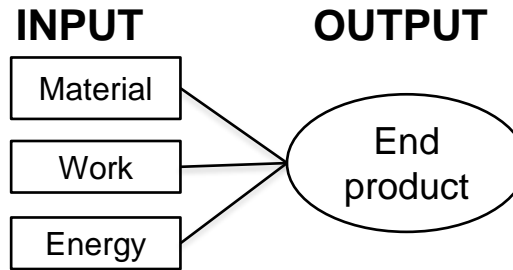
Number of copies / volume

High



Three viewpoints to production performance: TFV

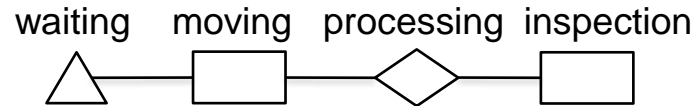
1. Transformation



MEASURE:

Efficiency

2. Flow



Lead time

3. Value



Fulfilment of the customer needs

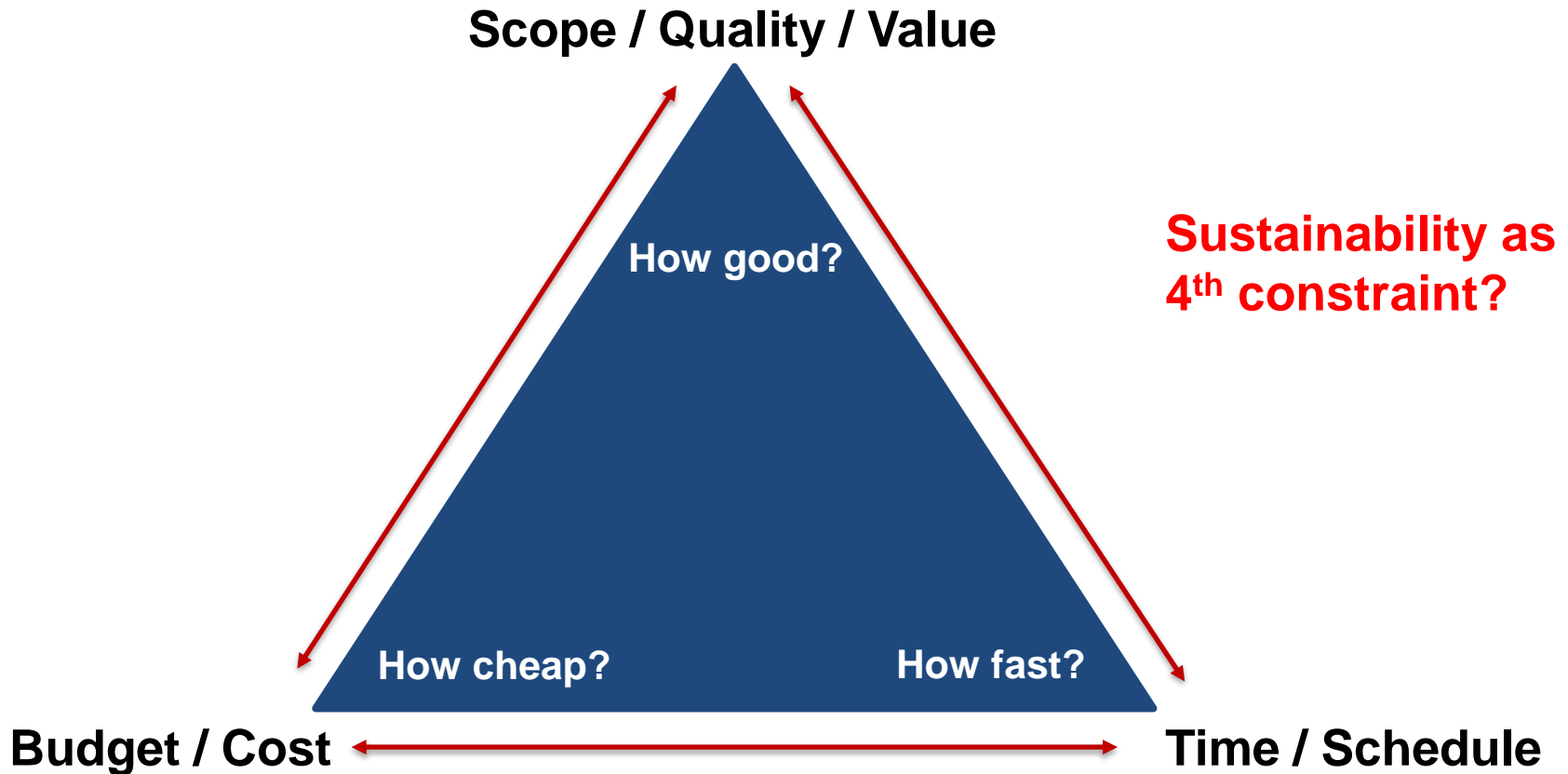


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Read more: Koskela (2000) An exploration towards a production theory and its application in construction. Doctoral dissertation.

Sacks (2016) What constitutes good production flow in construction? Construction Management and Economics.

Project management: The triple constraint



Construction projects traditionally seen as multi-stakeholder engineering projects

Methods well defined	No	Type 2 projects Product development	Type 4 projects Research and organizational development
	Yes	Type 1 projects Engineering	Type 3 projects Systems Development
		Yes	No

Project goals well defined

Project management with different project types

**Methods
well
defined**

No	Product breakdown Specialist group Quality, time	Mission definition Setting goals, Gates, Organizational change: Team building, Communication, Iterative definition cycles
Yes	Control of labor hours and costs, Task/activity scheduling	Phase-based approach Tight control Changes (customer)
	Yes	No

Project goals well defined

Limitations of the traditional engineering project management

- Pre-defined **time**, **cost**, and **scope/quality** targets direct project managers to achieve targets, not to optimize them or maximize project value
- “Design management is everything, production management is nothing” (or just not to make mistakes)
- ”Design in the making”
- ”Moving targets/value of the project”

Moving scope of the project, Case Tapiola project

From renovating facade of a commercial building to 2,7 € Mrd investments in Tapiola center (Metro, bus center, new commercial center, new residential buildings etc.)



Construction project - phases and processes

How does a construction project originate?

