Learning by doing: Public and private search for quick delivery and sustainability in building projects

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Abstract

Quick project delivery makes socio-economic sense as value can be delivered sooner. We investigate two approaches to achieving this; the modular super cube-concept for school buildings and conventional building conducted in series (repetition of design and floor plans between buildings). We study the methods and evaluate the degree of success in quick project delivery, while also looking into sustainability-aspects of the two cases. The identified enablers of speed include clear owner priorities, learning effects and quality assurance at the conceptual level. The enablers of sustainability include clear owner priorities. We then evaluate if there have been a trade-off between the concerns for sustainability and the goal of quick project delivery, identifying cost as the suffering factor.

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1. Introduction

The aims of profit, cost-efficiency and quality are important drivers in the evolution of any sector, including building and construction [1]. Reductions in construction time for building projects allows property developers higher turnover rate on projects and thus increased profits without increasing the profit margins on the individual project. Reduction of construction time can also be a target for actors in the public sector, in order to provide capacity and facilities for schools and health care to serve the population.

Meanwhile, changing regulations and expectations from stakeholders with regards to environmental impacts and sustainability force whole industries to innovate and approach projects differently with regards to planning and execution [2, 3]. “Sustainability” of buildings and projects however remains difficult to pin down and measure. A range of organizations has proposed various approaches formalize the “sustainability” of buildings, including certification (BREEAM, LEED and Green globe). Academics in the field of sustainable construction are working towards the same goal [4-6]. At it’s core sustainability is about balance and trade-offs; it is a holistic concept that revolves around local and global, short- and long-term concerns and consequences within the environmental, economic and social dimensions.

The purpose of this paper is to document the process and findings of two case studies in which construction speed (or quick project delivery) and sustainability have been of the essence. The research questions we have addressed are: (1) what are the enablers that contribute to the achievement of quick project delivery and sustainability in the delivery process and in the delivered asset (the building) and (2) are there trade-offs that result from simultaneously pursuing quick project delivery and sustainability in process and product. An enabler is defined by the Cambridge dictionary as “something or someone that makes it possible for a particular thing to happen or be done” (2017). A barrier denotes the antonym, “anything used or acting to (...) block something from happening”. A trade-off is defined as “a situation in which you balance two opposing situations or qualities”.

Speed and sustainability may appear to be examples of two such “opposing qualities”; one focusing on the short-term delivery, whereas the others main concern is the long term. We have used a mix of methodologies in covering the two cases, including interviews, questionnaire surveys and action research in order to identify the enablers and the trade-offs in the process of achieving quick project delivery and sustainability in the delivery process and the product that have been delivered.

Case study 1 is of a module-based concept for school construction (primary school extensions) of which 8 cubes have been constructed. The principal argument for developing the concept was initially quick delivery of additional capacity to schools that were either becoming to small due to population increases, or to replace outdated temporary barracks dating from the last 40 years. However, after the four first cubes had been delivered, policy changes in the municipality resulted in new requirements with regards to the energy use and insulation meant that the subsequent four cubes were to be delivered according to passive house standard [7]. Case study 2 is of an apartment complex at Fornebu outside Oslo. Four nearly identical apartment buildings are being constructed at half the time of “normal” projects. Disregarding the short construction time, the building process is conventional building, meaning prefabrication is used for structural elements such as columns, elevator shafts and hollow core floors, whereas the rest of the building is done at the site.

Table 1: overview of cases

<table>
<thead>
<tr>
<th></th>
<th>Case 1: Super Cubes</th>
<th>Case 2: K2 apartment complex</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project size</strong></td>
<td>Seven projects each around 2000 sq.m.</td>
<td>Four apartment blocks 15 100 sq.m.</td>
</tr>
<tr>
<td><strong>Building method</strong></td>
<td>Prefab steel modules</td>
<td>Conventional hybrid construction (prefab/place built)</td>
</tr>
<tr>
<td><strong>Type of contract</strong></td>
<td>Design build alliance</td>
<td>Engineering, procurement and construction contract</td>
</tr>
</tbody>
</table>

Learning effects due to repetition within and from one project to the next pose a great opportunity for improving project performance with regards to both speed and sustainability. Experience can help both decision-makers and
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