Global MMC Perspective

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Presentation for **NSW MMC Taskforce**

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Australian Government
Department of Industry, Science and Resources
AusIndustry
Cooperative Research Centres Program

UK

Sweden

USA

Singapore

UK

Public-Private Collaboration

Image: Digital Construction Week, https://www.digitalconstructionweek.com/building-a-sustainable-future-how-prefabrication-is-advancing-esg-goals/

Background | UK

- UK has a **history of engagement** with MMC that dates back to post-WWII reconstruction, and mass public housing during the 1960s.
- The UK has a **legacy of construction reviews** and reports that in its contemporary form dates back to the Latham Review of 1994.
- UK Government Construction Industry Strategies of 2011 and 2016 recognised the importance of construction to the **national economy**.
- *Construction 2025,* a 2013 Government White Paper mapped a vision for increased **private-public collaboration** and utilisation of MMC.
- The 2016-20 strategy sought to develop the UK Government's capability as a construction **client** to achieve cost efficiency and support best practice development.

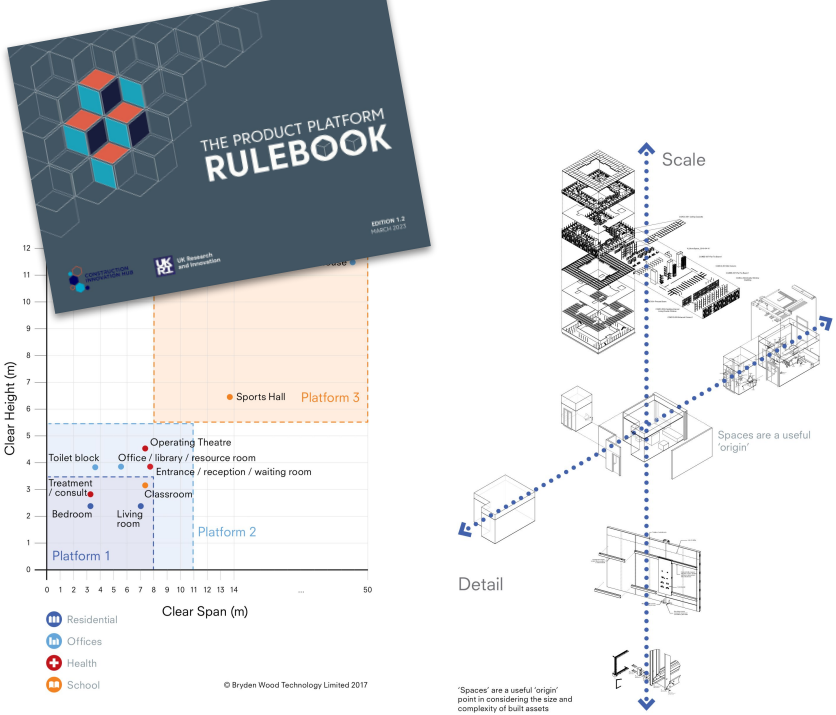


Image: Bryden Wood, via Construction Industry Council, https://mic.cic.hk/files/MicEvent/23/File/20210929_Bryden_Wood_UK_.pdf

Image: Digital Construction Week, https://www.digitalconstructionweek.com/building-a-sustainable-future-how-prefabrication-is-advancing-esg-goals/

Bryden Wood; Construction Innovation Hub (CIH)

Bryden Wood explored shared components across Government assets // CIH took this work forward as an Industry-Government R&D node.

Laing O'Rourke; University of Cambridge

$200m investment in offsite manufacturing, establishing a Centre of Excellence, R&D, and creating rules for DfMA within their projects

Sectoral Response: R&D and Implementation

Image: Bryden Wood, https://www.brydenwood.com/news/s134311/

The Forge, Southwark, London (2021)
Landsec with Bryden Wood + Specialist Consultants

Net-zero Office Building constructed utilising a *Kit of Parts* developed through cross-industry R&D and collaborative contracting

Image: https://mic.cic.hk/files/MicEvent/23/File/20210929_Bryden_Wood_UK_.pdf

Product Based Building Solution (2023)
Laing O'Rourke + UK Research and Innovation

A demonstration R&D showcase of a kit of parts building system for cross-typology response: education and residential, healthcare, commercial

Test-builds & Exemplars: 2020-Present

Tophat UK's factory

Image: Parametric Monkey, https://parametricmonkey.com/2024/06/17/modular-constructions-conflicting-truths/

Successes

- Strategic **collaboration** — government, academia, and private sector
    - Government-backed initiatives like **Construction Innovation Hub** and funding for public housing MMC projects.
- Industry frameworks, tools and guides developed for digitisation and **Design for Manufacture and Assembly (DfMA)**.

