

IMPROVING THE LEARNING OF DESIGN MANAGEMENT OPERATIONS BY EXPLOITING PRODUCTION'S FEEDBACK: DESIGN SCIENCE APPROACH

Joonas Lehtovaara - Doctoral Candidate, Department of Civil Engineering, Aalto University, Finland

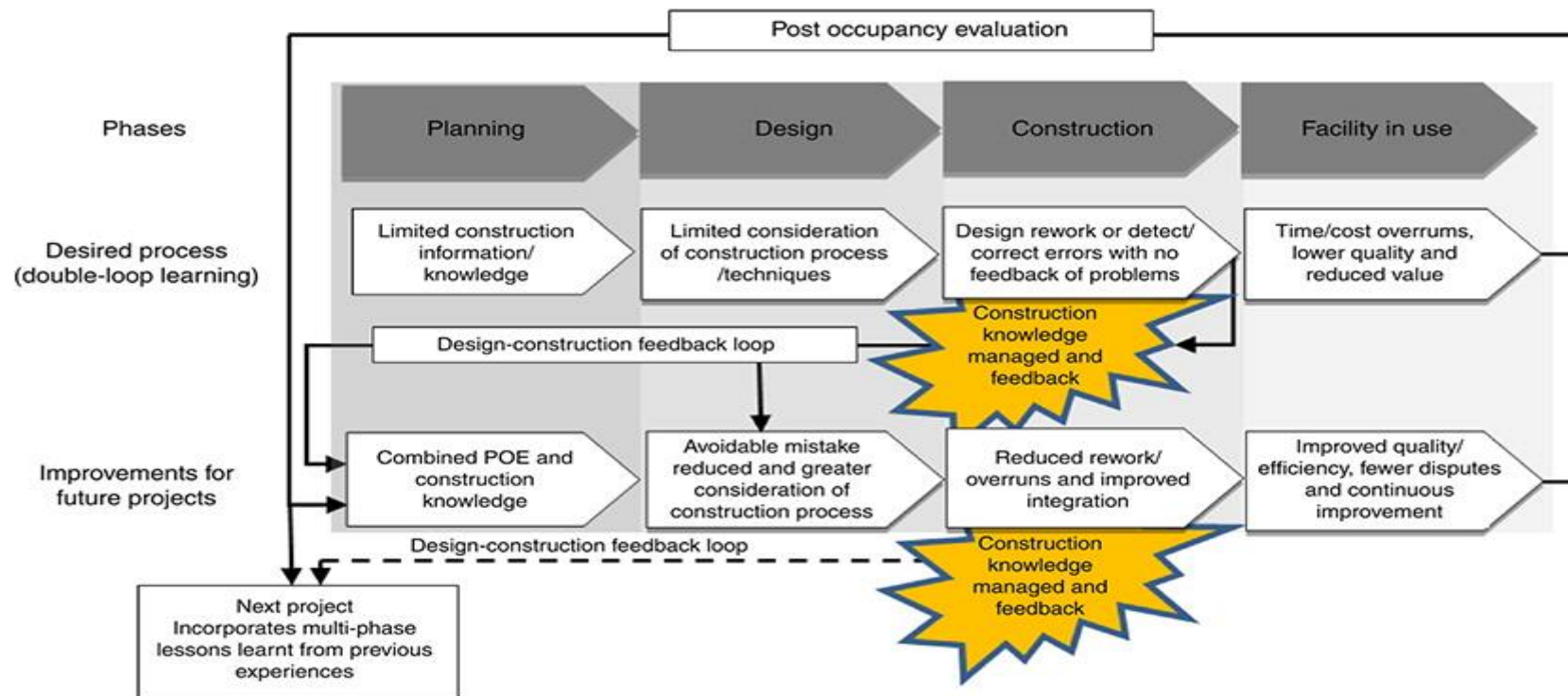
Olli Seppänen - Professor of Practice, Department of Civil Engineering, Aalto University, Finland

Antti Peltokorpi - Assistant Professor, Department of Civil Engineering, Aalto University, Finland

Research background – a need for efficient learning

- To increase productivity in construction, organizations and especially design management operations should exploit the knowledge created in previous projects, and particularly the knowledge created in the production phase, more effectively.
- Even though the *identification, collection, analysis, storage* and *reuse* of tacit and explicit knowledge from projects has been recognized as a pertinent part of the learning of design operations, the nature of the project-based industry sets barriers for development.
- The lack of proactive, double-loop learning from an actor's own mistakes is one of the fundamental reasons for poor productivity development.

