

## Construction management – emerging practices and new ways of working

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Boost Brothers Ltd



Picture: Erik Johansson

## Contents

- Introduction
- Emerging practices in construction management
  - Case I New social and healthcare center – selected as the public sector construction project in the world
  - Case II Kinnari school – flagship project of new learning environments in Finland
- What's next in construction management?

## Boost Brothers Ltd – Developing construction

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### Our mission:

Find the most valuable information in construction and take it into practise



## Key figures (2021)



35 experts



Turnover 3 meur



NPS = 100

The fastest growing construction management company in Finland 2018-2020  
(Top 100 Companies in the construction sector, Rakennuslehti)



## We work as client's construction management expert in construction projects

- **Boost Brothers Ltd**

- Founded 2009, headquarters in Helsinki
- Construction management company
  - We work as client's construction management expert in projects
  - Currently involved in 70 construction projects including schools, kindergartens, hospitals, airports, churches, energy storage, power plants, housing, and office
  - Project portfolio exceeds 1000 million euros (procurement value)
- Highly R&D intensive company e.g., over 500 R&D projects together with clients on construction management, 50 scientific publications, 5 dissertations etc.
- Company DNA and team background are highly multidisciplinary
  - Construction management, philosophy, innovation theory, management science, psychology and organizational theory



## Boost Brothers offers construction management services

Service offering for client organizations

### 3. R&D services



- Service network design
- Investment analysis
- Market & technology studies

+

### 2. Coaching



- Milestone evaluation
- Team competences
- New technology adoption

+

### 1. Project management



- Project planning & briefing
- Cost management
- Procurements
- Project management & supervision

Value promise

Increase competitiveness

Get value for money

Secure project delivery

**BOOST  
BROTHERS**

## New ways of working in construction management are needed!

### Real estate owner challenges in 2021: uncertainty, uncertainty, uncertainty!

- Changing user processes and needs?
- New ways of working?
- Carbon neutrality by 2035?
- Increasing maintenance backlog?
- Indoor environment problems?
- Political pressures?
- Cost and schedule overruns due to ad-hoc decision-making and poor project management and organization?



**Huge market opportunities! For example, in Europe project cost overruns exceed 60 billion euros annually and investors are looking for professionally managed construction projects**



- 3 000 000 construction projects completed annually



- 60-100 billion euros cost overruns in construction projects annually



- 1000 billion euros of real estate investment capital in hibernation mode looking for professionally managed construction projects
  - Real estate investors are searching for investment projects that are managed professionally (RICS, 2020)
  - In particular, the investors look for new investment planning and project management models
  - Investor want to improve the management, monitoring and transparency of budget, schedule and other key targets in construction projects

## Impact of coronavirus on construction management?

- **In general, the impact has so far been relatively limited** – especially in housing and public projects – homes, schools, kindergartens and hospitals need to be operational!
- **Increase in public real estate spending.** Major increase in funds for Senate properties, Infrastructure authorities, social housing
- **New development opportunities!**
  - Need for new transparent investment management and project management approaches
  - Building flexibility and modifiability has emerged number 1 investment criteria (overriding location!)



Kuva: Erik Johansson

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## New social and healthcare center of Järvenpää city

- **Client and main user: city of Järvenpää**
- **Targets:**
  - The design process and solution must enable the city of Järvenpää to generate **health benefits** to the inhabitants via new healthcare processes and methods. The design solution must **adapt to functional changes**.
  - Maximize value-in-use
  - In budget 62 M€
  - Completed on time in October 2016
- **Project model**
  - Design alliance + Project alliance + life-cycle alliance (10 year warranty period)
  - Contract parties were all project key participants: user, investor, contractor, designers
  - External project auditing organization
- **Achievements**
  - Exceptional client and user satisfaction
  - Numerous awards e.g., best public sector construction project 2016



## Our role in the project

### 3. R&D services



- Service network design
- Investment analysis
- Market & technology studies



### 2. Coaching



- Milestone evaluation
- Team competences
- New technology adoption



### 1. Project management



- Project planning
- Cost management
- Procurements
- Project management & supervision



### Kuulostaako 2000-luvun sadulta? Järvenpää rakentaa soite-taloa, jossa potilas on kuningas

Järvenpää on suunnitellut kahdeksan vuotta ja kymmeniä miljoonia euroja maksavaksi sairaalaksi, jossa potilas on kuningas. Aloitteja on ollut useita, mutta nyt on tullut aika toteuttaa.

Kuoli: 20.11.2014 klo 10:00 - 10:15





## Key risks and potential solutions were identified and developed at the early stages of the project

- **Investment decision does not account for uncertainty**

- Real option analysis

- **Claims between project parties**

- Project alliance model

- **User needs change concurrently**

- Open building strategy

- **User is not satisfied with the design solution**

- User oriented design process

- **Poor quality of the construction work**

- Milestone evaluation of the project



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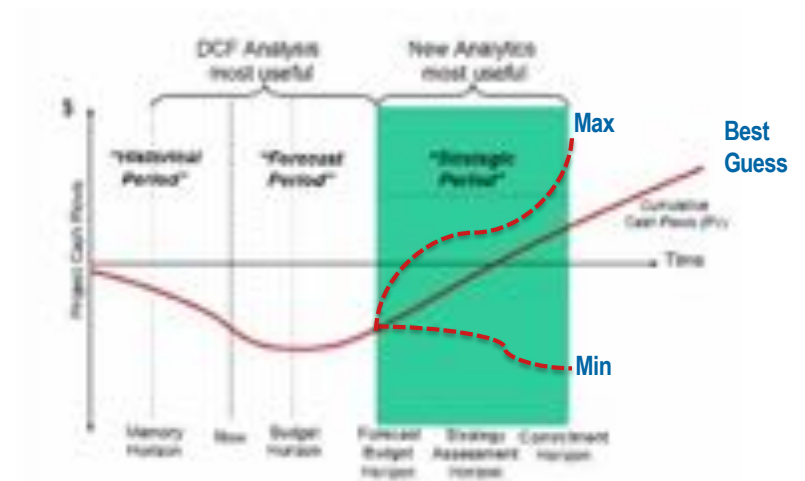
- **Poor quality of the construction work**