Starting points for a building construction project

1. Need for space



2. Under-utilized (-performing) asset



Overview on construction project phases

1. Needs assessment

2. Program planning

3. Design proposals

4. Master plan design

5. Construction permit tasks

6. Detailed design

7. Production planning

8. Construction

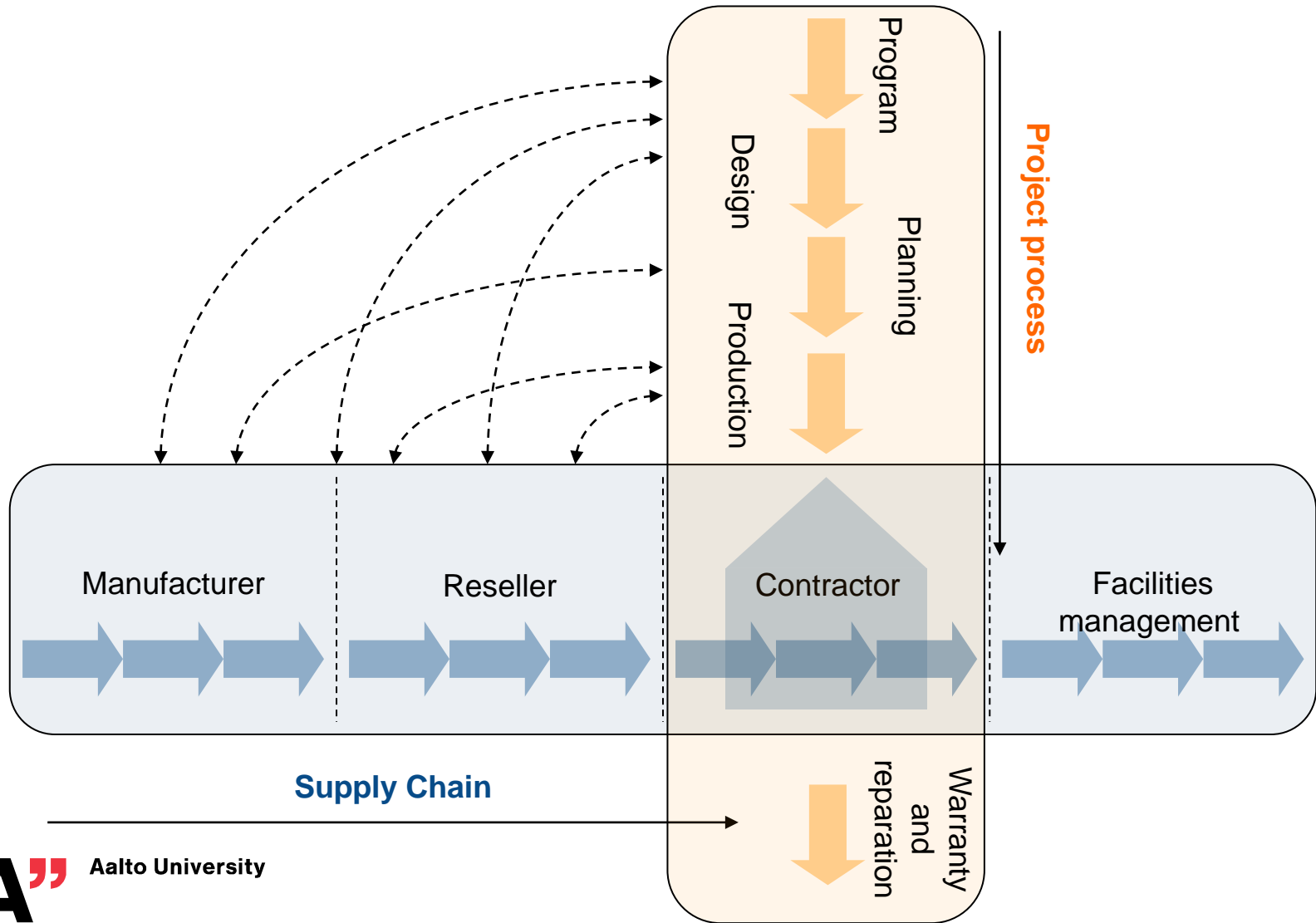
9. Start-up of operations

10. Period of guarantee

OBS!

1. **Importance** of phases vary a lot between projects
2. Phases can be conducted **parallel**
3. Process can be **iterative**, need to return previous phases

Project process vs. Supply chain



Typical phases of a construction project: Early phase design

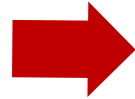
Project manager
is nominated

Designer(s)
are selected

1. Needs assessment (Tarveselvitys)

- Justifying the need for space or need to modify existing space
- Preliminary description of needed facilities and their requirements
- Exploring alternative solutions (e.g. rental, new construction)

• **Outcome: Project decision**



2. Program planning (Hanke-suunnittelu)

- Setting specific targets for functionality, quality, cost, timing and the maintenance
- Program plan is created which consists of general scope and quality targets, room program, and initial project delivery method

• **Outcome: Investment decision**



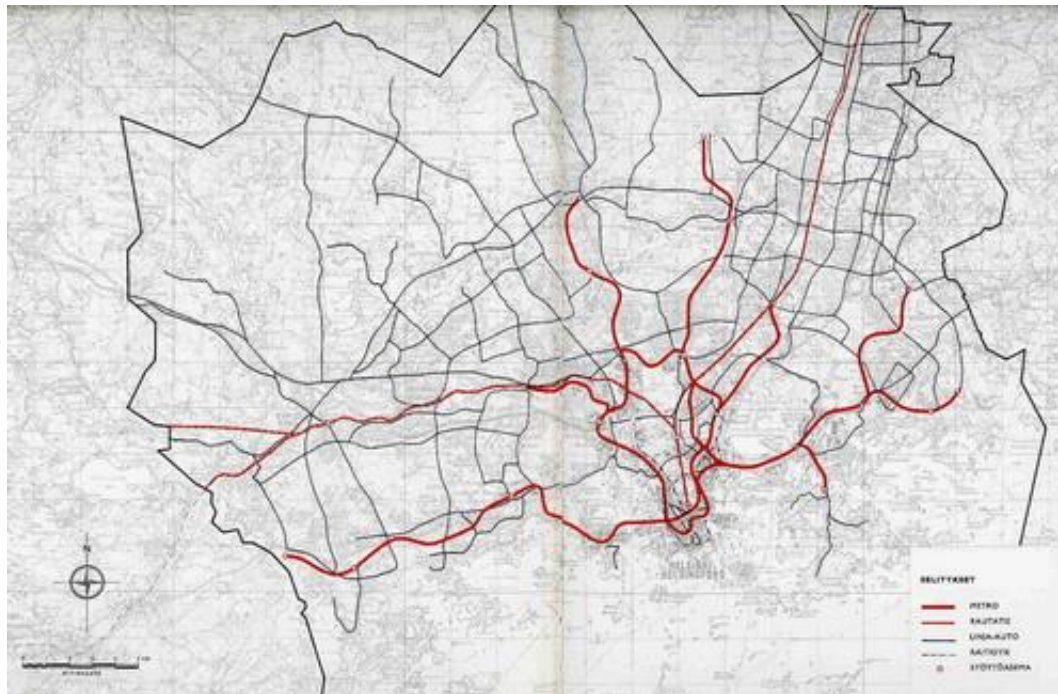
3. Design proposals (Ehdotussuunnittelu)

