

SLACK IN CONSTRUCTION

PART 2: PRACTICAL APPLICATIONS

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July 14, 2021



INTRODUCTION

- **Variability coping mechanisms** in construction and other sectors are usually approached in the production management literature from a limited perspective: capacity, inventory, and time buffers (Spearman and Hopp 2020).
- Literature on buffers **neglects both the social and the informal dimensions of coping with variability**, offering an overly **technical and mechanistic perspective**.
- Formoso et al. (2021) propose a concept and theorization of slack that:
 - **Integrates a wide range of variability coping mechanisms** that account for both **formal and informal approaches**, across all relevant processes at **different levels** of project production systems;
 - **Inspires a revision of lean construction practices** so as to check (and increase) the extent to which they **fit to the levels of complexity and risk that characterize construction projects**.

Slack

“A cushion of actual or potential resources which allows an organization to adapt successfully to internal pressures for adjustment or to external pressures for change in policy” (Bourgeois 1981).

INTRODUCTION

- Aim of the paper:
 - Illuminate the concept of slack in construction with **practical examples derived from both the literature and the authors' experience** as lean construction scholars and practitioners.
- The examples of slack stem from two sources:
 - **Research projects** led by some of the authors of this paper on the topics of lean construction, resilience engineering, and production planning and control;
 - Reinterpretation of **known management practices** from the viewpoint of slack.
- The examples are classified according to:
 1. **Slack strategies** adopted
 2. **Slack resources** involved
 3. Rationale for using slack (**why is slack needed?**)
 4. **Unintended consequences** of using slack

EXAMPLES OF SLACK IN PRODUCTION MANAGEMENT

Slack strategies (adapted from Formoso et al. 2021)

Slack strategy	Definition
Flexibility	The ability of an organization to deploy and redeploy its resources effectively in response to changing environmental and internal conditions (Gerwin 1993).
Redundancy	A condition where some types of resources are provided in addition to the minimum necessary to perform a specific function (Nonaka 1990), or when more than one resource performs a required function (Azadeh et al., 2016).
Margins of manoeuvre	It addresses the creation or maintenance of margins and additional resources that allow the system to continue to function despite unexpected demands (Saurin and Werle 2017).

EXAMPLES

Strategy of deployment: **Flexibility**



Resources: People (number of)
People (problem-solving perspectives)

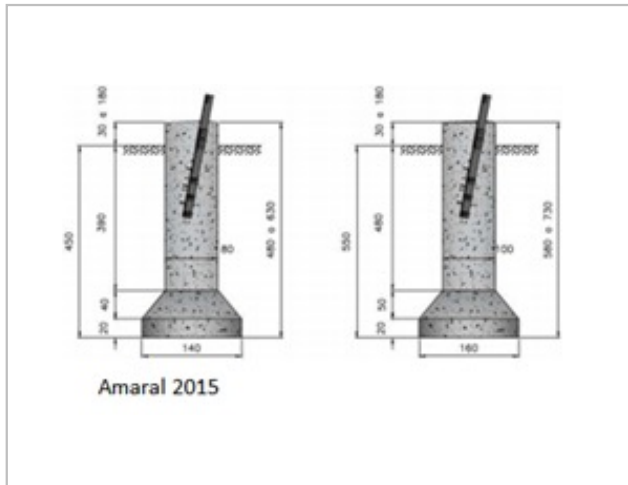
Description: Reallocation of workers across gangs and shifts to meet daily production goals. This decision making occurs in daily huddles.

Why is slack needed? To avoid delays.

Unintended consequences Waste from moving equipment and tools.
Activities from which workers were removed could be delayed.

EXAMPLES

Strategy of deployment: **Redundancy**



Resource: Design

Description: Alternative designs for different types of soil.

Why is slack needed? Heterogeneity of the soil and the limited soil surveys.

Unintended consequences: Extra short-term costs for producing alternative designs.



Resource: Space

Description: More than one escape route or emergency exit.

Why is slack needed? One of the escape routes/exits may be overcrowded or unavailable.

Unintended consequences: Costs with refurbishment and adaptation of facilities.