- Milestone evaluation of the project

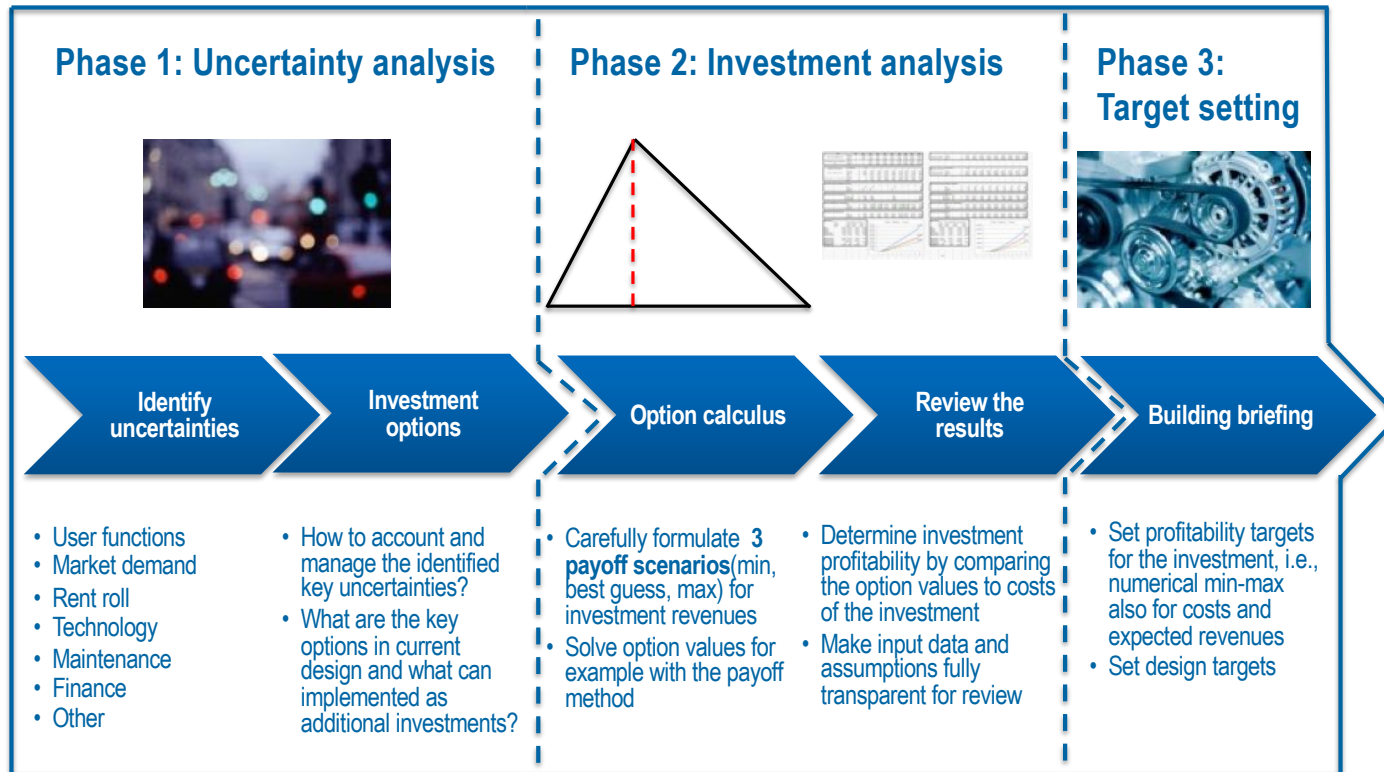


## How to account for uncertainties in your investment decision? Real option thinking is an emerging practice

- A real option is a right, but not an obligation, to change a system in the face of uncertainty – **like the spare tire of your car!**
- Key idea of real option analysis is that flexibility is valuable: a building that has options (e.g., to increase capacity, to switch use) is more valuable than a project without options.
- Real option analysis a systematic process to value and set targets for building investments, particularly flexibility
- The calculus is practical and straightforward as only 3 payoff scenarios are needed for valuation with the payoff method.



Real option analysis (ROA) a systematic process to valuate and set targets for building investments, particularly flexibility. ROA has 3 phases.



## ROA was applied to carry out the investment analysis of the new healthcare center

### Investment analysis results for the new healthcare center

Investment	Target	Investment focus	Cost	Real option value	Recommendation
New health care center	Address the increasing demand of health care services	New building	██████████ €	+ ██████████ (value of old premises)	Go
Service flexibility	Higher occupancy / renting out vacant spaces	Infill technical features, especially separability of spaces	██████████	+ ██████████ new tenants)	Go
Modifiability	Higher occupancy / facilities can be modified to all uses without expensive retrofits	Base building technical feature, particularly reservations for extra HVAC capacity	██████████	+ ██████████ (savings from HVAC retrofit)	Go
Ground heat system	Reduction of maintenance costs	Energy production	██████████	+ ██████████ (40 year life-cycle)	Go
Building expansion capacity	Increase asset value	Preparation for horizontal expansion	██████████ (horizontal expansion. 2000sqm)	+ ██████████ new tenants)	Go



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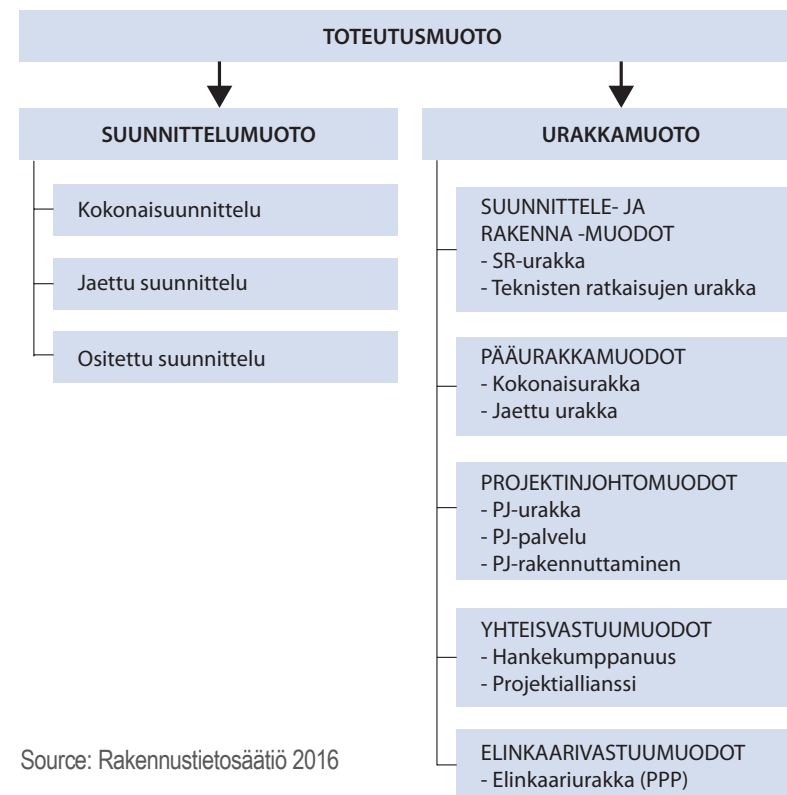
- **Poor quality of the construction work**

- Milestone evaluation of the project



## Selection of project delivery system is a major decisions for the client

- **Project delivery system** determines how the client aims to manage the project and carry out procurements and contracts
- **Two key decisions: design ja construction delivery system**
- **Most traditional choices** are field-specific design and general contracting
  - In general, good applicability to basic projects with little uncertainty
  - Often easy to work with due to extensive experience of market actors
- **Modern project** delivery systems are cooperative and have collective responsibility
  - Encouraging project experiences during the last decade – **brings designers, contractors and building users to the same table**
  - Designer and contractor can be simultaneously procured

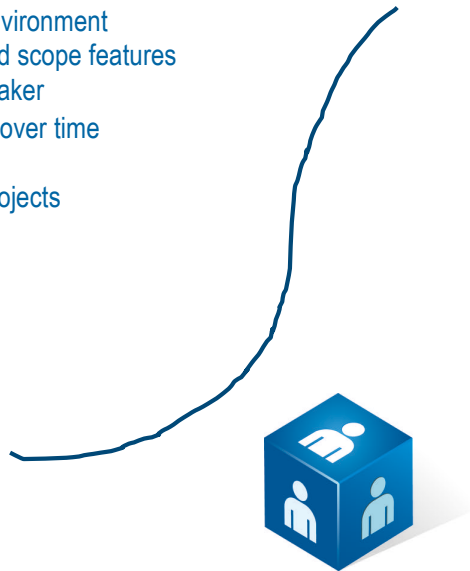


Source: Rakennustietosäätiö 2016

## Cooperative delivery systems are a reasonable choice for demanding projects

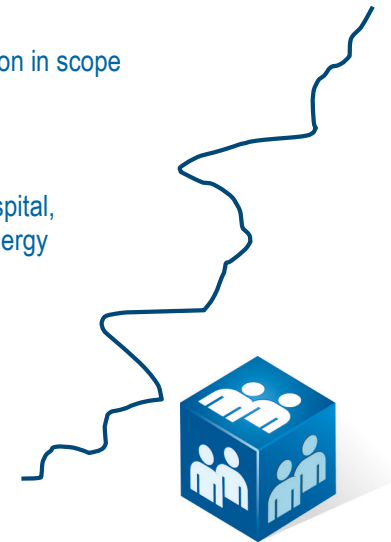
### Traditional

Deterministic environment  
Fixed quality and scope features  
One decision-maker  
Budget evolves over time  
Flexible timeline  
E.g., housing projects



### Cooperative delivery systems (e.g., project alliance)

Uncertain environment  
Several decision-makers  
Concurrent changes, variation in scope  
Fixed budget  
Need for innovation  
Challenging timeline  
Demanding project e.g., hospital,  
school, church, seasonal energy  
storage