Challenges

- **Public Confidence** & UK Parliamentary Inquiry
    - Public sector investments were **not insistent on the use of MMC** — finance, supply chain & contracting challenges.
    - Lack of **clarity on the cost of MMC** — no agreement if MMC is more or less expensive than traditional construction.
    - Lack of **data on MMC utilisation** — little data to measure progress, no overseas learnings of best practice.
- **Skills gaps** in the workforce.

Outcomes | UK

SWEDEN

Operational Excellence

Image: Phttps://www.homag.com/en/company/news/case-studies/detail/modular-constructions-in-wood-the-future-way-of-building


Image: Timbro, https://timbro.se/app/uploads/2013/04/den-svenska-integrationspolitiken_4_1.pdf


Image: Mjöbäcks, https://mjobacks.se/nyhem

- From the 1920s, Sweden's forestry industry & **sawmills** began manufacturing building products (truss & frame) as a means of value-adding.
- Single-dwelling 'prefab' companies consolidated during the 1960s, today create c.85% of the single residential market.
- The **Million Homes Programme** (1965-74) successfully delivered 1 million new homes in Sweden — legacy is problematic re: social outcomes and building quality.
- **Regulatory change** in the mid-1990s made multi-storey timber construction viable, resulting in significant R&D to ensure viability.
- **Multi-residential timber** MMC companies have developed sophisticated products and production systems and account for c.15% of the development market.

