



Can MMC Improve Housing Productivity?

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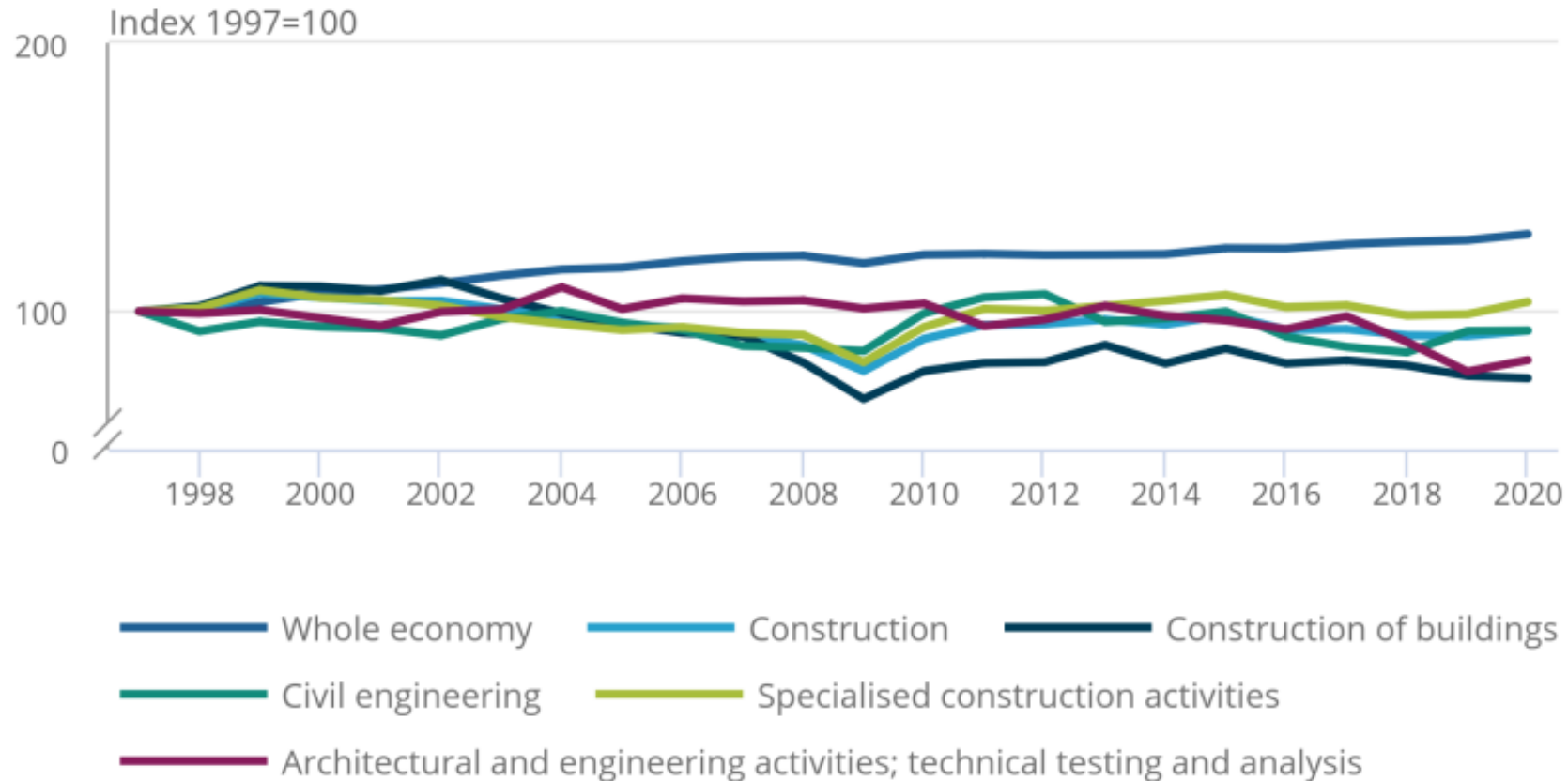
- Technology as the enabler of productivity growth
- The house that Ford built
- MMC in housing production
- What's the problem with the Cat 1 business model?
- The Challenge of continuity
- Can MMC improve housing productivity?
- The way forward with “manustruction”?

Technology as the Enabler of Productivity Growth

- Productivity defined as the ratio of inputs (usually labour) to outputs
 - **Not** production against plan as in the project management definition
- Economic growth can be achieved by increasing size of the workforce
 - But only productivity growth can achieve higher standards of living
- Productivity can be enhanced by
 - Working longer hours
 - Ensuring workers are fully trained for tasks
- But these are inherently limited in their effects
 - Technological change is the **only** sustained way to improve productivity
- Industries with low productivity growth are subject to the Baumol effect
 - Their products become increasingly expensive relative to high productivity sectors
 - This is manifest across construction; effect compounded in housing by markets for land

The Rate of Technological Change in Construction is Far too Slow

Output per hour worked, construction industry and sub-industries and whole economy, UK, 1997 to 2020, index 1997 = 100



The House that Ford built

- 1919-21, Dearborn, MI
- Dearborn Realty and Construction Co (Ford owned)
- 7 standardized high-quality house types
- Assembly-line construction methods
- Dedicated crews on each station of the workflow in sequence
- Standardized materials and sizings
- Pre-assembly in on-site shops
- Ford reckoned working in the open air rather than the factory was good for the workers
- Choice of timber or brick facades
- 250 houses built
- Sales tailed off due to recession
- Dearborn Realty never built another house



MMC in Housing Production

- Cats 3,5,6,7
 - Enormous technological change over the last 100 years
 - Introduction of better and better power tools and craneage
 - Modular “pods” well-established
 - Successful largely because they do not challenge the fundamental organization of production in construction
- Cat 4 (additive printing)
 - Remains a niche technology
- Cats 1 and 2 hold out much greater promise for step improvement
 - Policy and industry focused on Cat 1 as the greatest promise for single family housing
 - Yet there is something seriously wrong with the business model!