## Project alliance aims to facilitate cooperation and manage uncertainties

### Project alliance delivery system

1. **Parties have collective responsibility** for project implementation (common targets, sharing of risks and opportunities)
2. **One project organization** – project is managed by alliance steering group with unanimous decision-making
3. Client compensates the parties according to **open book principle**
4. Project is carried out by a team that works for **”the best-of-the-project”** without hidden agendas
5. The parties **solve disagreements through negotiation** and waive the right to litigate through courts

Service provider / alliance partner is typically procured through a negotiative process and the decision is based quality factors, particularly the competence to co-operate and add value in project alliance

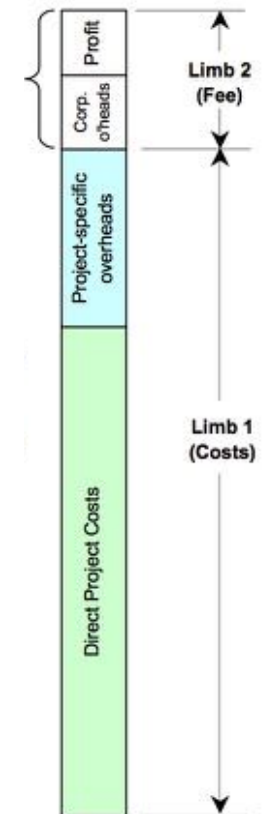


Illustration only  
Not to scale

## Alliance steering group makes decisions in project alliance

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Clients organization

Building user organization

Project group (assistance)

---



### Alliance steering group

- 1-2 representatives from each party
- Manages project
- Approves organization and team members
- Approves project targets
- Approves major procurements
- Builds common understanding
- Makes unanimous decisions



### Project manager

- Runs project group
- Monitoring, forecasting and reporting
- Risk management



### Project group

- Responsible for project implementation
- No organizational borders -thinking
- No parallel roles or systems

## Examples of risks related to project alliance delivery system

1. Client and building user's decision making power is transferred to other parties
2. Client waives the right to litigate other contract parties
3. Subcontractors may not follow alliance principles
4. Project alliance alone does not increase project team competences
5. Heavy organizational / transaction costs in smaller projects

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- **Poor quality of the construction work**

- Milestone evaluation of the project



## Open building is a strategy for organizing construction project to produce user-oriented facilities and manage changing user functions

### Key principle:

- The open building approach is based on the ideas of Habraken (1962).
- A building can be divided into a **permanent base building** (or “support”) and **infill** (“modifiable spaces”)

### Open building targets:

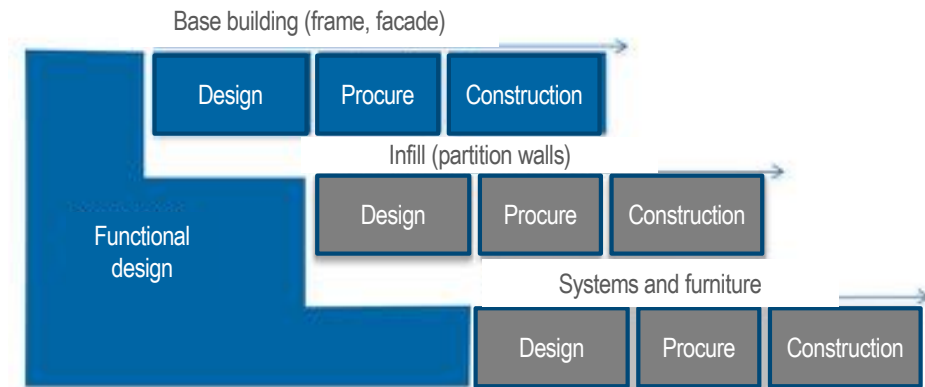
- Minimizes building system interdependencies to **facilitate design and decision-making flow**
- Moreover, it seeks to ensure that **design decisions enable buildings to change** and thus remain valuable in the future.



Picture: Kendall et al. 2012

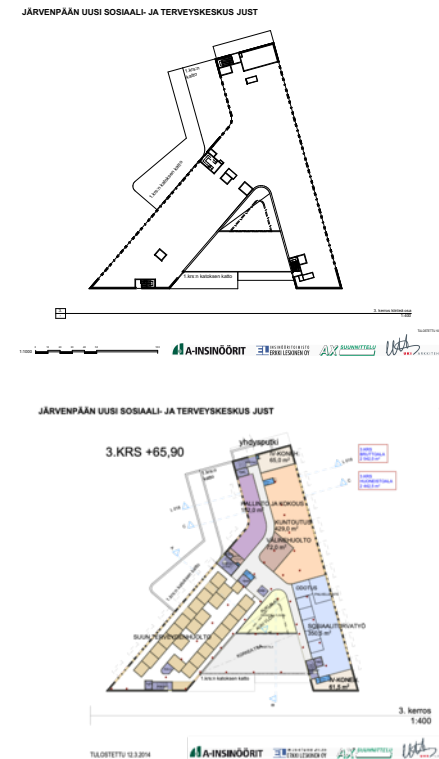
## Open building enables smart decision-making and flexibility in complex construction projects

- In open building, building design and construction is divided into two parts: a permanent base building and infill.
  - This gives the building user more time to do functional design and make decisions
- **Base building design and construction emphasizes long life-cycle and flexibility**
  - Client driven – client makes the approval decision
- **Infill & systems and furniture design and construction focuses on value-in-use**
  - User driven – building user makes the approval decision



## In open building approach, a building is required to offer two quite different forms of flexibility: service flexibility and modifiability

- According the open building principles, a building is generally required to offer two quite different forms of flexibility: modifiability and service flexibility
  - **Service flexibility** refers to the capacity of the facilities to be operated and used in different ways
    - e.g., ward → doctor's appoint room
  - **Modifiability** refers to the capacity of the building to be adapted to changes occurring many years ahead, such as changes of users. (Saari et al. 2007)
    - e.g., office space → housing



## How to start applying open building in practise in a building project? Flexible room program is a key tool for briefing

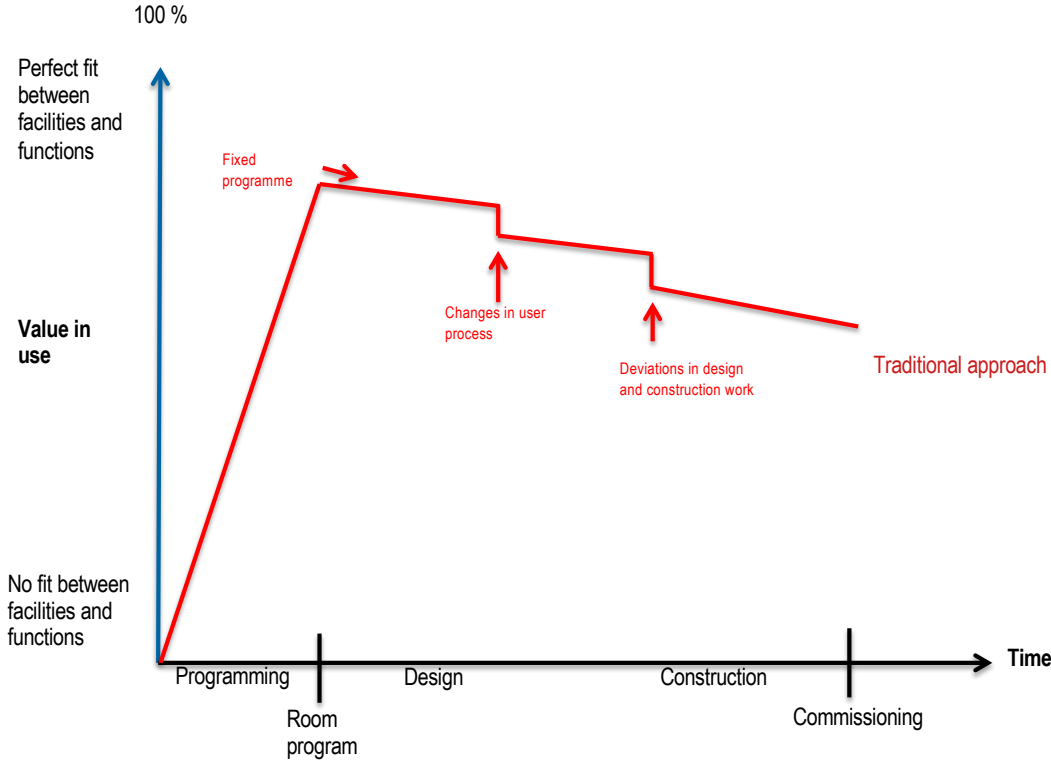
Room type	Space need (sqm2)	Main daily functions	Requirements for service flexibility	Requirements for modifiability	Requirements for interior environment
Surgery and administration	3000 - 4000	1000 customers	Type rooms must enable functions of all surgery units	30 type rooms must be modifiable to ward rooms	Room temperature management must be of a high standard, 20-22 C in winter and 23-26 C in summer. CO2 emissions must be under 700 ppm
Operation rooms	120 - 160	50 operations	Type rooms must enable functions of surgery and emergency		
Ward	1200 - 1560	60 beds	Type rooms must enable functions of all surgery units		
Dentist and diagnostic	1100	220 customers, 300 diagnostic missions			
Support functions	1930	1000 dishes, 300 staff, 50 meetings			

