How can a vertically-integrated developer, builder and off-site manufacturer best control their costs, supply chain and quality in the early days of establishing the business?
Premises

- Volumetric Steel Modules – 1,000+ per year
- PBSA, Hotels & Residential
- 45,000 – 75,000 sq ft

- Established in June 18
- Production started in January 2019
- First project underway
Full Vertical Integration (Nearly...) 

- Projects designed specifically for volumetric modular
- LPA discussions relevant to MMC
- Key design consultants external
- Move towards internalising expertise
  - Development Directors
  - Architectural Design
  - Technical Designers
  - BIM Co-Ordinator
  - Procurement team
  - On-site Self-delivery
  - Installation & Logistics
  - Manufacture
### Key Investment Considerations to Commence Operations

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>RISK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land</td>
<td>One ‘live’ project and five pipeline projects</td>
<td>Subject to Vagaries of Planning; 18 months acquisition to manufacture</td>
</tr>
<tr>
<td>Premises</td>
<td>Suitable premises are scarce; 10 year lease</td>
<td>Change of Planning; Significant adaptation of premises; balance of “security” vs “commitment”</td>
</tr>
<tr>
<td>Design / Software</td>
<td>Traditional RIBA 3 &amp; 4 Design through to DfMA and shop drawings</td>
<td>Separate ‘languages’ of construction vs manufacture; interface between on-site &amp; off-site;</td>
</tr>
<tr>
<td>Factory Hardware / Technology</td>
<td>H&amp;S requirements; Efficiency through lighting, machinery, flow lines etc</td>
<td>Most ‘scale-dependent’ item ie heavy barrier to production for smaller companies;</td>
</tr>
<tr>
<td>Human Resource</td>
<td>Need to implement correct procedures and environment ahead of employment</td>
<td>Recruitment takes time &amp; training; but reliance on contractors is expensive and non-progressive</td>
</tr>
</tbody>
</table>
## Key Cost Considerations to Commence Operations

<table>
<thead>
<tr>
<th>ITEM</th>
<th>COST CONTROL</th>
<th>AND / BUT...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land</td>
<td>Provincial land is inexpensive per module vs London (c.£40k per consented room)</td>
<td>With relatively small scale projects, there’s a constant (and expensive) design ‘battle’</td>
</tr>
<tr>
<td>Premises</td>
<td>Leasing vs Buying manages cashflow better - although gets written off</td>
<td>Being a tenant creates constraints around factory adaptations &amp; investment</td>
</tr>
<tr>
<td>Design / Software</td>
<td>Hard to implement – new broadband solution, new staff, new work model</td>
<td>Most embedded way to control costs in the medium-term eg BIM, MRP etc</td>
</tr>
<tr>
<td>Factory Hardware / Technology</td>
<td>“L&amp;G model” compared to step-by-step adaptations. Gantry cranes, extensions</td>
<td>Most ‘scale-dependent’ item ie heavy barrier to production for smaller companies;</td>
</tr>
<tr>
<td>Human Resource</td>
<td>Difficulty in recruiting eager, precise staff who want to be in manufacturing</td>
<td>Requirement to ensure it’s an attractive place to work long-term – food, transport, facilities</td>
</tr>
</tbody>
</table>
### Role of Digital Design in Controlling Processes and Costs

**Control, Efficiency, Quality & Transparency**

Main focus on software tools for digital collaboration:

<table>
<thead>
<tr>
<th>BIM software providers</th>
<th></th>
</tr>
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<tbody>
<tr>
<td>• Increasingly mainstream among Architects</td>
<td></td>
</tr>
<tr>
<td>• ‘Internalise’ BIM control to use various levels and increase potential</td>
<td></td>
</tr>
</tbody>
</table>

Level 1 – (2011) 3D CAD but not fully collaborative

Level 2 - collaborative BIM. Federated model information is shared within a Common Data Environment

Level 3 onwards – integrates various alternative ‘dimensions’ eg cost

Digital Design provides control over all of this AND Management, Strategy, Costs, Programming, Risk, Staffing etc
## Various Elements of “Technology”

<table>
<thead>
<tr>
<th>1. Construction Technology</th>
<th>New Materials; Off-Site Elements; Robotic Delivery; 3D Printing. But emphasis is moving away from construction – is automated on-site brick-laying really the future?</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Manufacturing Technology</td>
<td>Barrier to investment of bespoke digital machinery; Emphasis on Scale and Uniformity? More “Engineering” than “Technology” until it reaches robotics and suits huge-scale</td>
</tr>
<tr>
<td>3. End-Product Technology</td>
<td>Sustainability; Well-being; Connectivity Well underway and only helped by engineered solutions</td>
</tr>
<tr>
<td>4. Design Technology</td>
<td>Precise, 3-D, Collaborative, Single-Source, Transparent</td>
</tr>
<tr>
<td>5. Risk Management</td>
<td>Materials Requirement Planning; Material Requirements Planning; Document Management</td>
</tr>
</tbody>
</table>
Impact of Scale on Investment – Always Best?

- L&G Homes Feb 2016
- 550,000 sq ft new facility
- £55m investment
- 550 staff
- 4,500 homes p.a.
At 1/10\textsuperscript{th} the scale…

- Stelling located factory in May 19
- Prototype testing by November 19
- Commenced manufacture this
- Barriers to increased scale without:
  - More machinery
  - Expansion of factory
  - Digitalisation of all processes
  - Recruitment / Training
- Agile Frigate vs Tanker
- Government needs to focus on smaller scale operators to establish in order to allow MMC into the mainstream
At 1/10th the scale (but growing...)

- Stelling located factory in May 19
- Prototype testing by November 19
- Commenced manufacture this
- Barriers to increased scale without:
  - More machinery
  - Expansion of factory
  - Digitalisation of all processes
  - Recruitment / Training
- “Agile & Adaptable” vs “Efficiency of Scale” – both should work
- Government could focus on SME’s to establish in order to allow offsite manufacture into the mainstream
Benefits of Digitalisation in Cost Control

- Enables better QA
- Clarifies/People Consultants Internalises Expertise
- Programme of Manufacture
- Stage by Stage Process
- Enables DfMA
- Bill of Materials
- Procurement Supply Chain
- Supply Programme/Stores

Digital Design

Enables DfMA
Consultants Costs

- Faster
- Practical
- Repetitive
- Defined
- Innovative
- Efficient
- Cheaper
- Better
- Simpler