Resource: People

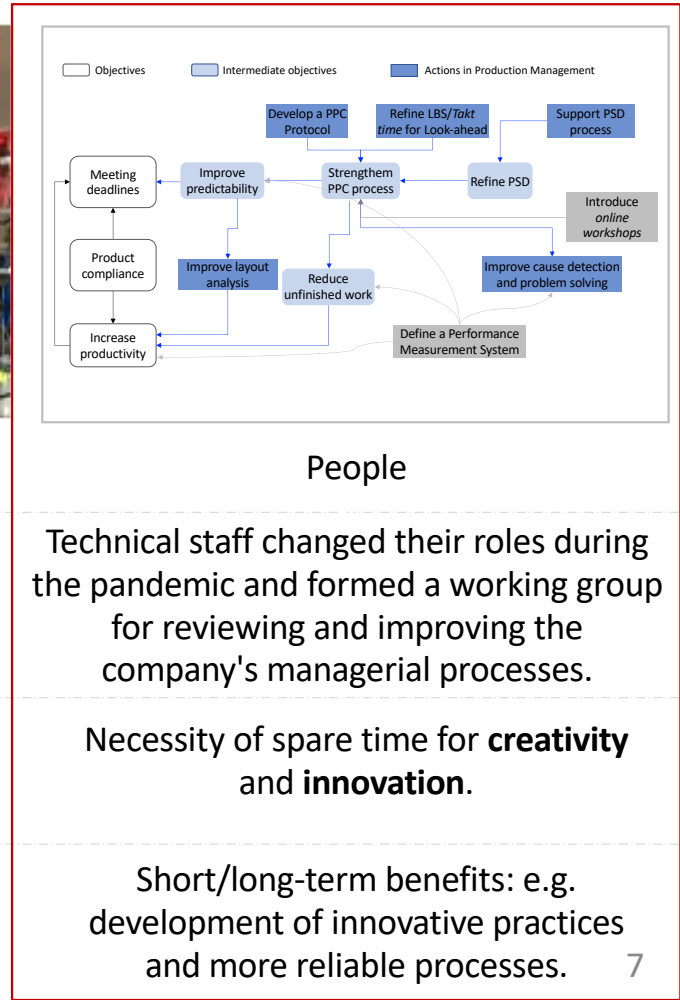
Description: Multi-skilled employee.

Why is slack needed? Hiring and training a new crane operator takes time.

Unintended consequences: Wages of multi-skilled employees are higher than those of regular employees.

EXAMPLES

Strategy of deployment: Margin of manoeuvre



Resource(s):

Space and Equipment

Space

People

Description:

Regular inpatient wards that can be adapted to intensive care.

Patient bay layout in an intensive care unit can be changed to facilitate care provision.

Technical staff changed their roles during the pandemic and formed a working group for reviewing and improving the company's managerial processes.

Why is slack needed?

Surges in demand (e.g., COVID-19 pandemic) imply the need for extra intensive care beds.

Caregivers do not have 360° access around the bedside in standard layout.

Necessity of spare time for **creativity** and **innovation**.

Unintended consequences

Some requirements of ICU clinicians may not be fully met in the adapted inpatient wards.

Layout changes cause discomfort to the patient and increase the risk of accidents.

Short/long-term benefits: e.g. development of innovative practices and more reliable processes.

CONCLUSIONS FROM THE EXAMPLES

1. Slack plays a **role in several processes** such as contract management, safety management, supply chain management, product design and development, and production planning and control;
2. Slack is **deployed** through a variety of **strategies** and **resources**, which are **not limited to the traditional buffer resources of time, inventory, and capacity**;
3. **Slack has a social-technical nature**, which means that **people's behaviours and knowledge play a role as slack resources**; and
4. **Slack is often implicit in existing practices** (e.g., daily huddles). However, there is a **risk of taking the availability of slack for granted**, which can lead to complacency.

CONCLUSIONS

- The identified characteristics of **slack** indicate that it has a broader meaning than the **concept of buffer**.
- This article adds empirical evidence on the **use of slack as an alternative to the pure use of buffers** in lean construction.

FUTURE RESEARCH

1. Investigate the trade-off between slack and waste, shedding light on the criteria to be accounted for when managing that trade-off
2. Analyse the implications of slack for innovation and resilience in construction
3. The investigation of slack in product development seems to be promising as it has the potential of developing more cost-effective solutions in comparison with those devised on the spot during construction

ABOUT THIS RESEARCH

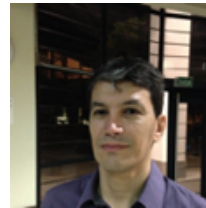
- Outcome of a non-conventional research project
- Result of literature review and theoretical discussions
 - Group of 13 academics
 - 10 weekly on-line meetings during a 4-month period
 - Development of a concept map



Carlos Formoso



Iris D. Tommelein



Tarcísio Saurin



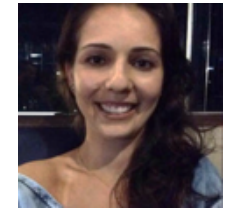
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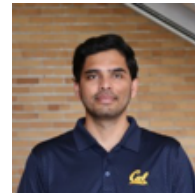
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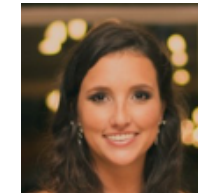
Rafael Coelho



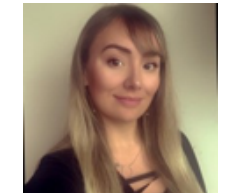
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THANK YOU!

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