Flexible room programme includes

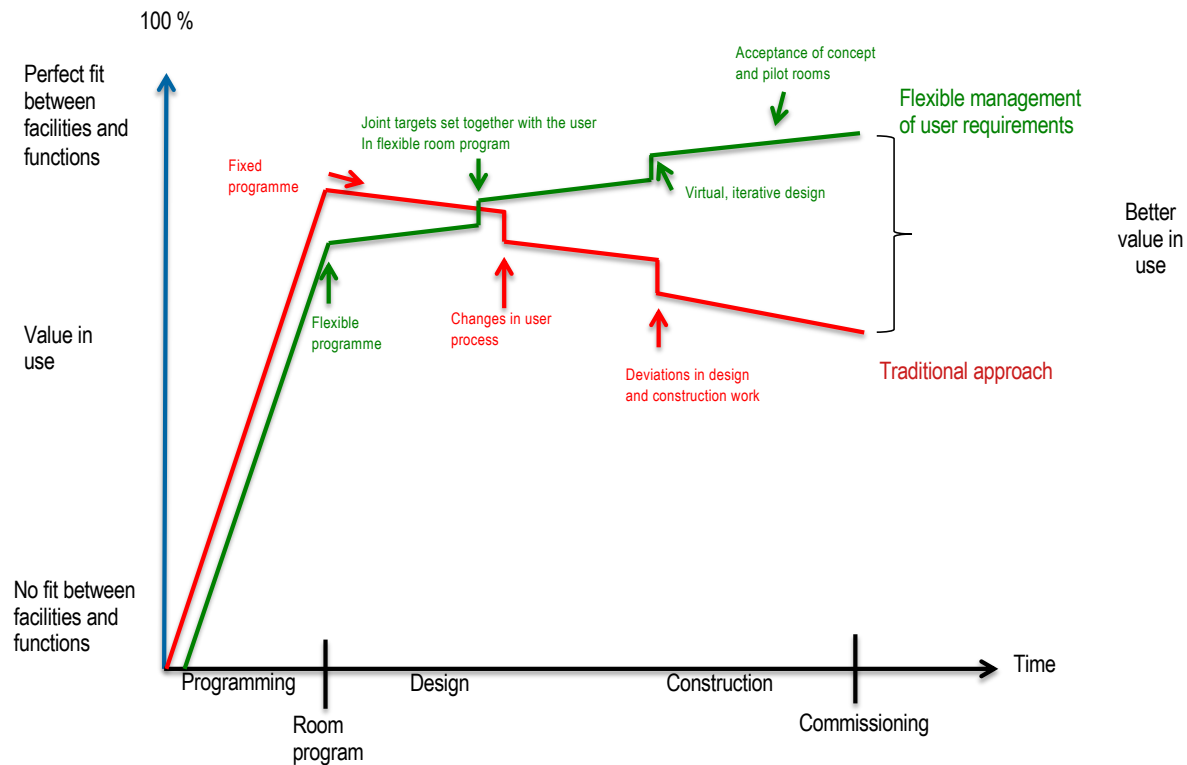
- room types,
- space need min-max
- targets for infill and flexibility
- requirements for interior environment



# What's the point of managing changing user needs?



## What's the point of managing changing user needs? Better value in use



Flexible user requirement management through flexible room program is particularly useful in healthcare, where user processes change constantly.

For example in this project the user process (i.e. room program) changed 27% during the design phase.