- Drawing up alternative design solutions to meet the objectives set

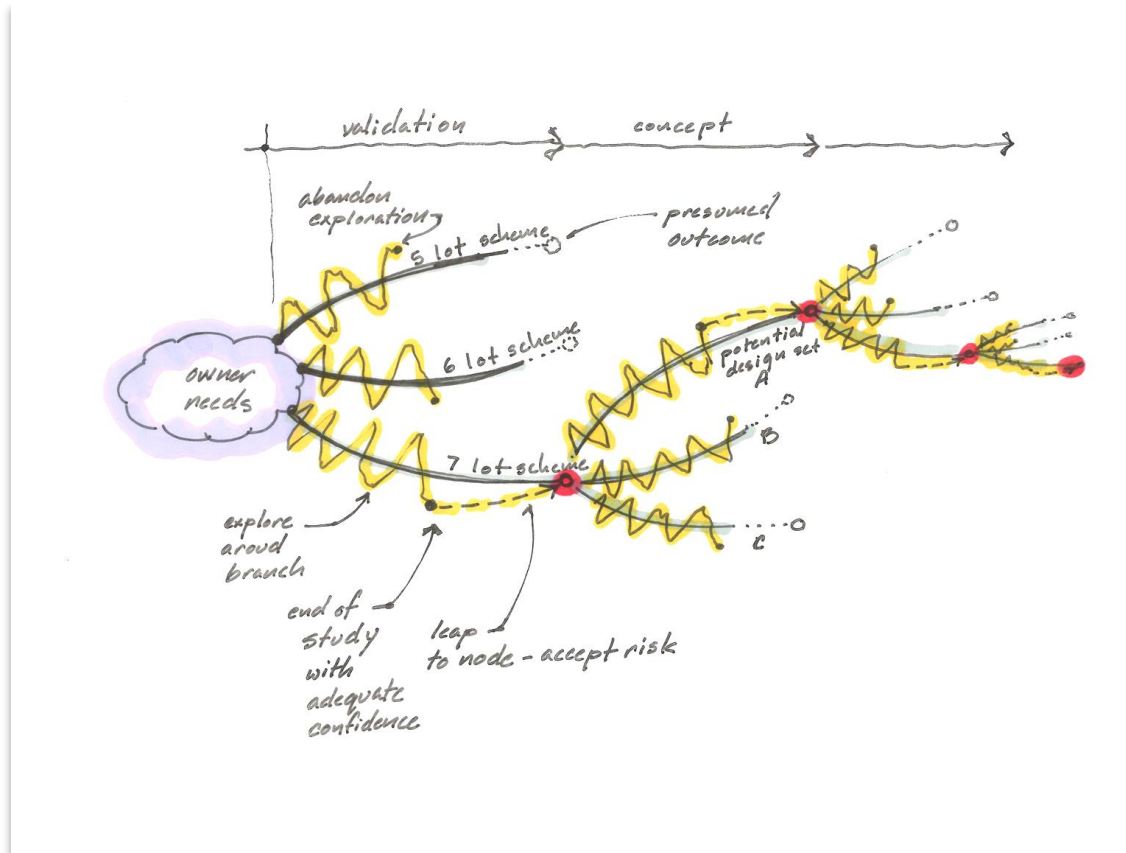
• **Outcome: Selected design proposal**

How long can be a project front-end phase?

