Haahtela

Target Value Delivery  
BIM Prior Design  
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Haahtela Group

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Target Value Delivery

TVD Research Group in UC Berkeley

Steering (a process to deliver value)
Target Value Delivery
Information Models Needed for Steering
Taking part in International Lean Management Research
The Literature on cost:

- At stage prior design, almost nothing is likely to be known about the building except its general size, and therefore it is pointless to go into detail about cost before any designing has been done. The accuracy is +- 30%.
However, in Haahtela production, completed costs can be reliably predicted before start of design (budget versus completed costs, 5 % standard deviation).
Inductive complexity

Best movie ever?
Programming
- Tens of stakeholders with different interests
- Spatial needs competing for the same money than daily operations
- Value through commitment process

Design
- At the start building as an object is unknown
- Cumulative process to define
  - shape of the building in its (built) environment
  - locations of customer activities in the mass
  - components of the building that can be found in the markets
- Numerous possible design concepts for a single programming

Construction in site
- At the start, the object is known, it has not built yet
- Value is not added anymore, but the promises should be delivered
Wicked problem does not have a stopping rule. When is it ready?

Commitment making is a crucial part of production.

Affective commitment making

- Support and stimulate strategic and operative managers to participate in decision making
- Decentralize the decision making to the levels where responsibilities are met
- Be transparent in terms of information handling. Decisions made by one affect to others possibility to make decisions
- Tread all information equitably, regardless of its origin
The Theory of Steering
Our contribution in UC Berkeley and Lean Construction Institute led Research

One paradigm of managing complexity, cybernetics, comes from Greek "kybernao", meaning “to steer, navigate or govern”
Steering at simplest

- Define the Goal (functional, financial, temporal…)

- Rapid measurement of the proposed solution to fulfill the goal
  - “if you cannot measure, you cannot manage”

- Rapid feedback to the system (customers, project managers, designers, subcontractors…)

- Actions to minimize the difference between goal and proposal
Steering

The same concept all along the project
- Programming (project definition…)
- Design
- Construction in site

The question is:
• How to define the goal in each stage?
• How to measure?

Steering theory is simple in concept, though very difficult in practice.
Data quality is high if
- It fits for intended use
- It is proper for decision making
- It is complete
- It is accurate

To provide management with proper information, modeling and language translations are needed.
Target costing is defined through dialogue of expected cost and allowable cost.

**Allowable cost**
a cost that the customer is willing to pay to get facility with defined performance

*Defined by customer (business plan, ROI, maximum funding)*

**Expected cost**
a cost if the facility were provided at the current best practices

*Defined by the project team (Project/ construction managers, designers, facility planners…)*
In Haahtela TAKU® Pro process modeling three types of goals are defined

1. Project Level Target
   - Handles customer functional demands and cost
   - Intended to steer the customer

2. Component Level Target
   - Assigns target cost to the systems
   - Enables rapid estimation
   - Intended to steer design

First two are to be defined before start of design

3. Procurement Level Target
   - Assigns target cost to the procurement packages
   - Is to be defined before the start of procurement process

Rapid Estimates
BIM

Information content
- Shape and form in urban environment
- Connections of the activities defined in programming
BIM

Information content
- No piles, beams or lifts
- No taps, cooling units or inlet fans
- No luminaires, switchboards or nurse call
Value generation

After four weeks design...
Actions modeling of spaces

• The client do not say the size of the space but describes the functionality
• Information model defines the size and what kind of a space (bigger, better sound insulation…)
• Required actions dictate the size and nature of the space
Activity modeling
Activities in a space represents value. Empty space is Waste. Use of time dictates number of spaces
Activity modeling

**Present State of Commitment**
- Bill of Activities
- Social environment teaching
- Psychotherapy teaching
- Ergotherapy teaching
- Acuteward teaching
- Human ageing teaching
- Nursery teaching

**Proposed temporal and geometric loads to the spaces**

**Alternatives for Value Generation**
- is the activity really needed?
- are other activities needed?
- combine activities to the same environment

**Space: Combined lab for ward-type activities**
utilization degree 45%

**Value Evaluation against Strategy**

**Actions**
1. 
2. 
3. not in use

**Time**

**Size**
Building Information Model prior Design

Building types do not exist anymore.

My nearby shop that I use in Helsinki:
- a Retail Center in the earth level
- a Restaurant in the earth level
- a Pharmacy in the earth level
- A Health center in the earth level
- Residences from floors 2 to 8
- Four storeys of car parking in the cellar

Is it a shop? Or parking hall? Or a residence building?
Data Quality?

A statistical Building Type does not represent real life, it is not accurate or complete

Good quality data is to represent functionalities.
TAKU® Pro and Project Level Target Costing

TAKU® Pro transfers customer’s functional demands to spaces and cost

Functionality

<table>
<thead>
<tr>
<th>Functional sector</th>
<th>Structural classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day care center</td>
<td></td>
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<tr>
<td>Day care center - time based modelling</td>
<td></td>
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<tr>
<td>Dental clinic</td>
<td></td>
</tr>
<tr>
<td>Diagnostic Imaging</td>
<td></td>
</tr>
<tr>
<td>Emergency unit</td>
<td>30 000 exams/ y</td>
</tr>
<tr>
<td>Exhibition center</td>
<td></td>
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<tr>
<td>Fitness center</td>
<td></td>
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<tr>
<td>Garage</td>
<td></td>
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</tbody>
</table>

**Activities**

**Dental care**
- Appointment rooms: 1
  - Appointment room, dental: 5
  - Appointment room, dental hygienist: 3
  - Appointment room, dental specialist: 2
- Examination room: 1
- Corridor: 2