The building was designed according to open building principles

### Base building



### Infill: part 4/24



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KOY Järvenpään Terveystalo

3. kerros jaettavuussuunnitelma 1:50

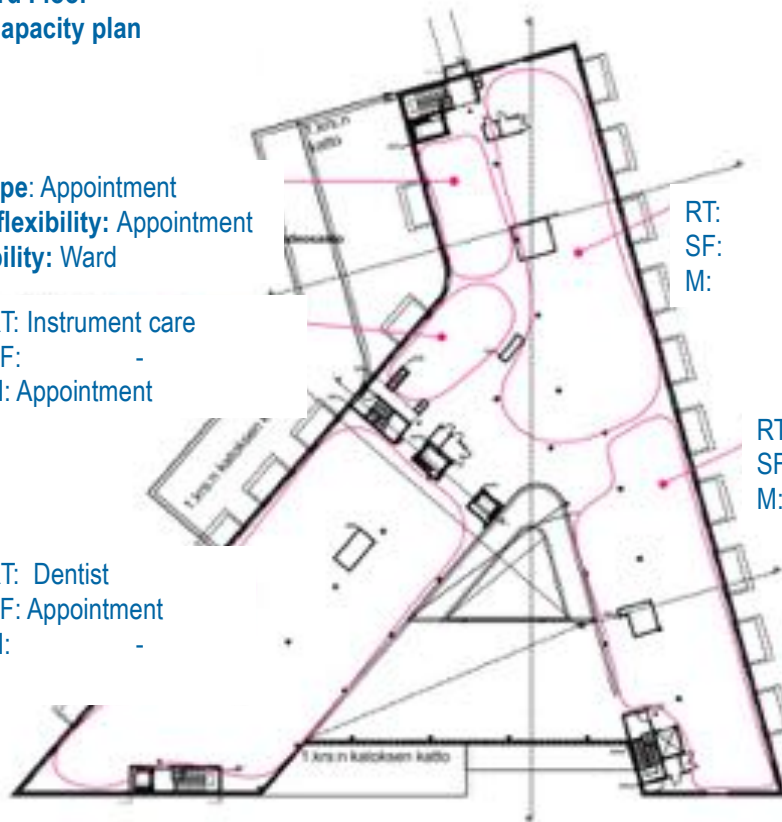
## Scope: capacity analyses

3rd Floor  
Capacity plan

Room type: Appointment  
Service flexibility: Appointment  
Modifiability: Ward

RT: Instrument care  
SF: -  
M: Appointment

RT: Dentist  
SF: Appointment  
M: -



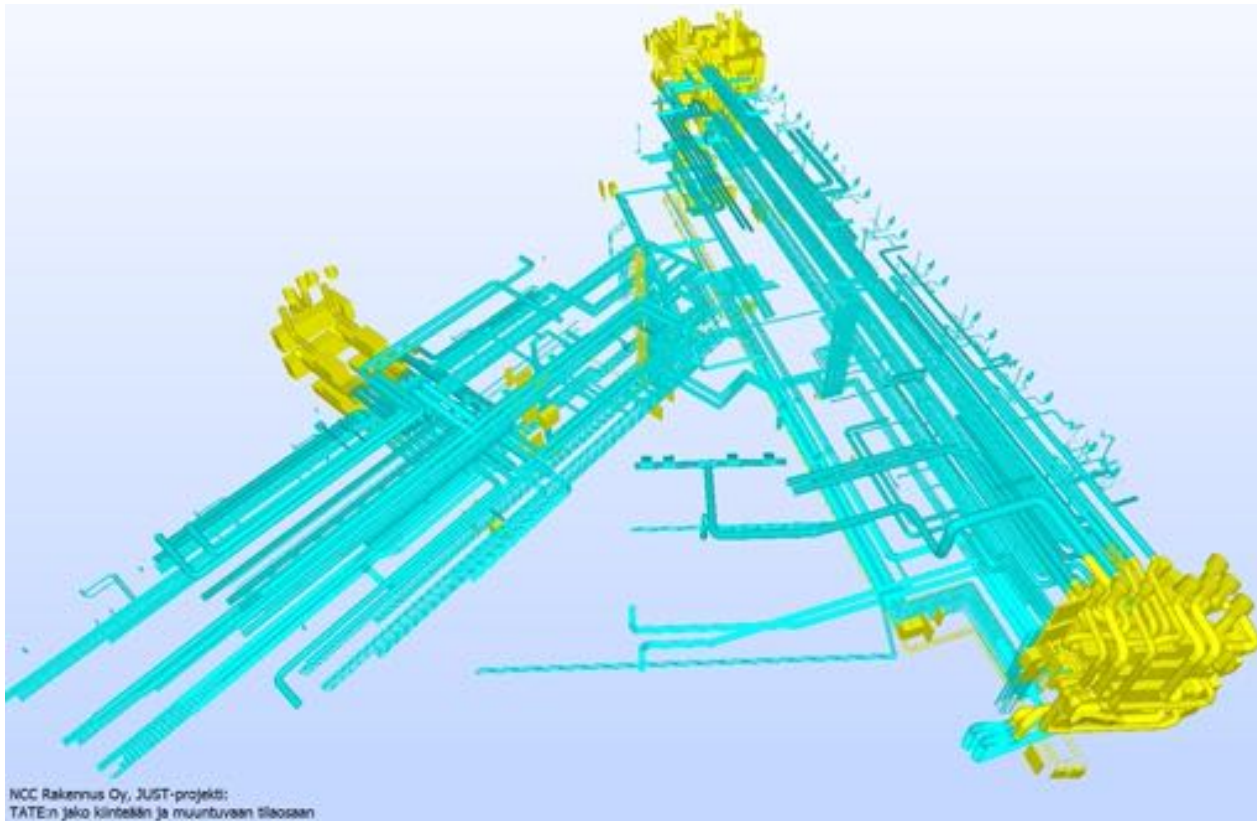
OK	= avokäyttö
KJ	= käyttösuojelu
M1	= suoritustila 1 (sisätyötilä tilaus- tai tilakoko ja -muutokset)
M2	= suoritustila 2 (sisätyötilä tilaus- tai tilakoko ja -muutokset)

RT: Rehabilitation  
SF: Appointment  
M: Ward

RT: Appointment  
SF: Appointment  
M: Ward

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## The HVAC and electricity infill and base building BIM models



## Key risks and potential solutions were identified and developed at the early stages of the project

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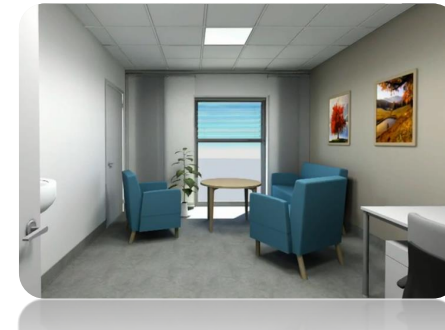
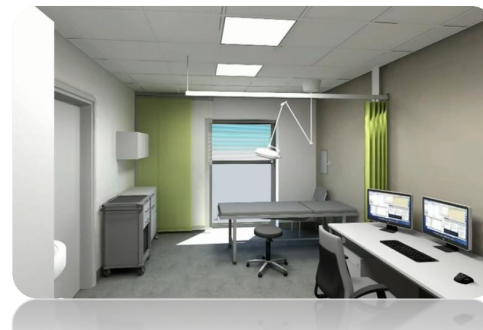
- User oriented design process

- **Poor quality of the construction work**

- Milestone evaluation of the project



The users were strongly engaged in the design process: physicians and nurses experienced and analysed the designs in 3D Caves



Pictures: Jari Toivo



Physical pilot rooms were also highly important to steer the infill design and keep up the user experience also during the construction stage



Pictures: Matti Sivunen & KOY Järvenpään Terveystalo



The designs were also evaluated by seniors



## Final evaluation: future users



Picture: KOY Järvenpään Te

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Pictures: Matti Sivunen & KOY Järvenpään Terveystalo

## Key learnings on building user engagement & cooperation in the project

- **Project targets should be based on user needs – common understanding needs to be reached**
- **Common understanding on key requirements for project success and principles for decision-making**
- **Common understanding on schedule**
  - Deployment
  - Project stages
  - Time needed to prepare for the next stage
  - Decision-making timetable
- **Engagement and commitment** of all user groups at all stages – continuous process with a focus on the matters that are interesting for the users
- **Common language and an "interpreter" is highly important**



Pictures: Matti Sivunen & KOY Järvenpään Terveystalo

## The project reached and exceeded its targets - why did it succeed?

- **Careful project preparation and briefing**

- E.g., engaging international and domestic gurus to the project, detailed analysis of uncertainties, investment costs and revenues, building use and project models
- Project alliance was an excellent choice for this project

- **Simultaneous and synchronized building design, service design and ICT systems design**

- Physicians, nurses and patients were strongly engaged in space design
- Construction management experts need to have a very good understanding of building user operations and ICT

- **Target cost was set according to the worst case scenario, and budget was fiercely defended**

- Experts carried out procurements, cost management and milestone evaluation, which provided strong support for the project team

- **Committed and ambitious project team**

- "This is my project" -attitude

## Further information



Procedia Engineering  
Volume 85, 2014, Pages 473-481



### Managing Risks Related to Functional Changes by Design Alliance ☆

Matti Sivunen <sup>a</sup>, Juho-Kusti Kajander <sup>a</sup>, Juhani Kiiras <sup>b</sup>, Jari Toivo <sup>c</sup>

Show more

<https://doi.org/10.1016/j.proeng.2014.10.574>

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### Valuing Indoor Air Quality Benefits in a Healthcare Construction Project with Real Option Analysis

by Juho-Kusti Kajander <sup>\*</sup>, Matti Sivunen and Seppo Junnila

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*Buildings* 2014, 4(4), 785-805; <https://doi.org/10.3390/buildings4040785>

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(This article belongs to the Special Issue The Impacts of the Building Environment on Health and Well-Being)

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  - Case I New social and healthcare center – selected as the public sector construction project in the world 2016
  - **Case II Kinnari school – flagship project of new learning environments in Finland**
- What's next in construction management?

## New Kinnari school project, city of Järvenpää

### 3. R&D services



- Service network design
- Investment analysis
- Market & technology studies



### 2. Coaching



- Milestone evaluation
- Team competences
- New technology adoption



### 3. Project management



- Project planning
- Cost management
- Procurements
- Project management & commissioning



### Kuin valtava avokonttori: Lapset opiskelevat jopa 100 koululaisen "soluissa" Järvenpään uudessa koulussa

Kinnarin elokuussa valmistunut uusi yhteiskoulu on rakennettu uuden opetussuunnitelman ihanteiden mukaisesti. Suurin osa koulusta on avointa tilaa, joka voidaan jakaa pienempiin osiin sermeillä ja liikuteltavilla seinillä.