Smith-Polvinen: Länsimetro, 1968



Working with design proposals: Set Based Design



Example of detailed room program

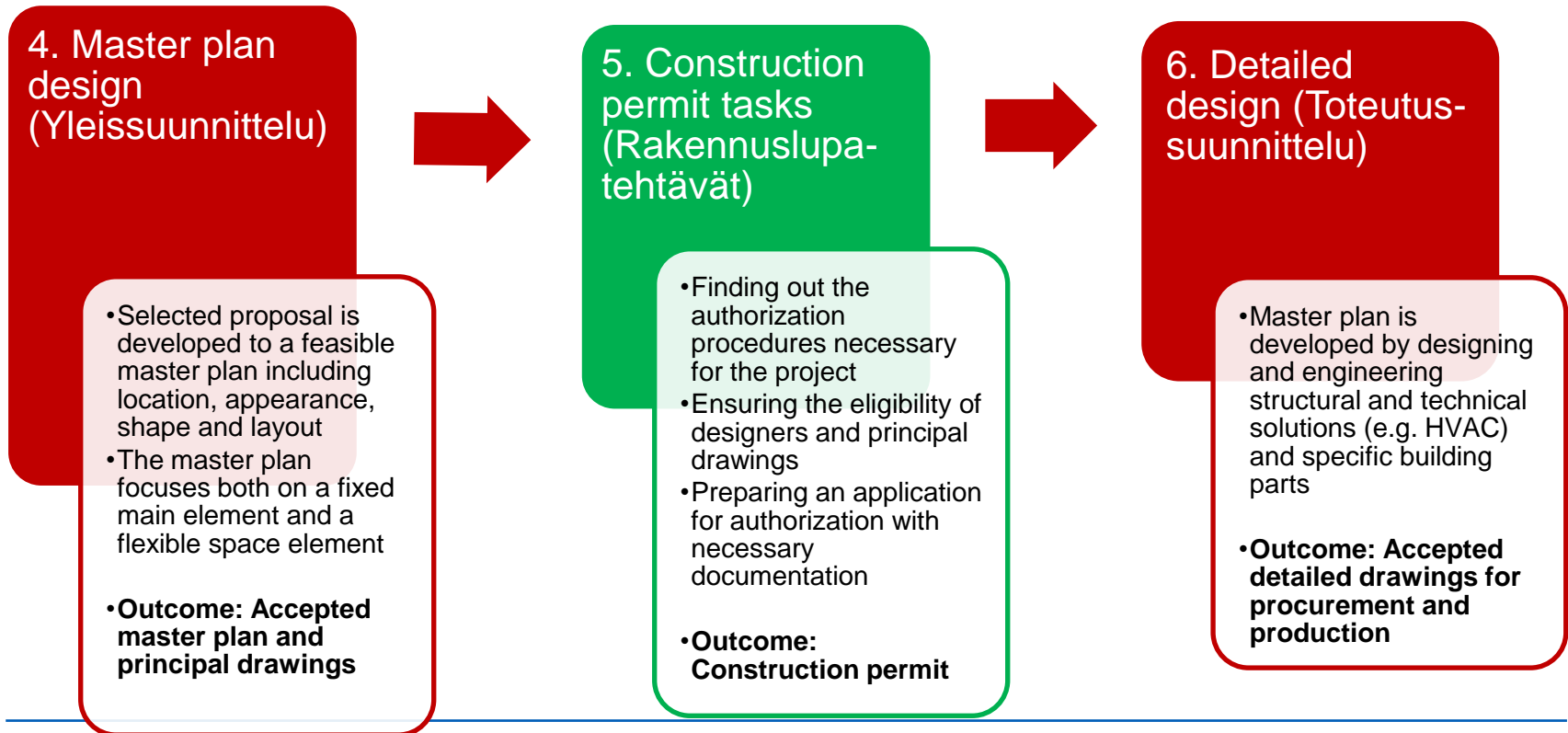
Hospital building

Region: Finland, Capital area

	1 LOBBY AND PUBLIC FACILITIES		Quantity	m2/a	total
	In English	In Finnish			
P	1 Lobby Office	Aulatoimisto	1	50	50
P	2 Info	Info	1	30	30
P	3 Walk-in lobby features	Walk-in-aulatoiminnot	1	300	300
P	5 Recruitment	Työhönotto	3	7	21
P	6 Quiet room	Hiljentymistila	1	60	60
Y	1 Checkroom	Vaatesäilytys	1	50	50
Y	2 Toilets	WC	2	4,5	9
Y	3 Toilets	WC	1	6	6
V	1 Entrance hall	Tuulikaappi	1	20	20
A	1 Cleaning Rooms	Siivoushuone	1	15	15
A	1 Kitchen	jakelukeittiö	1	20	20
H	1 Job Lunch Restaurant Hall	Työpaikkalounasravintolasali	1	80	80
H	1 Toilets	WC	2	4,5	9
	2 COMMERCIAL SERVICE FACILITIES				
U	1 Business space	Liiketila	4	35	140
U	2 Business space	Liiketila	1	80	80
U	3 Social space	Sosiaalitila	7	3	21

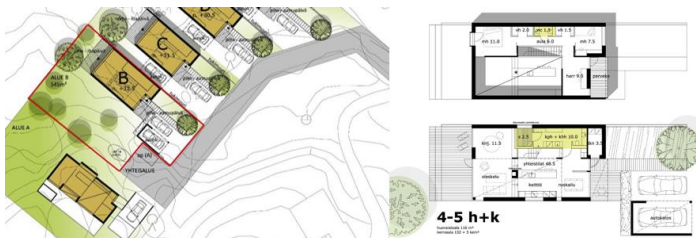
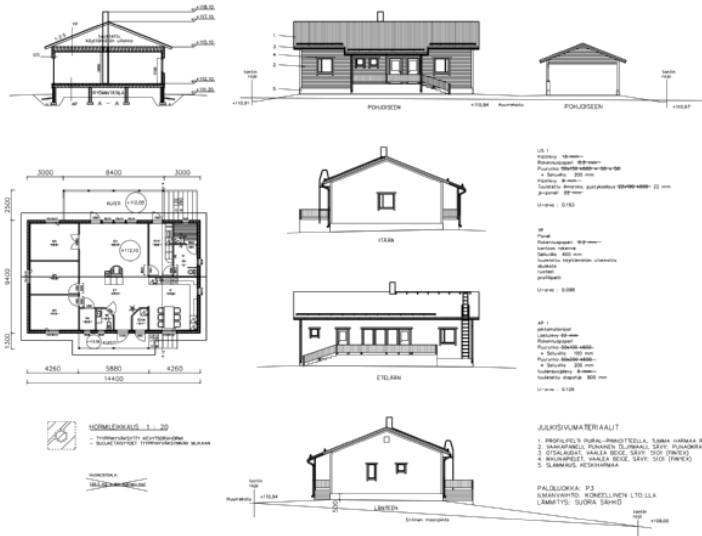
Typical stages of a construction project: Detailed design