Desired double-loop learning through a design-construction feedback loop *(Henderson et al. 2013)*



Research background – a need for participatory research

- The reactive touch to learning reflects the inefficient implementation of new learning processes, which have been criticized for their inefficiency to drive change.
- Research on project-based organizations has centred only on visible problems at hand and asking *what* should be done, instead of focusing on *how* to concretely solve the problems Eriksson (2013).
- To overcome this inefficiency in management research, researchers should take a more active role in designing the solutions instead of only observing from a distance.

Research aim

- Therefore, there is a certain need for designing but also for concretely implementing more effective learning processes into the construction design operations.
- The goal of this study is to develop a concrete construction design learning process by an experimentative design research approach while answering the following research question:

How can the learning of design management operations in a construction company be improved through feedback acquired from production?

Research strategy – Design Science Research (DSR)

- Reciprocal collaboration between the case company’s design management operations



The diagnosis of the current state & development of the preliminary learning process

Literature review, interviews, observation



Testing and development

Testing and development of the process in collaboration with the target company

Collaborative development, workshop, validation



Discussion & Conclusions



Diagnosis – knowledge management in construction

- An organizational knowledge management strategy can be based on the balance between two different approaches that should be appropriately balanced through the learning process:
- **Personalization**, a human-based view, emphasizes the meaning of tacit knowledge and is usually present in small and agile organizations.
- **Codification**, a technology-based view, describes an approach where knowledge is managed through systems and documents and the knowledge is mainly explicit