#### Järvenpää -luetuimmat

JÄRVENPÄÄ  
HS Järvenpää: Rolf Westphal jätti raskaana olevan vaimonsa Yhdysvaltoihin ja suuntasi Suomeen toteuttamaan 11-metrisiä patsasta  
24.8.2019

#### Luetuimmat

- | JUURI NYT   | PÄIVÄ | VIKKO |
|---|-------|-------|
| 1. Illalla nukuttaa, mutta aamuyöllä alkaa väkominen - Lian vaihtoi heräily on monen vaiva, ja unitutkija kertoo, mistä siinä on kyse <a href="#">Tilaa jille</a> |       |       |
| 2. 11 000 tutkijaa varoittaa: Maapalloa <a href="#">Lue lisää - Tilaa jille</a>   |       |       |





## Kinnari school project targets and results

- **Client and main user:** city of Järvenpää
- **Targets:**
  - Outstanding and safe learning environment for over 800 students
  - Energy class A, ground heat and solar pv
  - User-centric design according to the new Curriculum for Basic Education
  - Healthy building criteria
  - In budget 31.3 Meur
  - On time August 2019
- **Project model**
  - Project alliance + life-cycle alliance (10 year warranty period)
  - Contract parties were all project key participants: investor, contractor, designers
  - External project auditing organization – milestone evaluation
- **Achievements**
  - Exceptional user and client satisfaction
  - Completed over 10% under the budget and on time
  - One of the first schools based on new curriculum



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MESTARITOIMINTA OY

JAAKKOLA  
ARKKITEHDIT

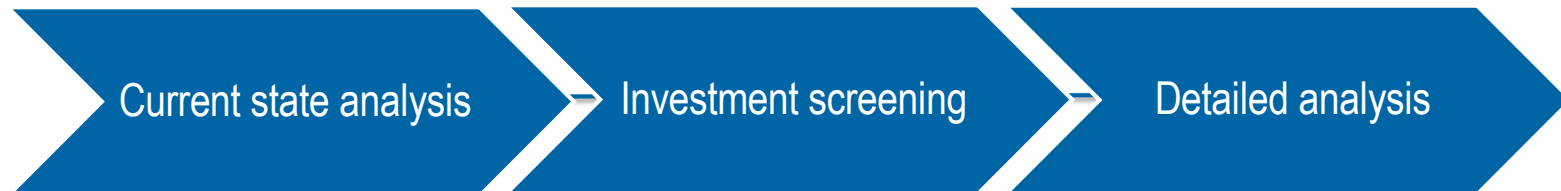




**Service and building network analysis was the first step in Kinnari school construction management – project targets and brief an outcome of the process**

**Building analysis**

- Building condition assessment
  - Investment needs
  - Targets (esim. pupil intake, teaching requirements)
  - Investment programming
- Screening of investment options
  - Typically over 20 alternative investments are analyzed and developed
  - 2-3 investments are selected to detailed analysis
- Detailed analysis with selected metrics (e.g., investment and life-cycle costs, flexibility, accessibility)
  - Proposal for city building investment plan and briefings for top priority projects



**Building user operations**

- Learning concept
  - Space efficiency target
  - Pupils per group and school size target
  - Elementary and / or junior high school emphasis
  - Neighbourhood target
- Development of building user service model and operations
  - Evaluation and development of new service models
- Rent level
  - Accessibility / way to school
  - Regional social segregation
  - Neighbourhood well-being
  - Equality in learning
  - CO2 impact

## Example of school programming in briefing

### 1. Learning vision and space concept for the school

1. Learning space type
2. Secondary user groups needs
3. Number of pupils per group
4. School capacity target
5. Elementary and / or junior high school

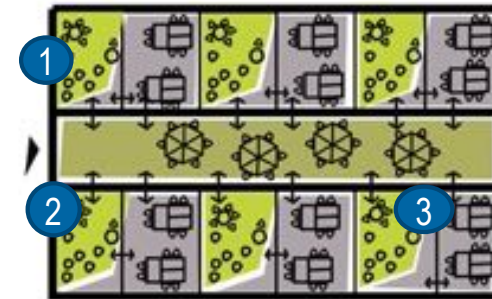
### 2. Space efficiency target

### 3. Flexible room programme

### 4. Quality targets (e.g. indoor environment)

### 5. Preliminary project schedule (cost level)

### 6. Budget for the project



Source: Julianna Nevari, Oivaltamo, avautuva oppimistila (2013)

Yhtenäiskoulun standarditilaohjelma		BOOST BROTHERS		Kerros (opettajat/kehilökunta)	
Sarjojen lukumäärä	5				0,66
Oppilaita/luokka	24				
Lukkaa	9				
Kouluisten mitoituskapasiteetti	1080				
Esikouluryhmiä	3				
Esikouluista/ryhmiä	24				
Esikouluisten mitoituskapasiteetti	72				
Henkilökunta/ryhmä	3				
Henkilökuntaa yhteensä	144				
Henkilöitä yhteensä	1296				
		Joista opetushenkilö kuntaa	95	Joista koulun opettajia	89
					Akuperän
Toiminta	Mitoitusperuste	Tilamäärä (arvio)	Kerros	Pinta-ala (m <sup>2</sup> )	Kinnat
Ikäkausiolut 0-6	Yhteensä 9 kpl, joista 3 esipetuvaihdella Yhdessä nuorimpien ikäkausiossa max 24*4=96 oppilasta. Yhdessä ikäkausiossa: - oppilaskohtaiset säilytystilat ä 0,15 m <sup>2</sup> /oppilas + kuratteenen 8 m <sup>2</sup> - Solussa yhteen kalvokeksusta; jaettavissa kalustein useaan toimintaympäristöön; seinällä erotettuja tiloja rauhallisempaan työskentelyyn tai opettajain työskentelyyn; sisältää varastotilat ym. ä 260 m <sup>2</sup> - Tiedonhakutila (ns. hajautettu kirjasto) ä 9 m <sup>2</sup>	35		2550	2040
"Yläkoulu-/ainesolu" (3.ile 24 oppilaan ryhmälle)	Yhteensä 3 kpl ä 180 m <sup>2</sup> Solussa tapahtuu mm. äidinkielen, vieraiden kielten, matematiikan, historian/yhteiskuntaopin, oop, terveystiedon ja uskonto/elämäntieteiden opetus ja ryhmätyöskentely	9		540	540
Biologia/maantieto (24 oppilaan ryhmälle)	ä 100 m <sup>2</sup>	2		200	100
Fysiikka/kemia (HUOM 16 oppilaan ryhmälle)	ä 100 m <sup>2</sup>	2		150	100
Kotitalous (1*24 oppilaan ryhmälle)	ä 190 m <sup>2</sup>	1		230	230
Musiikki (24 oppilaan ryhmälle)	ä 80 m <sup>2</sup>	1		80	80

## Further information



Available online at [2019.creative-construction-conference.com/proceedings/](http://2019.creative-construction-conference.com/proceedings/)

CCC 2019

Proceedings of the Creative Construction Conference (2019) 000-000

Edited by: Miroslaw J. Skibniewski & Miklos Hajdu

Creative Construction Conference 2019, CCC 2019, 29 June - 2 July 2019, Budapest, Hungary

### Estimating occupancy- and space utilization rates in non-residential buildings using planned-activity data

Matti Karjalainen<sup>a\*</sup>, Juho-Kusti Kajander<sup>a</sup>, Matti Sivunen<sup>a</sup>

*<sup>a</sup>Boost Brothers Ltd, Rautatieläisenkatu 6 00520 Helsinki, Finland*



Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

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Creative Construction Conference 2017, CCC 2017, 19-22 June 2017, Primosten, Croatia

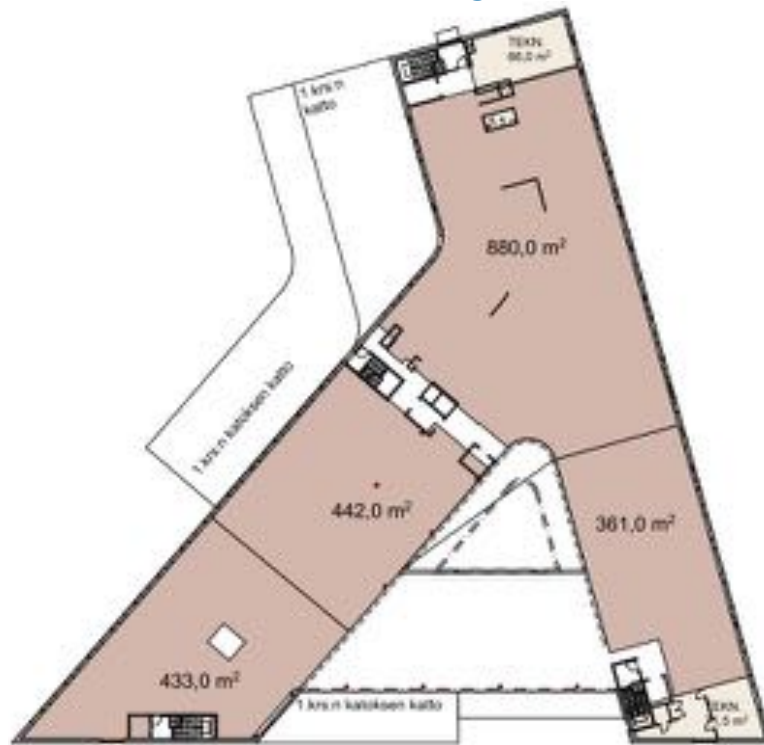
### Developing a project delivery system for construction project – a case study