Focus moving from architect to engineers

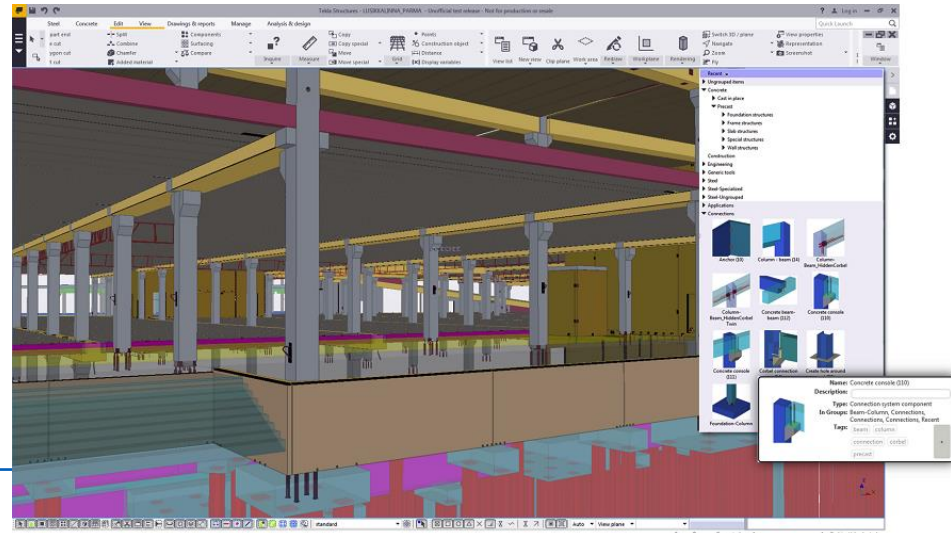
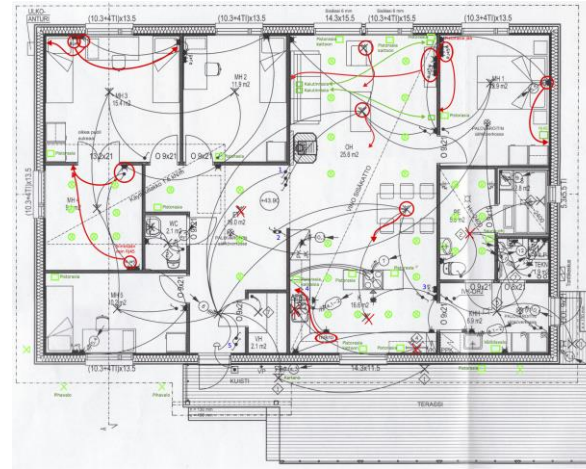
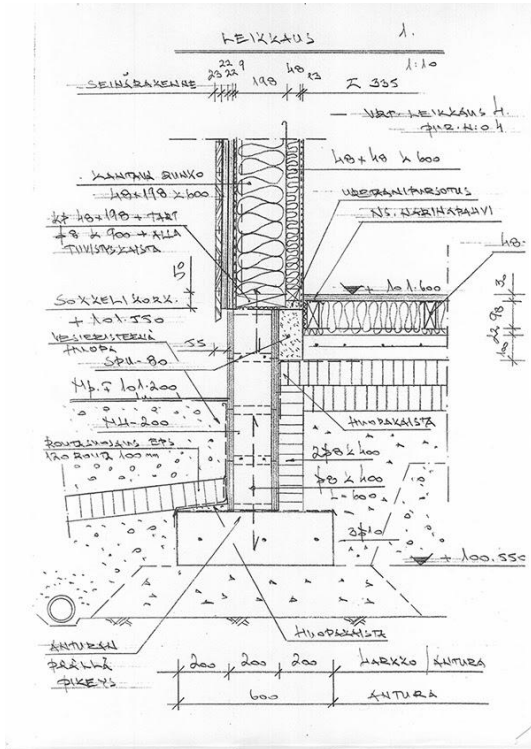


Iteration is **often** valuable!