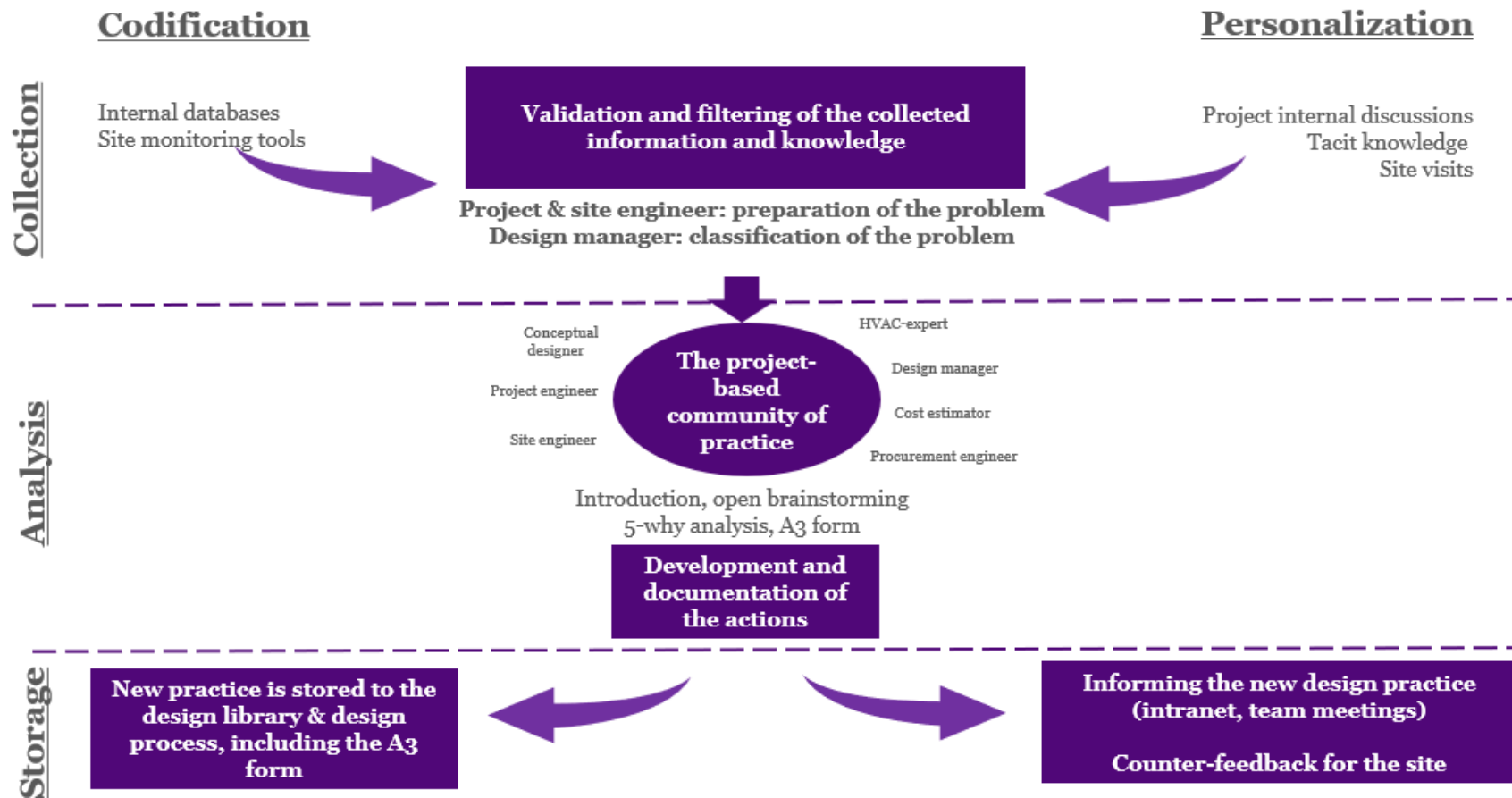
Diagnosis – learning in PBOs

- The most effective knowledge creation takes place within the group level. For project-based organizations, group-level learning can be enhanced by implementing so-called ***project-based communities of practice***.
- In these communities, experts working within the same area of interest share their knowledge created in the projects, while analyzing the knowledge and simultaneously sharing it with the organization.
- In an optimal setting, project-based communities of practice operate freely but at the same time, within a structure that enables continuous filtering and analysis of the created knowledge.
- For effective implementation of the communities of practice, **the culture of learning from failure** was recognized as one of the most contributing factors, in both literature and in the expert interviews.

Diagnosis – the preliminary learning model

- The vocabulary and process components applied should be clearly determined and presented while connecting the strategic and operations-level actions.
- **The balance between personalization and codification** should be ensured in every process step.
- The process should be **accessible, easy-to-use** and **lightweight**. Also, the collection and storage of information and knowledge should be as automated and standardized as possible.
- The project-based communities of practice should enable a space for **effective learning from failures and root causes**. The community should be supported by an experienced process owner and facilitator.

Diagnosis – the preliminary learning model



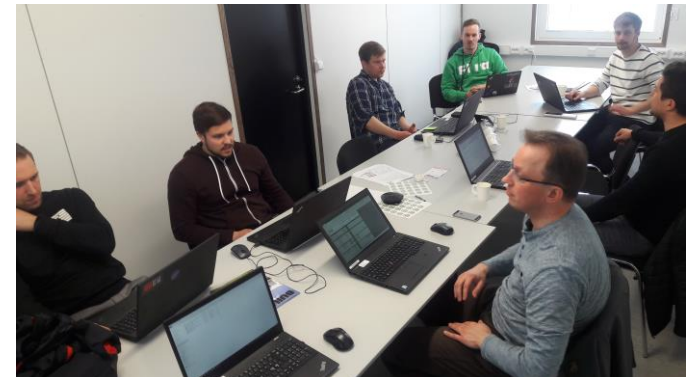
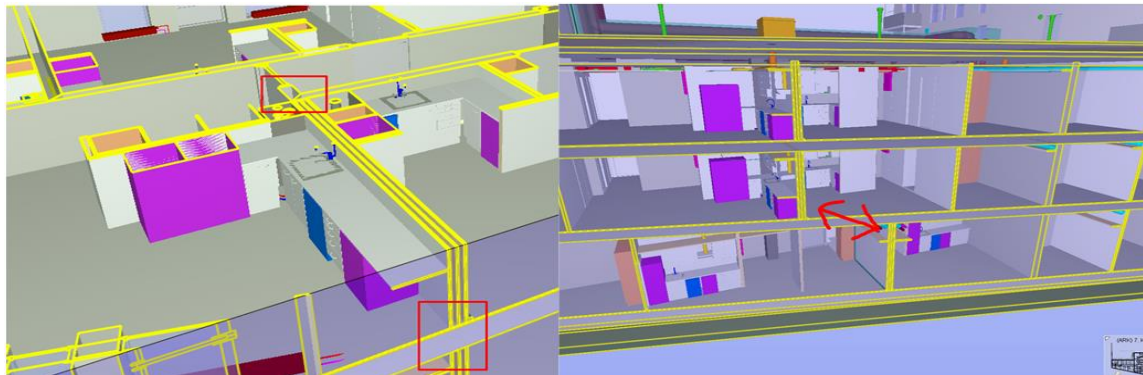
Testing and development of the model with a case