Petro Pöyhönen<sup>a\*</sup>, Matti Sivunen<sup>a</sup>, Juho-Kusti Kajander<sup>a</sup>

*<sup>a</sup>Boost Brothers Ltd, Rautatieläisenkatu 6, Helsinki 00520, Finland*

Design, procurements, construction, commissioning were organized according to open building strategy

Base building



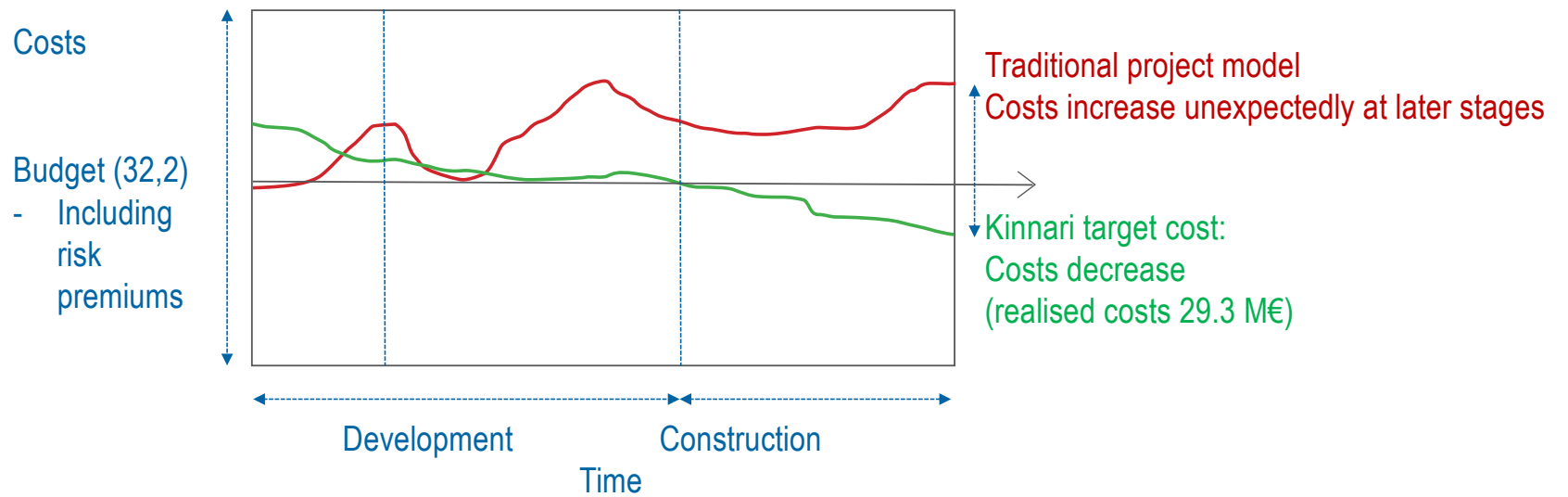
Infill



BOOST  
BROTHERS

3. kerros jaettavuussuunnitelma 1:50

## Kinnari's cost management was based on milestone evaluation



## Enhancing project results and learning through Milestone Evaluation

- **Background:**

- Incomplete information and great uncertainty in most construction projects → **need for steering mechanisms**
- Typical recommendation is to **learn** from past projects → timeframe often too long and knowledge transfer does happen

- **Idea**

- The project is divided into milestones that **steer project and project work based on real time information**
- Compensation of designers and contractors is connected to reaching targets
- Learning is boosted at milestone evaluations & coaching

- **Implementation**

- Milestone evaluation was developed and utilized the new Järvenpää healthcare center project. Later on it has been successfully deployed in more than 20 projects (schools, offices, apartment, kindergartens, church, power plants)

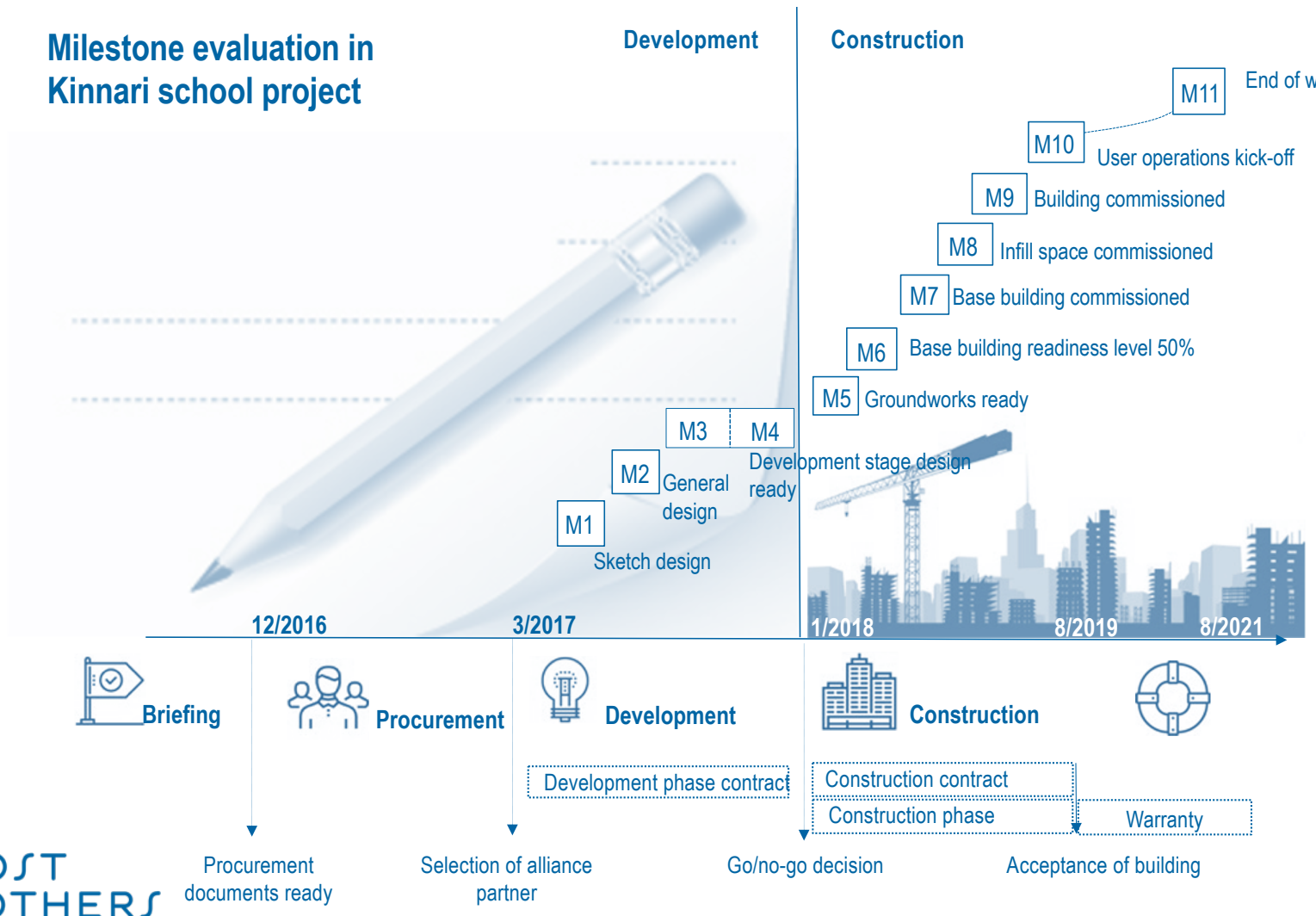
- **Results**

- All projects that have used milestone evaluation have been completed on time and in budget. Building users and clients have been very pleased with cooperation and quality outcomes.