Examples of master plan and principal drawings

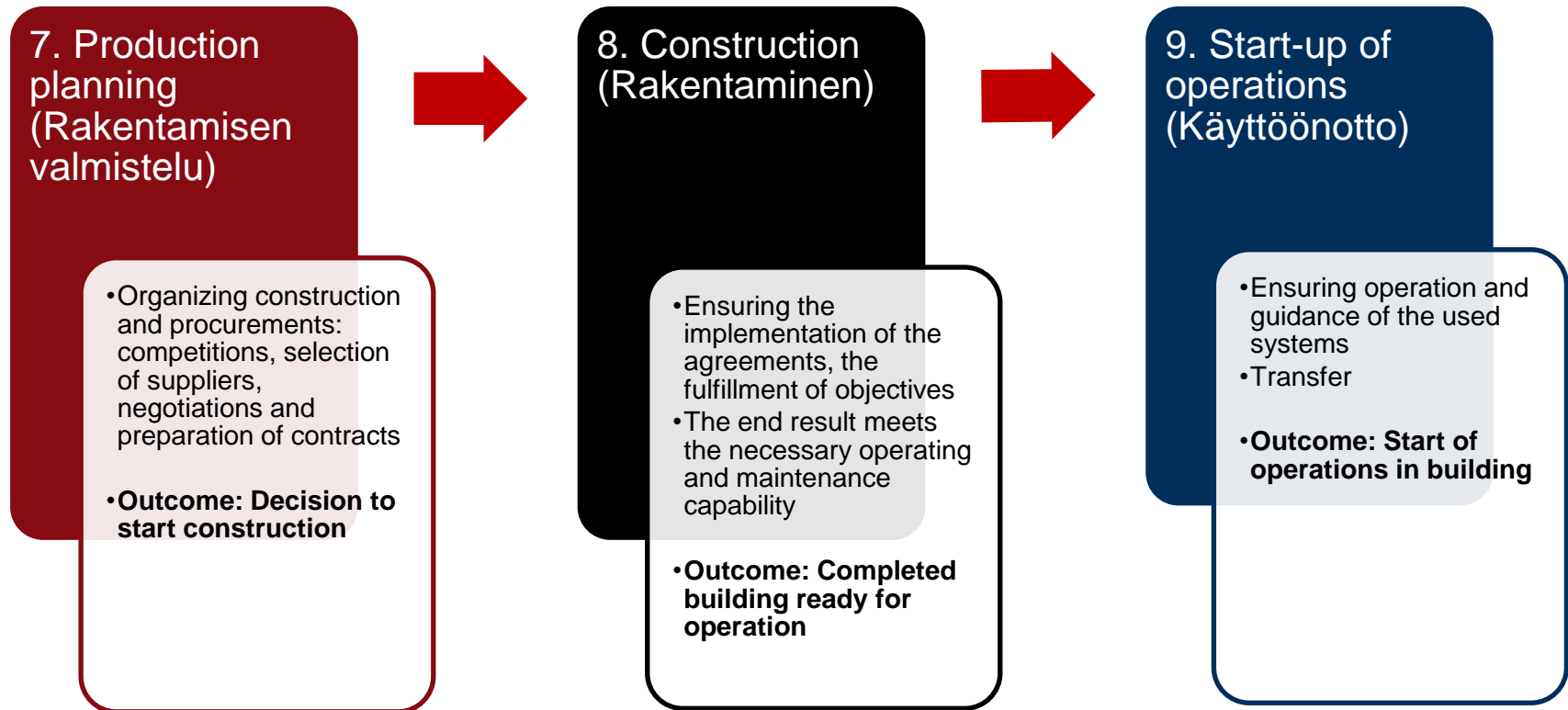


Examples of detailed design



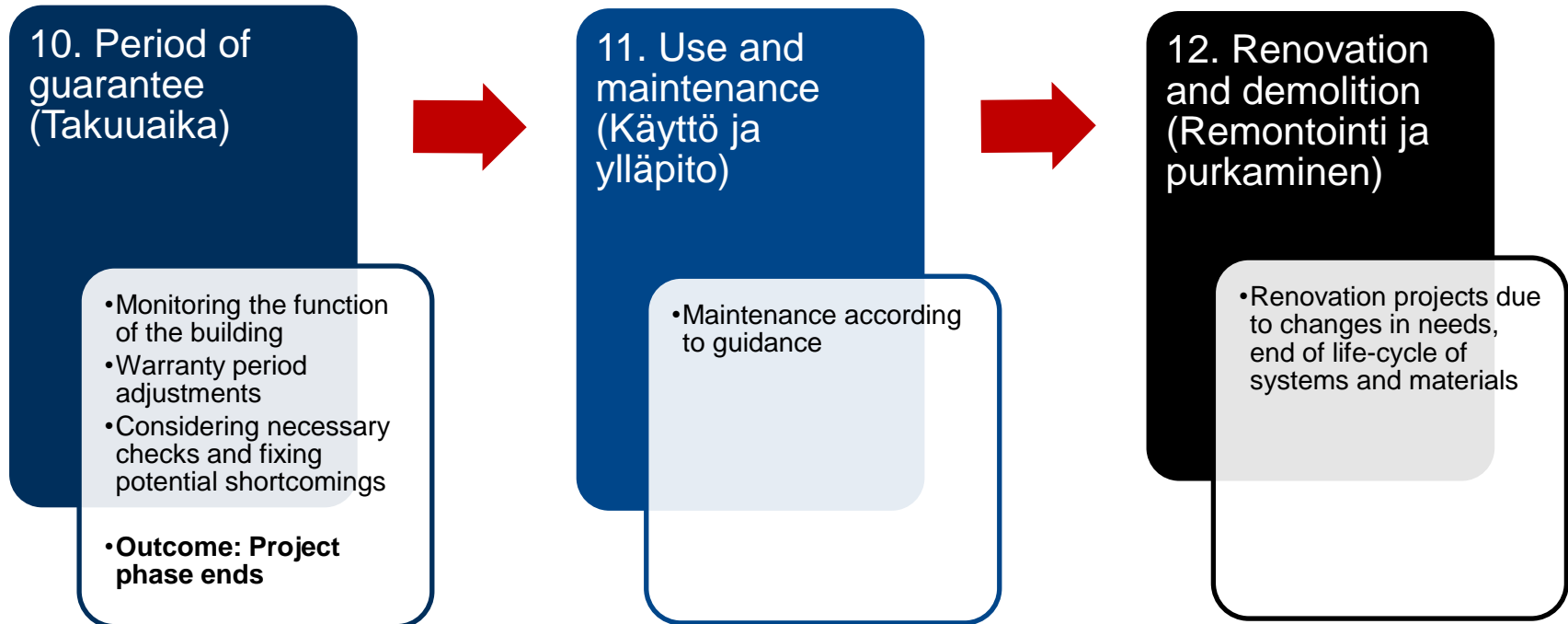
Typical stages of a construction project: Production planning and control

From project plans toward mobilizing
resources in supply chain



Typical stages of a construction project: Operation and use phases

Transfer of responsibility from project organization to owner and user



Construction project stakeholders and their tasks

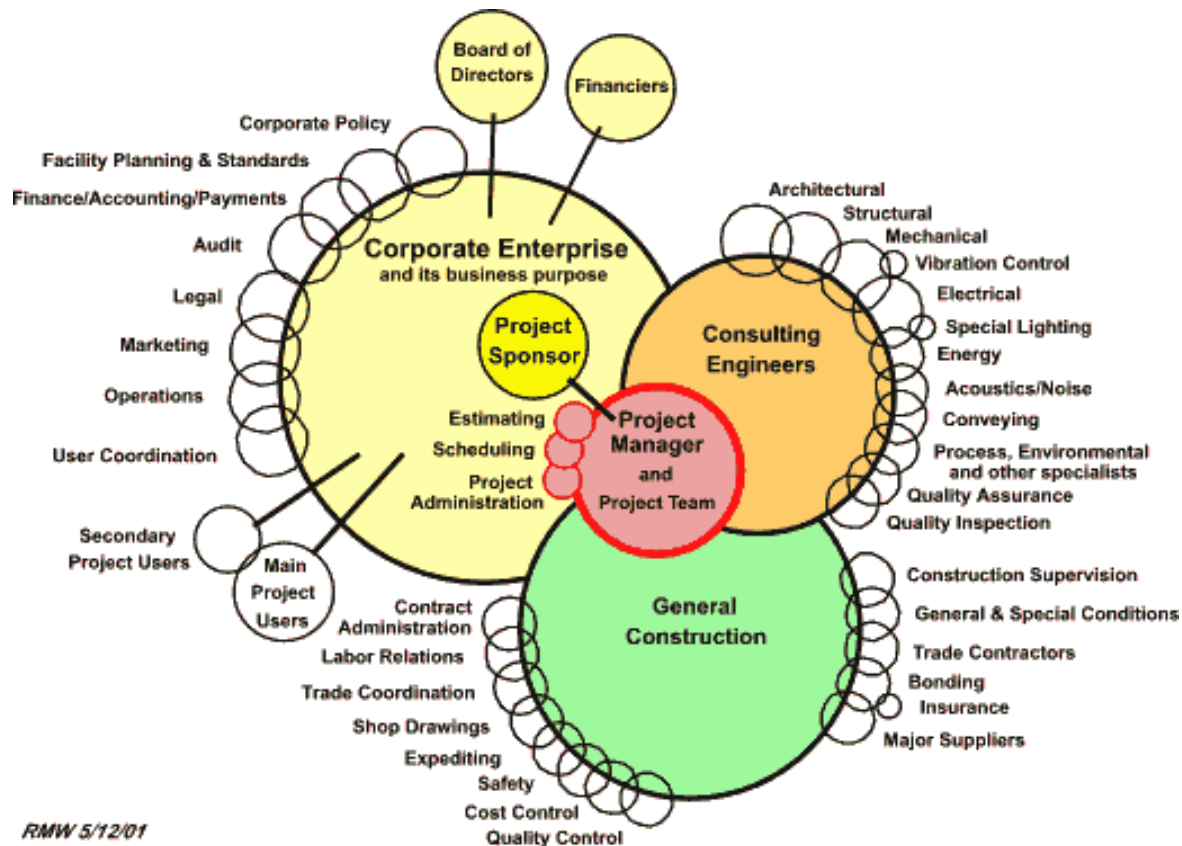
Project stakeholder

Project stakeholder =

”An individual, group, or organization, who may affect, be affected by, or perceive itself to be affected by a decision, activity, or outcome of a project”

(Project Management Institute, 2013)