Background | SWE

Lindbäcks Bygg

Image: https://www.byggindustrin.se/om/lindbacks-bygg/

Boklok

https://www.boklok.co.uk/about-us/Innovation/

Boklok

Lindbäcks Bygg

Peab PGS

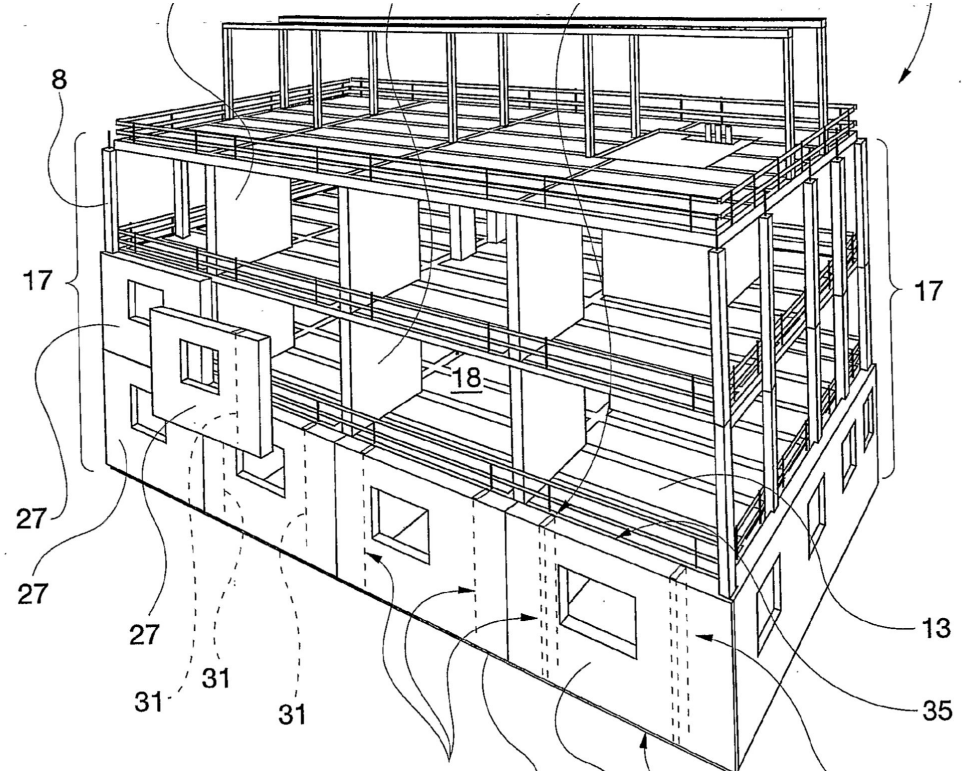


Image:https://peab.se/erbjudande/pgs

VeidekkeMAX

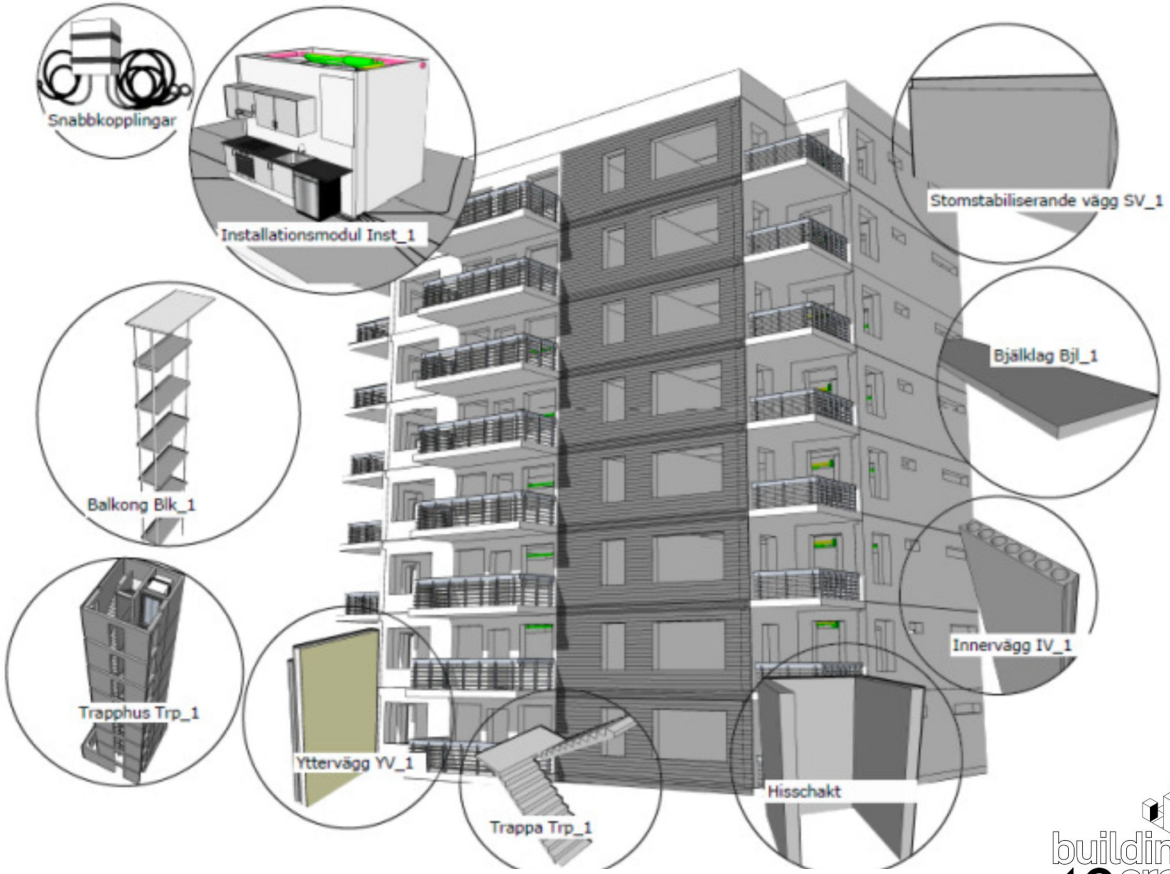


Image: Emile Hamon, VeidekkeMAX

Completed projects by Boklok (top) and Lindbäcks (bottom)

