

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

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Based on results from 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:
  - Conservatism of the industry, risks and stakeholder structure
- The empirical study highlighted enablers of innovation:
  - effective leadership, collaboration with partners, and industry-academia collaboration.

Previous experiences	3D printing characteristics	Implication for implementation of 3D printing
Focus on cost efficiency of the projects and lack of funding in R&D	3D printing technology is getting funding for R&D	The large funding will facilitate to implement it on large scale in construction industry
Mismatch between needs and innovation	3D printing will facilitate the mass customization in construction industry	As mass customization has high demand in construction industry, this feature of 3D printing technology should be leveraged in improvement projects.
Lack of skilled workforce in the market for innovation implementation.	High-skilled labour required for 3D printing operation	High-skilled labour is a big challenge to implement the 3D printing technology on large scale. Training and education initiatives are required.
Initial high cost of the innovation	High cost of 3D printing technology	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.
Risk in adopting new technology	The 3D printing technology is not mature for large scale usage	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.
Non-profitability	3D printing has capability of waste reduction, cost reduction and time reduction	The use of 3D printing will result in more productive and profitable projects, which should be escalated for wider implementation.
Multiple stakeholders create challenges and requirements for collaborative implementation of the innovation	Multiple stakeholders are involved in the implementation of 3D printing	Implementation of 3D printing technology requires a common understanding and interest within the whole construction value chain.

# 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