Project organizations are typically complex



Source: <http://www.maxwideman.com/papers/looking/external.htm>

Different perspectives on project stakeholders

Contractual agreements

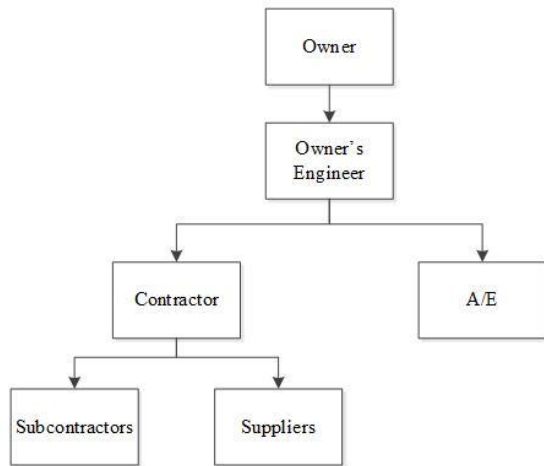
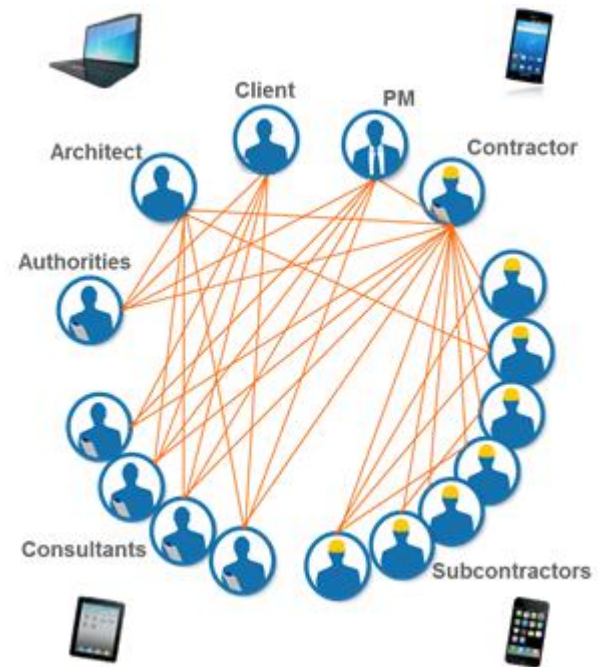


Figure 3: The general organization chart of DBB project in research study

Information flow



Tasks of construction project management (CPM)

- **Project management =**

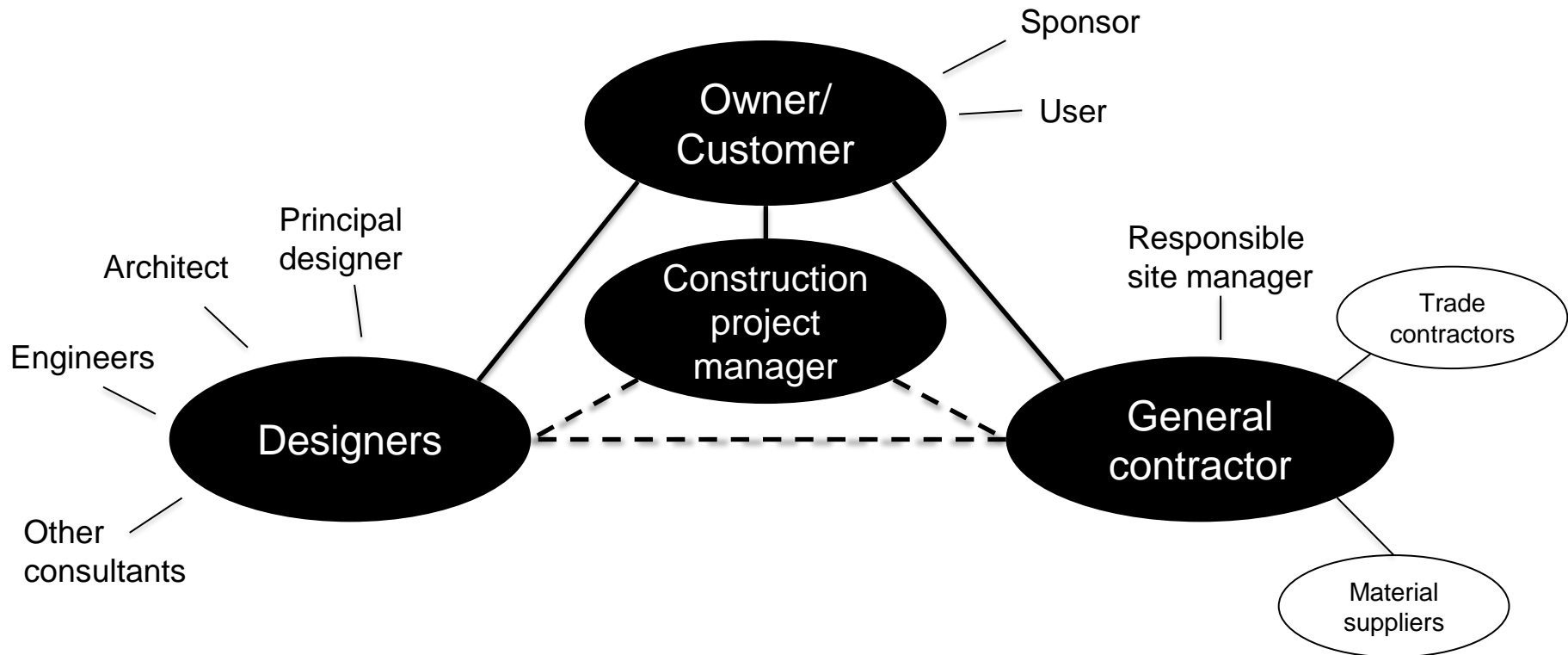
*“the art of **directing** and **coordinating** human and material resources throughout the life of a project by using modern management techniques to achieve predetermined objectives of **scope**, **cost**, **time**, **quality**, and **participating objectives**.”*

(Project Management Institute, PMI)

Tasks of construction project management (CPM)

- Set quality, scope, time and cost objectives for the project, and monitor their fulfillment
- Select designers and prepare needed design contracts
- Control costs of the project or recruit cost consultant
- Make needed decisions and acquire construction permits
- Select project delivery method, organize competitive biddings, and prepare contracts
- Control construction work, and make necessary changes in the contracts
- Manage tasks related to start-up of operations and commitments during guarantee period