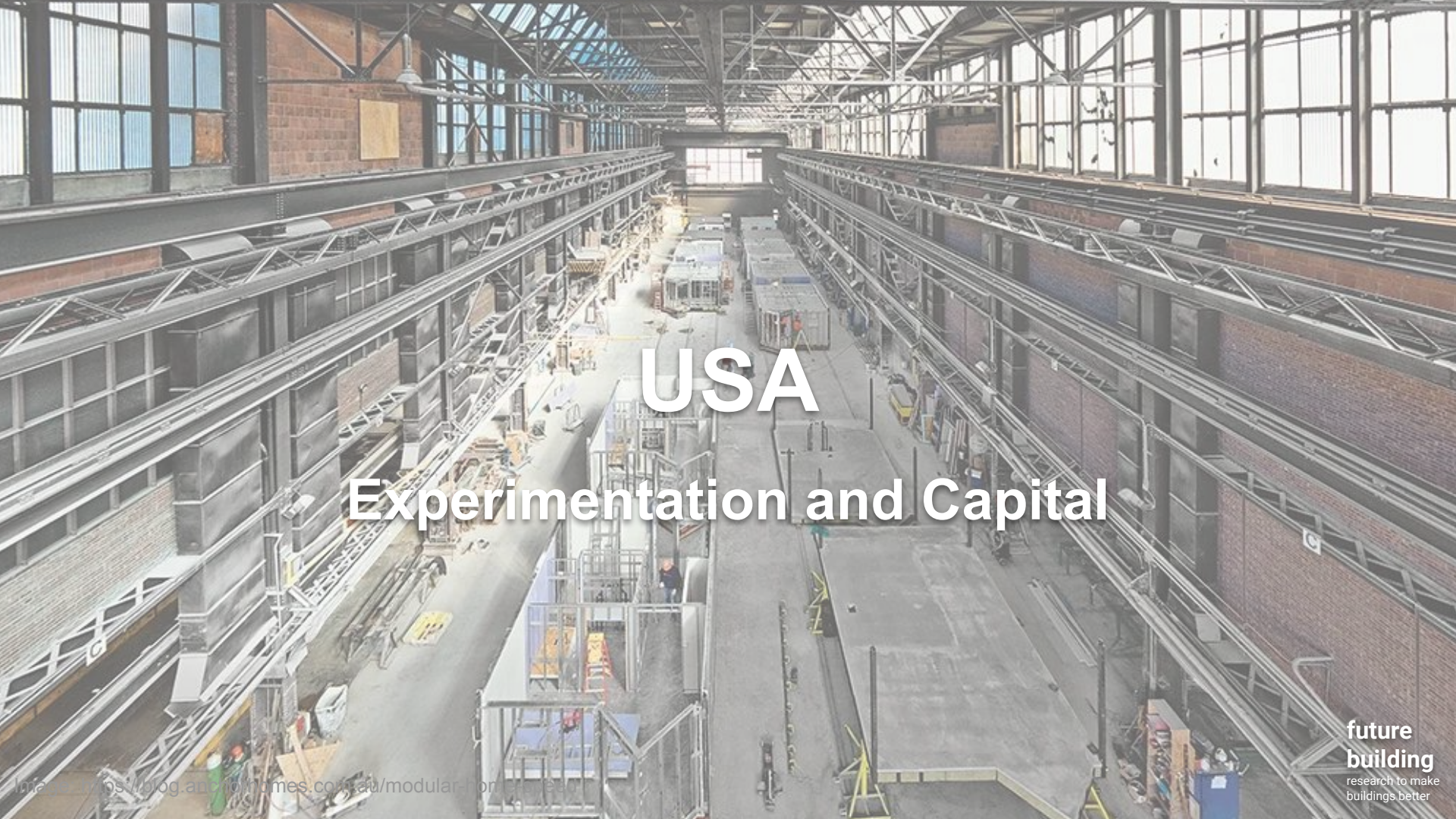
Outcomes | SWE

Successes

- A (cultural) **long-term innovation** focus, underpinned a commitment to process/operational excellence.
- **Understanding the market** before developing the system/ production.
- **Performance-based building codes** driven by carbon reduction and sustainability goals.
- Broader timber industry support + R&D for **timber** construction.

Challenges

- **Vertically integrated business models** allow control but lack agility
- **Upfront investment requirements** can create a barrier to entry and can constrain market flexibility.
- Standardisation focus has limited **design responsiveness** as markets have changed**.**



USA

Experimentation and Capital

Image: https://blog.and.co/homes.com.au/modular-hom...

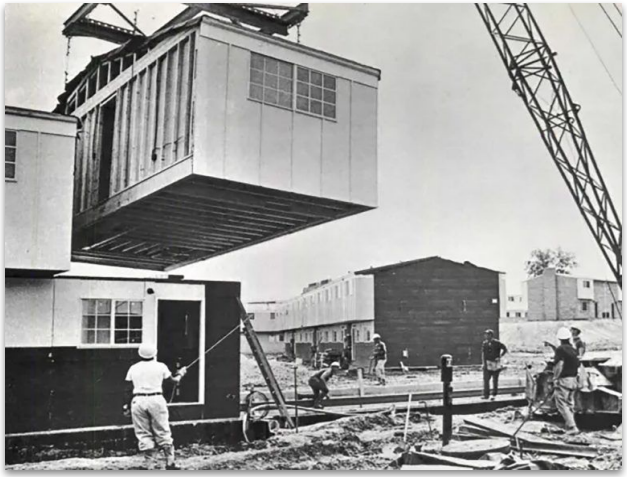


Image: AIA New York. "Operation Breakthrough's Forgotten Prototype Communities." Oculus Magazine, Fall 2022. Accessed 14 November 2024