Something is Seriously Wrong with the Business Model!

Firm	Fate	Date
House by Urban Splash	enters administration	May 2022
<u>Countryside</u>	closes modular factory	July 2022
<u>Swan</u> (HA)	closes modular factory	December 2022
<u>Legal & General Modular Homes</u>	to cease production	May 2023
<u>Ilke Homes</u>	enters administration (with debts of £319m)	June 2023
<u>Modulous</u>	enters administration	January 2024
<u>Beattie Passive</u>	enters administration	March 2024
<u>Lighthouse Modular</u>	enters administration	April 2024
<u>ModPods</u>	enters administration	August 2024
<u>TopHat</u>	to "wind down" its modular operations	October 2024
<u>Connect Modular</u>	enters administration	January 2025

So, What's the Problem with Cat 1 Business Model?

- Cat 1 modular does not supply a whole house, but a structural subsystem
 - Cat 1 is trying to change only one step of the overall production process which otherwise remains unchanged
 - Good proofs of concept, but inability to scale
 - Fundamentally it has not, and cannot, address the *continuity* challenge
- “mass production is the focussing upon a manufacturing project of the principles of power, accuracy, economy, system, *continuity* and speed”
 - Henry Ford, *Encyclopædia Britannica*, 13th ed, 1926
- Wise words, but nobody has yet developed a sustainable business model for applying these principles to the construction of low-rise dwellings
 - Ford himself could not do it!

What are the Specific Problems?

- Acquire land and regulatory consent
 - Outline planning permission not usually problematic from an MMC point of view
 - Major issues arise under “reserved matters” (detailed planning consent) around “appearance”
 - Very significant source of delays (and hence loss of continuity) in onsite production even if successfully appealed
- Prepare foundations
 - Need to construct the foundations to the structure, *not* the structure to the foundations
 - Major issues with the dimensional quality of foundation work; most subcontractors not up to the task
- Manufacture, deliver and assemble modules on site
 - Manufacturing approach *pushes* modules out of the door
 - But they are very difficult to store and very expensive to transport
 - Basic principle of supply chain management is ruptured:
 - Overall process should *pull* sub-systems into the main production system, not *push* them into the main system
- Roof modules (very quickly!!)
 - Until roofed, modules are exposed to elements, but this remains an onsite stick-built subsystem
 - Not valuable enough to modularize and tiles mean roofs it cannot be craned complete into place
- Clad modules (typically brick)
 - Traditional wet trade
 - Brick slips might make a bit of a productivity difference

The Challenge of Continuity

- Housing production is the way it is for good reasons
 - MMC needs to adapt to the way houses are produced
- Fundamentally, housing production fails to achieve Ford's requirement of *continuity*:
 - Localized regulatory approvals mean that specifications vary around the country and can cause significant delays while approvals are obtained
 - Housing is a capital good and therefore demand is much more variable through economic cycles than in the mainstream economy (accelerator effect)
 - The weather does not help!
- Without continuity, fixed capital investments (e.g. factories) are a burden not an opportunity
 - Traditional construction avoids fixed capital investment for good economic reasons!
- Continuity cannot be achieved by marketing means, unlike other production sectors
 - Discounting to increase sales is ineffective because largest cost is fixed in the land acquisition price
 - Switching to alternative markets such as exporting unviable too

Can MMC Improve Housing Productivity?

- The best has been the enemy of the good
 - The rhetorical ambition for the factory-made house has led to an emphasis on Cat 1,
 - Cat 2+5 arguably offers a more flexible approach less reliant on continuity of demand
 - Less capital is tied up; easier to store; less expensive to transport; but a little more assembly time on site
- Modular production focused on optimizing factory production using manufacturing principles
 - Real emphasis needs to be on optimizing *relationship* between factory and site using “*manustruction*” principles
 - This needs to involve vertical integration into foundation installation, and arguably roofing and cladding
- Longer-term work to break the cultural connection of housing with brick cladding and tiled pitched roofing would reap dividends
 - In many parts of the country render is vernacular and there are many possible modern roofing technologies
- The challenges are not technological
 - Private sector housing construction will always be cyclical
 - Housing associations have had their fingers seriously burned with the failure of modular firms
 - Changes to the land use regulatory regime are in the offing but this is going to be a very bumpy ride

Manustruction: The Way Forward for MMC in Housing Production?

- Housing production needs to retain flexibility in its production systems
 - At least in the shorter term (5-10 years)
 - Technological change will not solve the continuity problem in housing
- The principal lever for shorter-term change is the building regulations
 - Future Homes Standard
 - These changes need to be standardized nation-wide
- Well-designed Cat 2+5 can effectively meet these new regulations
- Cat 1 will remain valuable in niche applications
 - e.g. Build-for-rent high-rise



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