

INTERVIEW PROTOCOL

Case Study: COMPANY H

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1. CONTEXT AND CHARACTERISATION OF INDUSTRIAL CONSTRUCTION

Q1.1 *As a spin-off from a big manufacturing company, could you explain what factors lead the decision to enter into the construction industry?*

Q1.2 *What were the main barriers, challenges and benefits when joining the construction industry applying industrial production processes?*

Q1.3 *From your experience, which advantages/ know-how could manufacturers bring to the construction sector?*

Q1.4 *Do you consider advantageous the industrialisation of the construction sector? Why?*

Q1.5 *From your perspective, what is the key challenge when facing a modular construction project (design, fabrication, logistics, transport, assembling, operations, other)? Why?*

2. CLIENT ORIENTATION

Q2.1 *Client segmentation - Please, mark the type(s) of clients that you have:*

- *Individuals who want to buy a house*
- *Individuals who want to self-build a house*
- *Small developers*
- *Big developers*

Q2.2 *Could you identify the reasons that drive developers/individual clients to choose industrial construction and contact your company?*

Q2.3 *In terms of what motivates them to choose industrial construction, are you able to point out differences among the type of clients?*

Q2.4 *Do you offer customised offerings to your clients? To what extend?*

Q2.5 *How would you define the production model of the company (make to order / make to stock)? Is there a paradox with customisation?*

3. SERVICE ORIENTATION

Q3.1 *From your experience, does industrial construction enable the offering of product-services that help in the integration of the different project phases (Conceptualisation - Design - Execution - Operation/Maintenance – Disposal)?*

Q3.2 *Does your company integrate associated services throughout the project life cycle? In which phases?*

Q3.3 *Does your company use BIM methodology as an enabler to implement services?*

Q3.4 *Does your company offer home automation? If yes, does any type of automation lead to the inclusion of services?*

Q3.5 *Do you see potential in the development of smart services? Is Company H planning to offer these services in case they are not offered yet?*

Checklist 1 – PSS typologies

Please, mark the offering(s) that Company H offers in its portfolio:

- *Design / Architecture Consultancy*
- *Planning tools*
- *Services linked with the use of BIM*
- *Other consultancy services*
- *Financing*
- *Property / Real estate services*
- *Transportation*
- *Assembling*
- *Technical Services*
- *Services connected with operations of the building*
- *Services associated to building automation*
- *Any service connected with energy consumption*
- *Any service connected with the installation of sensors*
- *Any monitoring services*
- *Services of leasing / renting / shared ownership*
- *Turnkey projects*
- *Any service that involves Industrial partnerships*
- *Any other services (Please, explain here)*

4. SUSTAINABLE ORIENTATION

Q4.1 *What are the main advantage of industrial construction in terms of sustainability?*

Q4.2 *Could you quantify delivery time reduction in comparison with traditional construction methods?*

Q4.3 *Company H offers energetic certification A and, in some cases, BREEAM certification. Could you explain is these offering respond to a particular strategy?*

Q4.4 Does your company offer any service associated with the product (prefabricated modules) lifecycle assessment?

Q4.5 Does your company offer any service to provide long-term energy reduced consumption?

Checklist 1 – Environmental Performance of Industrial Construction

*It has been recognised that different factors affect the environmental performance of industrialised housing/construction – **Please, mark the ones** you consider more relevant and/or are taken into consideration by Company H*

- **System design** : influence of the environmental performance of industrial housing during product design
 - 1.1 Efficiency - refers to design strategies used to reduce the amount of materials used in construction
 - 1.2 Product modularity – refers to design strategy that aims to create both variable and standardized elements in a product
 - 1.3 Coordination of super-and sub-structure (i.e use of timber or other lightweight materials for super structure results in less materials for foundation construction)
- **Material design**: The choice of material for construction
 - 2.1 Embodied energy: the sum of energy required to produce a building component is taken into consideration
 - 2.2 Dematerialization: the concept of building a structure with less material while still serving the same or similar purpose is considered
 - 2.3 Durability: the long-term environmental performance of building material is taken into consideration
 - 2.4 Manufacturing and Logistics
 - 2.5 Waste reduction occurs through controlled processes of manufacturing building elements in a factory environment
 - 2.6 Production system impacts: reduction of environmental impacts driven by the type of production system used (i.e. introduction of lean principles in construction has created an opportunity to eliminate overproduction and excess inventory)
 - 2.7 Green supply chain management: coordination among key stakeholders such as suppliers, manufacturers and contractors to manage their environmental performance.
- **Transport and assembly**
 - 3.1 Equipment: energy consumed by equipment used during transport and assembly of elements / Energy consumption associated with hoisting prefabricated elements
 - 3.2 Location: the impact associated with transporting building. The main issue is the delivery distance of the elements. Transportation of building elements accounted for 20% of environmental impact according with some studies. transportation planning and efficiency is crucial
- **Operation**
 - 4.1 Operational energy: is energy consumed during use phase of buildings. Lightness of building structures / building materials could have a positive impact on energy performance
 - 4.2 Supplementary elements: the concept of adding elements that are not considered core to the functionality of a building such as solar panels to reduce the operational energy

- **End of Life**

5.1 *Reusability and recyclability: the potential of housing structures to be reused or recycled for further use.*

5.2 *Service based industry: the fact that houses can be constructed and handed out to clients but permanent responsibility is given to manufacturer or a third-party to maintain as well as dismantle the structure.*

- **Support and barriers of industrialised construction**

6.1 *Customer demand: is the end-users' requirements and desires to buy the housing. One of the key elements mentioned in driving or impeding innovative and industrial construction is customers' need for sustainable and affordable housing*

6.2 *Building codes: Building codes should accommodate the change in construction materials and methods*

6.3 *Policies and incentives: the regulatory and statutory requirements as well as special benefits drafted for housing projects. Regulatory entities play a major role in adopting innovation.*

FINAL QUESTIONS

From your perspective, is it off-site manufacturing/ industrial construction/ modularity an open door to the inclusion of services in the construction industry?

Is off-site manufacturing / industrial construction /modularity transforming construction industry towards a more sustainable sector?