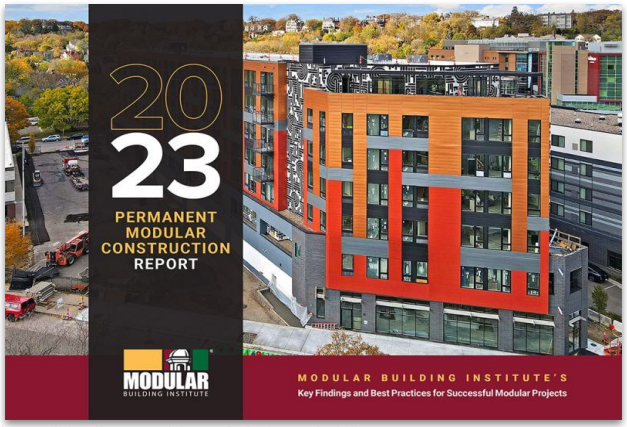
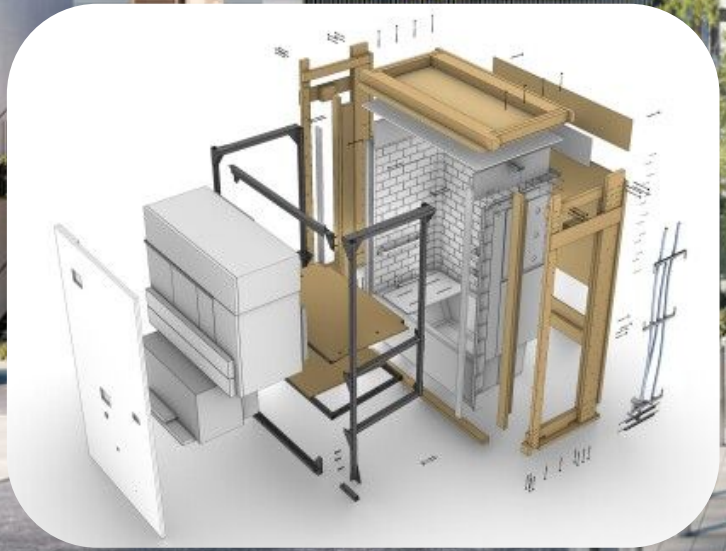


Image: https://www.modular.org/industry-analysis/

Background | USA

- Long history of interest in 'MMC' — **Post-WWII** efforts to utilise wartime infrastructure for construction.
- **Operation Breakthrough** (1969-76) sought to bring manufacturing techniques from automotive (very directly) to construction to increase supply and reduce cost.
- **Manufactured Housing** (distinct from 'modular') has broad uptake — governed by a federal building code administered by the U.S. Department of Housing and Urban Development (HUD)
- The Department of Energy's *Better Buildings Initiative* promotes MMC but substantial interest has been driven by **Venture Capital** finance.
- MMC accounts for ~3-5% of the housing market and is more widely used in 'bespoke' projects, though new ventures have emerged especially tech-driven startups.

Katerra | The Risk of Venture Capital



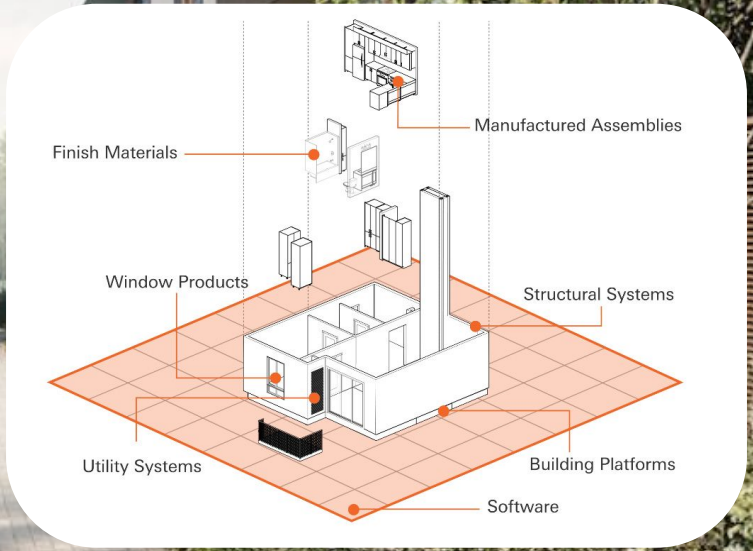


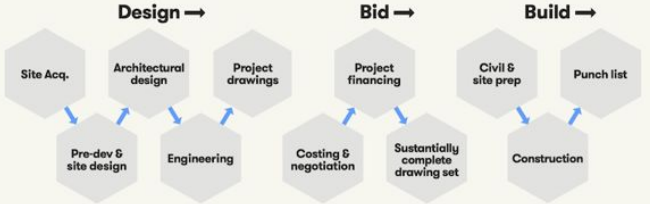
Image: https://www.architectmagazine.com/technology/q-a-katerras-michael-marks-is-upending-everything-from-a-to-e-to-c_o