Erik Johansson

# Milestone evaluation in Kinnari school project



M1...M11

Milestone = project milestone targets



## Example of M1 Sketch Design milestone evaluation

99%	Project schedule	☆☆☆☆
98 %	Quality targets	☆☆☆☆
89 %	Client and user satisfaction	☆☆☆☆
95%	Cost management	☆☆☆☆
100 %	Innovations	☆☆☆☆

### Result:

- Excellent preliminary plans were created M1 -stage according to targets

### Value for money results:

- **Co-creation of the operational design & building concept** and new learning environment solutions
- **Finding a highly efficient floor design** solution(brm2/hum2 1,09)
- Identifying relevant **renewable energy solutions**
- Innovative procurement of demolition work and specialty designers
- Innovative cooperation with city zoning officials

### Key action for learning and improvement at M2 stage

- Manage cost pressures emerging from rising construction cost levels



The key idea of milestone evaluation is to find out whether the project can continue to the next stage

- **Milestone evaluation focuses on risk management, and key targets and actions at the next project stage**
  - The aim is to anticipate and remove potential barriers to work tasks during the next stage (3-5 months typically)
  - After the tasks and learning assignments of the current stage have been completed, the project can continue to the next stage

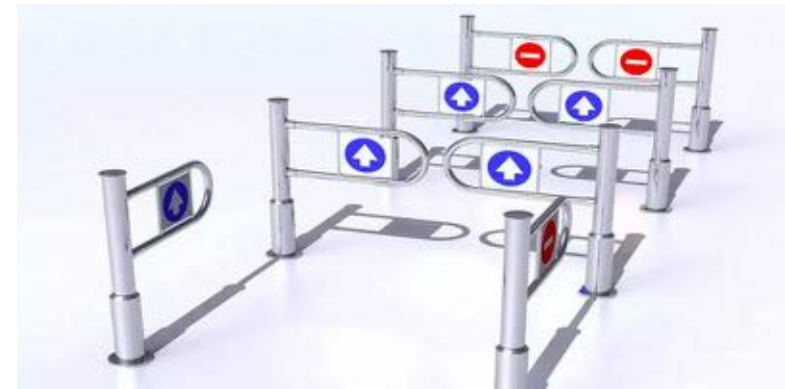


Photo Mulder, P. (2018). *Stage Gate process by Robert Cooper*. Retrieved 13.1.2019 from ToolsHero: <https://www.toolshero.com/innovation/stage-gate-process-robert-cooper/>

## What is evaluated?

- **Schedule**
    - Key outputs and results → especially schedule risk management actions
  - **Quality**
    - Key quality management actions e.g., esim. BIM, user-centric design, functionality of design, healthy building criteria, cooperation with authorities
  - **Cost**
    - Does the output / proposal meet investment and maintenance cost budget
  - **Satisfaction**
    - Does the project team work as planned with the client and users
  - **Innovation**
    - Number and impact of innovations
- Scale 0-100 points, every section typically with a weight of 15-20%

## Kinnari School project's commissioning was organized in three phases - first time in history of school buildings

- **Building commissioning** ensures **buildings** are delivered according to client's project targets.
- In Kinnari, phased commissioning model was developed and taken into practise based on open building approach
  - Phase I Base building & enclosed main HVAC systems
  - Phase II Infill spaces where user operations take place
  - Phase III Whole building
- **Key methods for phased commissioning include HVAC & structural & operational testing & approval procedure**
- **Phased commissioning enhances building deployment effectiveness and efficiency (used as designed, avoid extra costs and delays!), and user experience**



## Summary of Kinnari project highlights

- **Careful project investment analysis and target-setting together with the client and users**
- **Project strategy (e.g., open building) and delivery system (e.g., project alliance)** that enables user operations development (learning environment), smart decision-making, user-centric design and flexibility
- **Phased evaluation and steering mechanisms** for project execution – management, work planning and commissioning
- Committed and ambitious project **team** with how can we help you attitude



## Contents

- Introduction
- Emerging practices in construction management
  - Case I New social and healthcare center – selected as the public sector construction project in the world 2016
  - Case II Kinnari school – flagship project of new learning environments in Finland
- **What's next in construction management?**

## Examples of key trends (Already taking place!) in the real estate and construction sector 2021-2025



Picture: Erik Johansson

- **Trend 1:** automation in prefabrication and on-site assembly
- **Trend 2:** real estate as a service
- **Trend 3:** autonomous, self-guided, teams

## Increasing number of construction companies combine automatized prefabrication and rapid on-site assembly

Mass customization based on customer needs



Automatized prefabrication of building modules



Rapid on-site assembly



Life-cycle services



## International forerunner: Sekisui House



- The biggest construction company in Japan, whose international business ventures has increased rapidly including Europe
- Central in the company's business model are a powerful customer experience, long customer relationships and service business during dwelling
- **Product:** 1-5 storey steel apartment and service buildings, important in the buildings are customization and flexibility of use
- Annual production volume is approximately 60,000 apartments. Sekisui has built over 2.6 million prefabricated buildings in total
- Their competitive advantages are; highly automatized factory production (tasks, control of material flows), 60-year warranty, diagnostics and life-cycle services (e.g. module upgrades)
- **Carbon neutrality in practise:** Zero waste at all of our factories, 80 % of production net zero energy buildings (2020)

- Country: Japan
- Founded: 1960
- Employees: 16,000
- Turnover: over 18 billion euros
- EBITDA: 15-18%

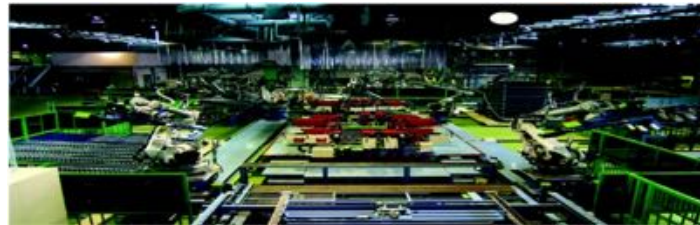




**Sekisui House has automatized 95 % of the work phases in prefabrication**



The automatized assembly of wall-modules



Product line without human labour



The automatized frame-module cutting and welding



Automatized sub-module surface finish



Façade-panel production line



Automatized factory logistics

## Examples of key trends (Already taking place!) in the real estate and construction sector 2020-2025



Picture: Erik Johansson

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## Sekisui offers 60-year warranty, diagnostics and life-cycle services



### Sekisui offers its customers:

- The handover and introduction services to the apartment
- Quality certification (indoor air environment, materials, HVAC, maintenance) to the apartment
- Diagnostics services (based on monitoring data) to the apartment
- A 20-60+ year warranty to main building parts according to the needs of the customer
- Upgrade and re-customization services, e.g. RENOVETTA-service, which reacts quickly to the changes in the customers' life situation and keeps the usability on a high level (e.g. partition wall removal, furniture an surface changes, equipment upgrade, user-interface)

## Examples of key trends (Already taking place!) in the real estate and construction sector 2020-2025



Picture: Erik Johansson

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## Huge potential for productivity improvement is in humans – how can we unleash this human potential in construction projects?

Difference in productivity between median worker and best 10. decile worker in selected jobs:

- Assembly line work **50 %**
- Customer service work **180 %**
- Demanding expert work **1500 %**
- Source: Harvard & NBER (2014)



## Why some teams perform better than others?

- **Google studied recently (2 year time series, 180 teams ja 250 characteristics) why some teams perform better than others?**
  - **Meaning:** work has personal meaning for everyone
  - **Dependability:** team members get things done on time
  - **Clear structure:** targets, roles, way of working
  - **Impact:** team believes that their work has a positive impact on community
  - **Psychological safety:** everyone feels safe in their work environment



## Great development opportunities for construction management!



Picture : Erik Johansson

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