Digitally supported innovation in project based industries, and the case of 3D printing in construction

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Based on results form research at NTNU and in the HINDCON project.
Innovation in construction and implications for 3D printing

- Literature reviews and empirical findings on innovation in construction industry
  - Innovation in general
  - Implications for 3D printing
- Two data sets; survey and interviews
- A resistance to innovation is a main challenge to the industry
Barriers of innovation in construction, from literature

- Focus on cost efficiency
- Lack of funding in R&D
- Lack of knowledge transfer from one project to another
- Lack of young talent and skilled workforce
- Lack of the management of innovation
- Construction industry fragmentation
- Conservatism in construction industry
Important barriers to innovation include:

- Conservativism of the industry, risks and stakeholder structure

The empirical study highlighted enablers of innovation:

- Effective leadership, collaboration with partners, and industry-academia collaboration.
<table>
<thead>
<tr>
<th>Previous experiences</th>
<th>3D printing characteristics</th>
<th>Implication for implementation of 3D printing</th>
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<tbody>
<tr>
<td>Focus on cost efficiency of the projects and lack of funding in R&amp;D</td>
<td>3D printing technology is getting funding for R&amp;D</td>
<td>The large funding will facilitate to implement it on large scale in construction industry</td>
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<tr>
<td>Mismatch between needs and innovation</td>
<td>3D printing will facilitate the mass customization in construction industry</td>
<td>As mass customization has high demand in construction industry, this feature of 3D printing technology should be leveraged in improvement projects.</td>
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<td>Lack of skilled workforce in the market for innovation implementation.</td>
<td>High-skilled labour required for 3D printing operation</td>
<td>High-skilled labour is a big challenge to implement the 3D printing technology on large scale. Training and education initiatives are required.</td>
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<td>Initial high cost of the innovation</td>
<td>High cost of 3D printing technology</td>
<td>Especially, the SMEs will have difficulties to afford the 3D printing technology. Actions to improve the technology and reduce the cost of it should be taken.</td>
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<td>Risk in adopting new technology</td>
<td>The 3D printing technology is not mature for large scale usage</td>
<td>High risk is involved for large construction companies to use this technology at large scale. New risk sharing models will be of importance to investigate.</td>
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<td>Non-profitability</td>
<td>3D printing has capability of waste reduction, cost reduction and time reduction</td>
<td>The use of 3D printing will result in more productive and profitable projects, which should be escalated for wider implementation.</td>
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<td>Multiple stakeholders create challenges and requirements for collaborative implementation of the innovation</td>
<td>Multiple stakeholders are involved in the implementation of 3D printing</td>
<td>Implementation of 3D printing technology requires a common understanding and interest within the whole construction value chain.</td>
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</table>
Implications for digitalisation in project based industries

- Construction is one of the major project-based industries
- Innovation do not necessitate digitalisation
- But most digitalisation is a kind of innovation
- 3D printing can make production more projectified
- In our case, digitalisation include close connection between BIM and production