Image: Jain, A. (2023). Housing for All and Sustainable Construction. In: Climate Resilient, Green and Low Carbon Built Environment. Green Energy and Technology. Springer, Singapore. DOI: 10.1007/978-981-99-0216-3_10

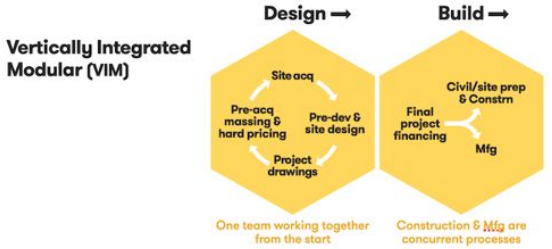
Blokable | Vertical integration for BtR

Vertically Integrated Modular (VIM) development process

Traditional Development Process



Vertically Integrated Modular (VIM)

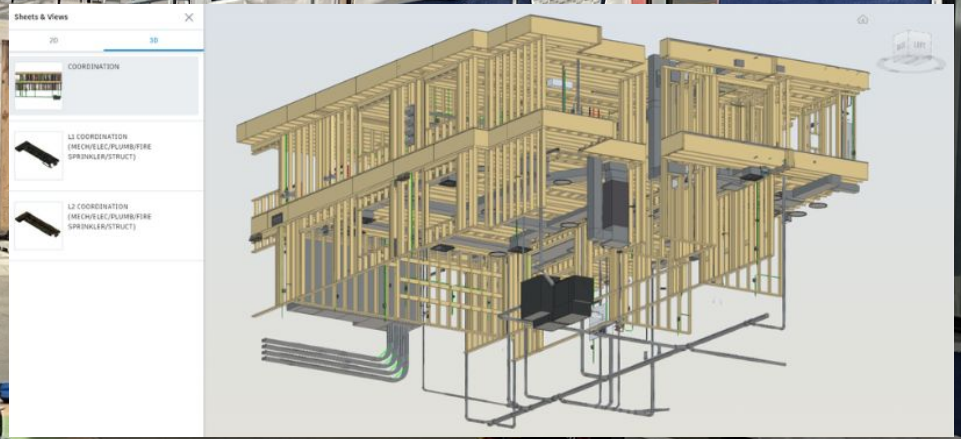


building 4.0 crc

future building
research to make buildings better

Volumetric Building Companies (VBC) | The next nutcracker?

Image:https://building4pointzero.org/wp-content/uploads/2024/08/Project-93-International-Research-Tour-Final-Report.pdf



Blueprint Robotics | Targeted integration

Image:https://www.blueprint-robotics.com/theblueprintmethod

Image:Pixabay

Image:https://gbr.sika.com/en/industry/offsite-construction.html

Successes

- **‘Unglamourous success’** — e.g. Manufactured Housing and the role of HUD
- **Experimentation** — an open approach to innovation, diversity of companies / approaches
- **Highly technical bespoke solutions** — unique projects of scale often trial MMC solutions

Challenges

- Significant **Venture Capital** investment in construction technology companies has ‘clouded’ the market
- **Return on investment** expectations associated with VC funding is often misaligned to reality of project delivery
- **Building codes vary** significantly between states limiting standardisation and resulting in complex compliance challenges, underpinned by limited/fragmented Governmental support.

