

# PRODUCTION SYSTEM DESIGN

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Construction products are produced by complex production systems: they span multiple organizations, employ a wide variety of production technologies, require extensive engineering design information, are fed by numerous supply chains, and, like most production systems, suffer variability and uncertainty.

In many cases, construction production systems have evolved over time, responding to changes in markets, technology and commercial contexts. Construction of a private home, for example, is performed differently in different countries and regions largely as a result of the way local conditions have guided evolution of the production systems themselves. This can be considered akin to a process of natural selection, as unsuccessful variant production systems prove unsuccessful and only the fittest survive. Partly as a result, traditional construction systems are resilient to change.

However, lean construction suggests that construction production systems can be improved in quantum steps if lean thinking concepts and tools are applied to them. It holds that systems can in fact be **designed** to meet specific goals in terms of providing value, reducing waste, increasing throughput, reducing cycle times, and so on.

This research theme includes theoretical approaches, practical implementations and case studies, quantitative analyses, simulations, and qualitative evaluations, of lean production system designs in all spheres of construction. Papers in this theme will commonly use terms such as: Batch size, Buffers, Bottleneck, Cycle time, CONWIP, JIT, Kaizen, Kanban, Little's Law, Make-ready process, Multi-skilling, Parallel processes, Production cells, Productivity, Pull vs. push flow, Setup time, Takt time, Throughput, Variability, WIP, Work structuring, and Workflow stability.

Most of these tools, more than a fragmented set, are part of a dynamic system with strong relationships. The well known "house of TPS - Toyota Production System" is a reference, for any industry, that guides the understanding of those relationships. Founded in stability, standardized work, kaizen and heijunka (leveling), the roof of goals (highest quality, lowest cost, shortest lead time) is supported by pillars of Just-in-time (including continuous flow, takt time and pull system concepts) and Jidoka (including built-in-quality and productivity, separating man and machine); most representations put a person inside the "house" (at the core of the system) to represent both client and worker.

Researchers and practitioners are challenged to translate these concepts into construction environments. To stimulate your thinking, we present below a small selection of papers presented at recent IGLC meetings. Authors interested in discussing this research theme are invited to contact us.

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