**Gross area**
- 8,240 grm²

**Square meter price**
- 2,038 €/usm²

**Total price**
- 15,526,260 €
**TAKU® Pro and Component Level Target Costing**

TAKU® Pro models the building components before start of design:
- Building elements with 100 % content
- Maintenance with 100 % content

<table>
<thead>
<tr>
<th>Emergency unit</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Medical care</strong></td>
<td></td>
</tr>
<tr>
<td>First aid room</td>
<td>1 131.9</td>
</tr>
<tr>
<td>Entrance</td>
<td>1 160.9</td>
</tr>
<tr>
<td><strong>Appointment rooms</strong></td>
<td></td>
</tr>
<tr>
<td>Consulting room</td>
<td>3 17.5 52.4</td>
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<tr>
<td>Appointment room</td>
<td>3 14.9 44.6</td>
</tr>
<tr>
<td>Corridor</td>
<td>1 26.9 26.9</td>
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<tr>
<td>Non-load-bearing structures</td>
<td>5.7</td>
</tr>
<tr>
<td><strong>Monitoring facilities</strong></td>
<td>1 338.2</td>
</tr>
<tr>
<td><strong>Treatment rooms</strong></td>
<td>1 95.6</td>
</tr>
</tbody>
</table>

### Equipment

- **Foundation**
  - Antura
    - Wall footing, cast-in-place concrete, w = 658.33 mm, h = ...
      - 106 m 56
    - Wall footing, cast-in-place concrete, w = 658.33 mm, h = ...
      - 251 m 77
    - Column footing, cast-in-place concrete, 2587.71 x 2587....
      - 63 pcs 1588

- **Lighting**
  - Tuoterakene
    - Emergency and emergency exit lighting
      - 205 pcs 135
    - Indoor lighting
      - 1 1 70 pcs 221
    - Outdoor lighting
      - 11 pcs 957

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<table>
<thead>
<tr>
<th>Cooling</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuoterakenne</td>
<td></td>
</tr>
<tr>
<td>Cooling terminal unit</td>
<td>36 pcs 441</td>
</tr>
<tr>
<td>Cooling piping</td>
<td>992 m 43</td>
</tr>
<tr>
<td>Cooling generation</td>
<td>183 kW 305</td>
</tr>
</tbody>
</table>
Steering Design

As BIMs start from 0% of the expressed quantities of building components, TAKU® -model always consists all the components needed to provide the customer product the customer needs.

Steering is on-going dialogue (between the agent, designers, owner and contractors and fast feedback loops between BIM and TAKU® process model)
The new Children’s Hospital in Helsinki
The new Children's Hospital

Owner
a Private Foundation of New Children’s Hospital. Wanted to have a Children’s Hospital earlier than scheduled. Put in order a fundraising and succeeded to get one third of investment money in a year.

User
Helsinki University Hospital leases the spaces.

Service ability
Surgery, Imaging, Rehabilitation, Laboratories, Mortuary, Outpatient clinic, Intensive care, Children’s psychiatry, Bedrooms, Catering...

Target Cost
175 million euros. Based on the Users willingness to pay rent. The Helsinki University Hospital has an investment schedule (Trauma-hospital, Cancer-hospital...). The rent has to fit to schedule.
Project’s state in summer 2014

Conceptual design was completed and designers prepared to start design for construction.

The Owner realized that they are failing with their targets. Costs were exceeding 15 %. Tenant would not be prepared to pay more.

The owner wanted to keep targets and asked for Target Value Design.

Haahtela inc. was hired to be a Project Manager.
Next steps in fall 2014

It was obvious that the architect cannot take off 5 000 gross-m2 in very short time without sacrificing functionality. The architect needed help.

Design was ceased for 3 months.

Project manager concentrated to steer the user to balance functionality and usable area. Most of the operations were modeled by BIM Prior Design to get instant feedback information for decision making.

Intensive work was done with help of doctors and other experts of the user (Helsinki University Hospital). They were supported by a hospital consultant NHG.
Utilization degree of recovery places was low

Utilization degree of post-surgical recovery beds was low (45 %) and thus there were too many beds in design proposal.

Doctors explained that because recovery-rooms / preparation- rooms are separated in two zones, they need more temporal buffers (also staff is working in separated locations). If recovery- rooms were in one zone, they could be planned to 55-60 % utilization.
Utilization degree of recovery places was low

Before

After
Utilization degree of outpatient clinic consultancy rooms was low

Utilization degree of consultancy rooms was 53 % with proposed design. It means 6 patients / day (8 hours).

Many doctors also work in the University as professors, researchers... They have used to do, but patient consultancy, also research in the rooms.

Consultancy rooms were decided to plan with 75 % utilization (8 patients / day or 6 hours / day).

Back-office workstations were placed to same floor as the consultancy rooms.
Utilization degree of outpatient clinic consultancy rooms was low
At November of 2014

Steering the User reduced the gross area from 53 000 m² to 48 000 m² (10%).

No sacrifices were done with the service ability of the building.

The architect was asked to collect design team and perform conceptual design again.
Steering Design

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The new children’s hospital in Helsinki

After steering the user, the design was still exceeding the target cost

Feedback to the architect:

- in design proposal there is 1 100 m² more circulation area (corridors, stairs) than in the Haahtela model based on usable area

- exterior wall is very expensive

- slabs are expensive
Architect’s Proposals

Before

Now

Ward bedroom floor

Hahtela
Steering Carbon Footprint of the Product

Product level

• Steering the Customer

Component level

• Steering the designers

TAKU® Pro assigns the construction elements straight to the customer needs. It is possible to trace CO2 – equivalent emissions straight to the customer’s decisions and designer’s decisions

And they can be steered.
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