Outcomes | US

SINGAPORE

Direct Government Intervention

future building
research to make buildings better

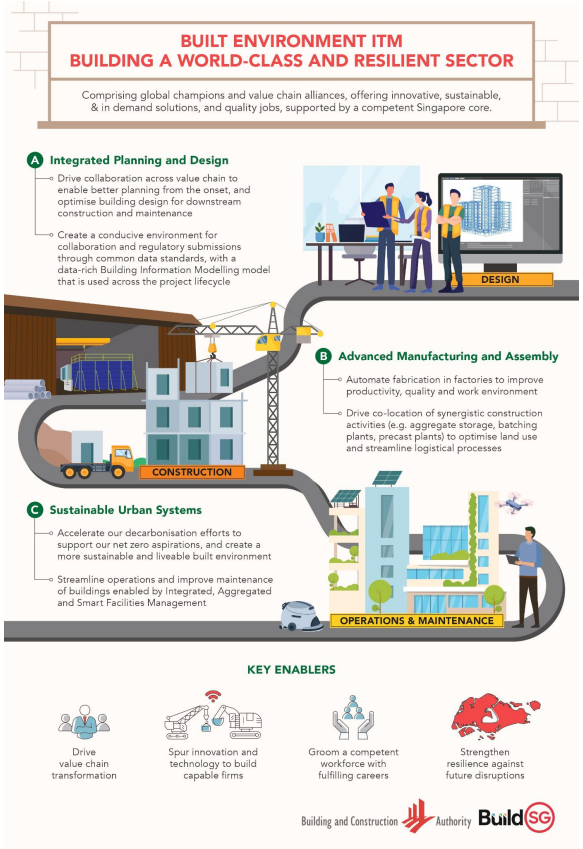
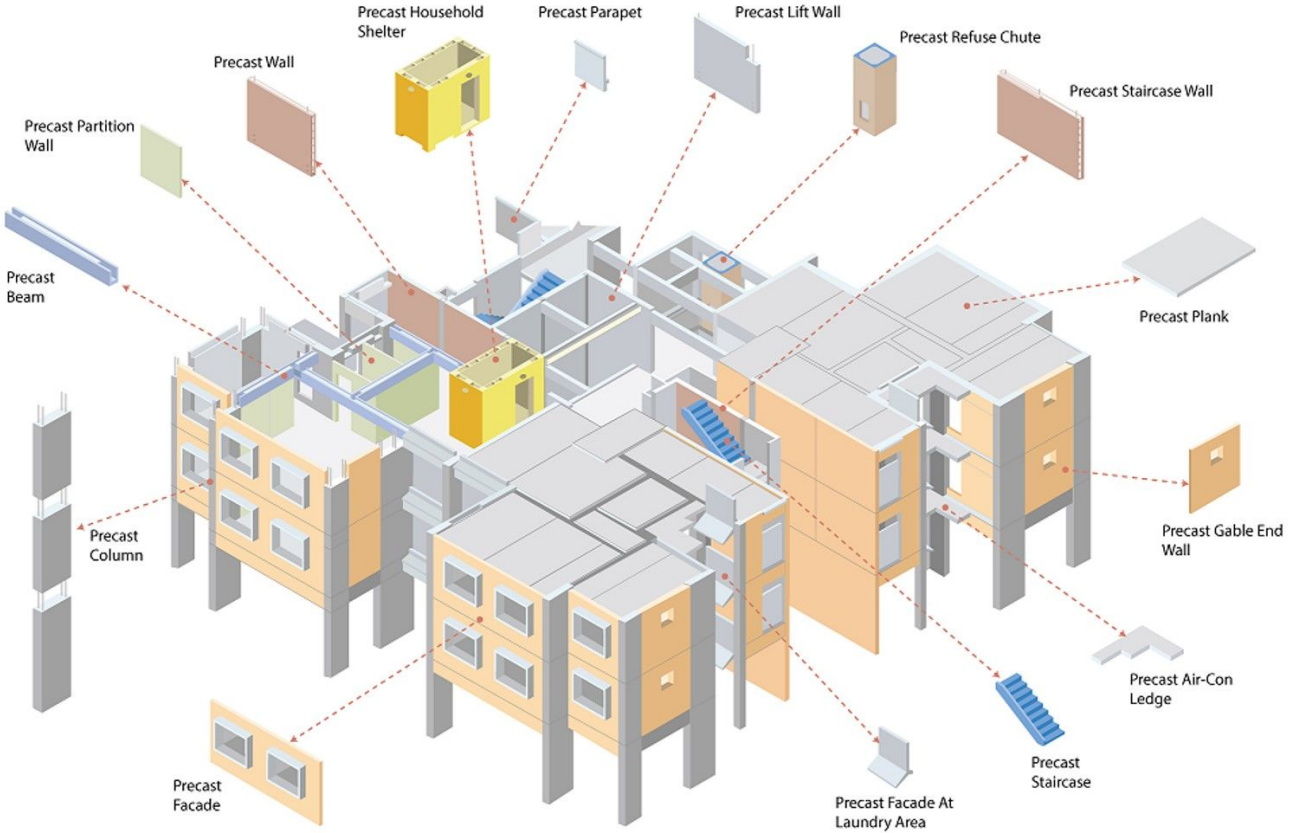


Image:Building and Construction Authority (BCA). (2024). Straits Construction CoreNet X