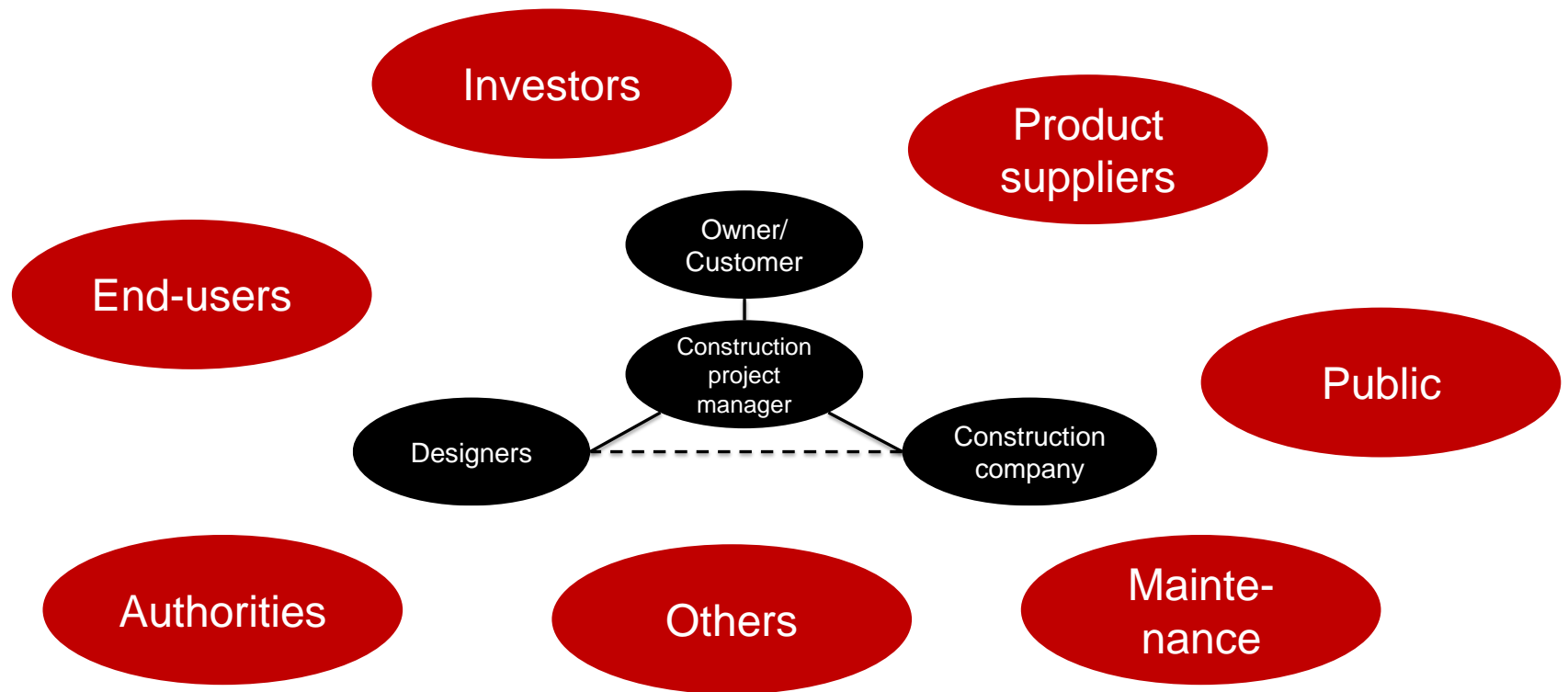
Main stakeholders in construction projects



Division of the CPM tasks

- **Construction project management tasks can be performed by a skilled individual, management group, committee, or consult organization**
 - Owner/customer conducts typically only part of the CPM tasks
- **Division of CPM tasks and roles into decision-making and implementation**
 - Decision-making:
 - *Construction committee or person in charge (owner heavily involved)*
 - Implementation:
 - *Project manager together with project team (often outsourced for consultant)*

Role of other stakeholders may vary a lot from project to project



Each stakeholder has an own viewpoint on project, and own project!

Frameworks and tools to manage stakeholders

Stakeholder Management Processes

POWER	High	Keep Satisfied <ul style="list-style-type: none"> • Leverage existing meetings • Presentations • Organisational briefings 	Manage Closely <ul style="list-style-type: none"> • Personal briefings • Workshops • Risk & issue awareness • Presentations
	Low	Monitor <ul style="list-style-type: none"> • No specific communications • Monitor messages from this group 	Keep Informed <ul style="list-style-type: none"> • Newsletters • Posters • Flyers • Website • Programme email address
		Low	High

INTEREST



Example of main stakeholders during project phases

1. Needs assessment
2. Program planning
3. Design proposals
4. Master plan design
5. Construction permit tasks
6. Detailed design
7. Production planning
8. Construction
9. Start-up of operations
10. Period of guarantee



O	Owner/Customer
P	Project manager
A	Architect
E	Engineers
A	Authorities
C	Contractor

Activation

- **Stop presentation for couple of minutes:**

Think about the most remarkable issue which according to your experience and understanding limits the efficiency and productivity in construction

Summary of the lecture

- **Role of construction sector and its sub-sectors**
- **Special characteristics of construction**
- **Three viewpoints for production performance**
- **Project vs. process management in construction**
- **Construction project phases and main stakeholders**

Further readings

- **Koskela. An exploration towards a production theory and its application to construction. VTT publications.**
<http://www.vtt.fi/inf/pdf/publications/2000/P408.pdf>
- **Crawford, L, & Pollack, J. (2004) Hard and soft projects: a framework for analysis. International Journal of Project Management, Vol. 22, 645-653.**
- **Schmenner and Swink (1998) On theory in operations management. Journal of Operations Management.**

In Finnish:

- **Talonrakennushankkeen kulku. RT-kortti. Rakennustietosäätiö.**
- **Hankkeen johtamisen ja rakennuttamisen tehtäväluettelo. Rakennustietosäätiö.**

Weekly assignment I – Productivity in construction

- Productivity of construction operations has remained low. Familiarize with the topic through lecture material and **at least two news articles or available reports** which discuss about productivity in construction.
- **Write an individual max 500-word essay** of your own reflections about the most remarkable **characteristics** which hinder productivity.
- **In your essay, ponder:**
 - Which are rather stable characteristics which you think are hard to change?
 - Which are more cultural and management-related characteristics which may be possible to change? Present your own suggestions to change issues.
- **Refer to used articles and reports in your essay, and show full reference in the end of the essay.**
- **Return your essay through MyCourses Assignments no later than Tuesday 9.11**