The design process of acoustic and fireproofing connection details in drywalls separating apartments

Potential cost of design error: 10'000-15'000e per wall

- (1) Collection of the information
- (2) Analysis: The community of practice
- (3) Storage of the analyzed knowledge

Analysis and further development of the learning process

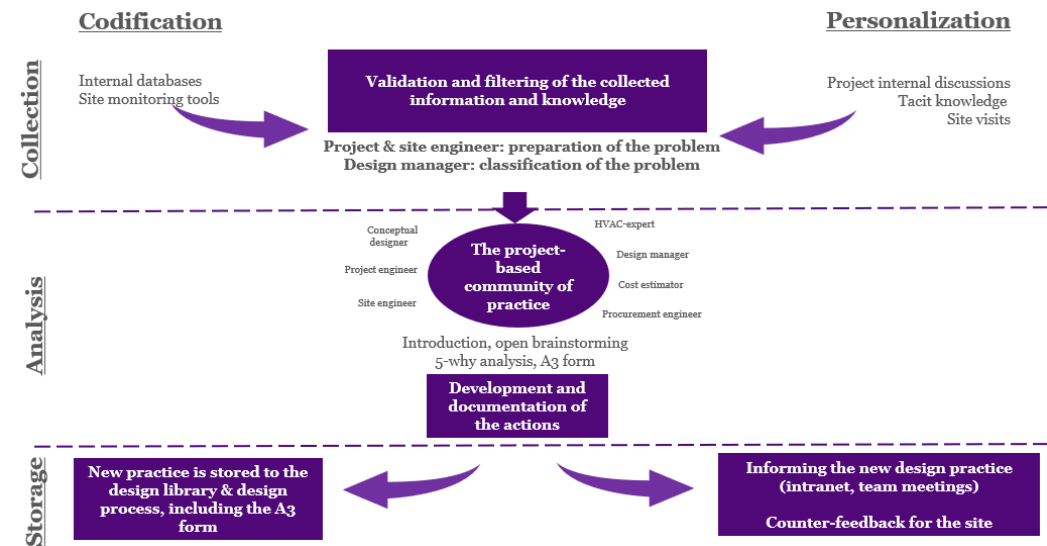


Testing and development of the model

- Process fluency:
 - The process should be as streamlined as possible to minimize the time spent by the participants
 - Standardized to easily and effectively implement it for another company's internal communities.
 - Should be accessible even during constant rush created by projects
- The process was further developed to be optimally streamlined and more easily adopted by determining clearer instructions and process steps.
 - Instructions were created for preparation, facilitation and knowledge storage
 - Improved A3 document templates were created

Discussion & Conclusions

- The implemented learning process enables more efficient construction-design learning process
 - Balance between stages of learning & between codification and personalization
 - Revelation of root causes
 - Easy-to-use process, high value with low effort



Discussion & Conclusions

- Additionally, the learning process is a potential enabler for tackling wider barriers for productivity development:
 - Missing the common language of knowledge management (Mäki 2008)
 - Ignoring the deeper root causes (Dave and Koskela 2009),
 - Lack of learning from errors (Cannon & Edmondson 2005), and
 - Forgetting to ask "how" (Eriksson et al. 2013)
- The proposed learning process attempts to educate the organization to address these barriers in an organized manner.
- The process could enable cumulative learning while individuals and implemented communities of practice would internalize the culture of the continuous learning in their daily work.

Avenues for future research

- More tight feedback loop through exploitation of digital monitoring and automation: "situation room"-approach
- Integration of client, users, contractors and designers into the process



Thank you!



INTERNATIONAL GROUP FOR LEAN CONSTRUCTION
DUBLIN | IRELAND | 1ST - 7TH JULY 2019



INTERNATIONAL GROUP FOR LEAN CONSTRUCTION
DUBLIN | IRELAND | 1ST - 7TH JULY 2019



INTERNATIONAL GROUP FOR LEAN CONSTRUCTION
DUBLIN | IRELAND | 1ST - 7TH JULY 2019



INTERNATIONAL GROUP FOR LEAN CONSTRUCTION
DUBLIN | IRELAND | 1ST - 7TH JULY 2019



INTERNATIONAL GROUP FOR LEAN CONSTRUCTION
DUBLIN | IRELAND | 1ST - 7TH JULY 2019