Background | SIN

- Singapore began exploring MMC to address housing shortages and increase efficiency of public housing developments, through the ***Housing Development Board (HDB)*** in early 2000.
- The ***Building Construction Authority's (BCA)*** *Construction Productivity Roadmap* (2016) placed a major emphasis on MMC to boost efficiency and reduce dependency on foreign labour.
- Construction productivity targets set to increase 25-30% by 2020 — a key focus on the adoption of prefabricated construction methods such as ***Prefabricated Prefinished Volumetric Construction (PPVC)*** and ***Mass Engineered Timber (MET)***.
- ***Integrated Construction and Prefabrication Hubs (ICPHs)*** promote prefabrication of building components.
- The Singaporean Government set a **70% target** of DfMA/MMC utilisation in projects by 2025 (44% at 2022).



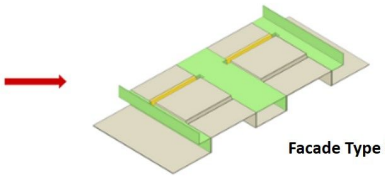
HDB Precast Building System

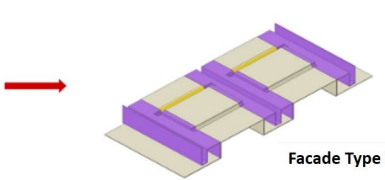
Image:Housing & Development Board (HDB). Prefabrication Technology.

HDB | Precast Building System

Fitting out of PPVC components off-site

Hoisting of PPVC components





Same Mould For Different Facades

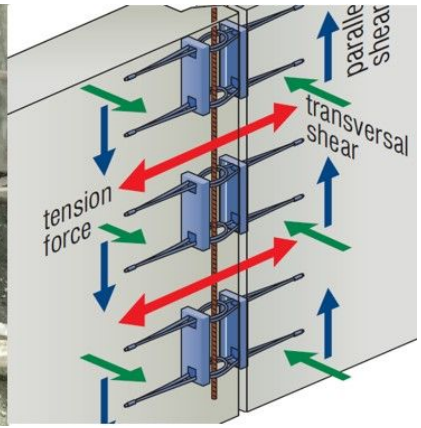


Image:Housing & Development Board (HDB). Prefabrication Technology.

HDB | Prototyping and Test Labs

Image:Housing & Development Board (HDB). Prefabrication Technology.

Dragages Singapore | Prefabricated Prefinished Volumetric Construction

Image: Dragages Singapore. The Clement Canopy Project. https://dragages.com.sg/projects-post/the-clement-canopy/

Dragages Singapore

Image: Dragages Singapore - The Clement Canopy Project, https://dragages.com.sg/projects/post/the-clement-canopy

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Image: Housing & Development Board (HDB). Prefabrication Technology.

Image: National Archives of Singapore. (2017). HDB Construction Productivity [Press Release]

Successes

- **Government Mandates** — BCA has utilised clear targets and mandates; enabling cross-sector standardisation and a certain pipeline.
- **Centralised Oversight —** BCA's centralised oversight ensures effective MMC implementation, aligning government policy with housing needs.
- **Reduction in Labour Dependency:** Government focus on prefabrication reduces reliance on foreign workers, traditionally a major part of Singapore's construction workforce.

Challenges

- **Dense Urban Logistics:** Singapore’s urban environment creates significant challenges for transporting large modules to construction sites and on-site storage
- **High Initial Costs:** Setting up *Integrated Construction and Prefabrication Hubs (ICPHs)* and adopting new technologies like PPVC require significant upfront capital investment, limiting participation by smaller firms.
- **Quality Control:** some PPVC approaches have faced module alignment and jointing issues during assembly, causing delays and challenges in meeting Singapore's building regulations.

Outcomes | SIN

Summary

DO

- ➔ Long-term commitment to innovation
- ➔ Utilise MMC for sustainability targets
- ➔ Public-private collaboration
- ➔ Practical, scalable solutions
- ➔ Regulatory reform

DON'T

- Product development <u>without</u> understanding market needs
- Venture capital <u>with</u> unrealistic ROI expectations
- Fragmented — Regulations / inter-Govt support
- Misunderestimate capital costs & project-cycles

SUSTAIN & SCALE

- ➢ MMC is the only reliable mechanism to meet national sustainability goals, compared to traditional building
- ➢ Workforce training and upskilling is required and is a significant investment opportunity
- ➢ New approaches to supply chain collaboration and logistics coordination
- ➢ Project delivery timescales of construction require staged and focused MMC investment / implementation

Actionable Insights