IGLC 2021
LIMA, PERÚ - 29TH ANNUAL CONFERENCE
INTERNATIONAL GROUP FOR LEAN CONSTRUCTION

BUFFER TYPES AND METHODS OF DEPLOYMENT IN CONSTRUCTION

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AGENDA

1. INTRODUCTION
2. RESEARCH METHOD
3. RESEARCH FINDINGS
4. DISCUSSION
5. CONCLUSION

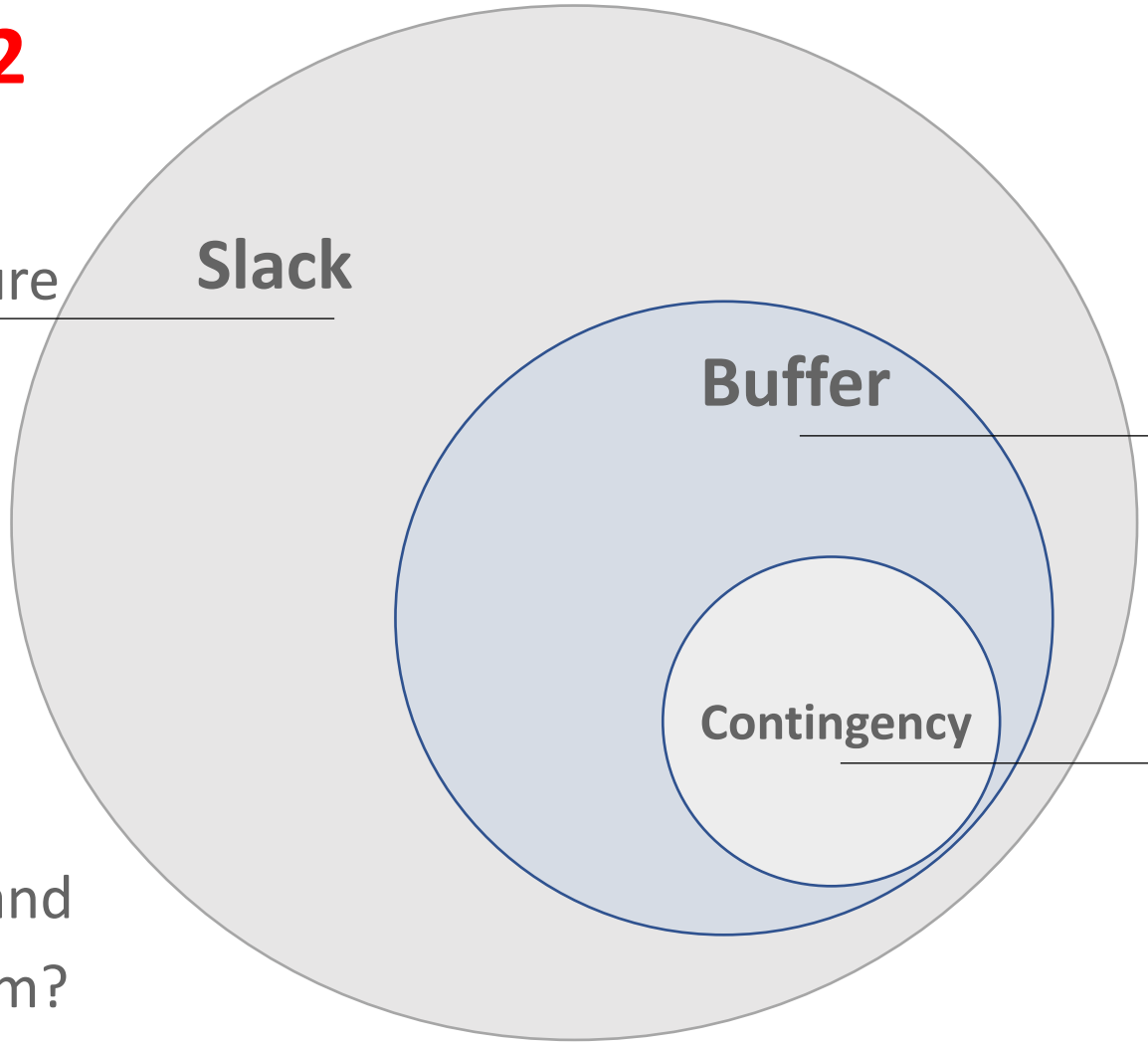
INTRODUCTION 1

Due to the **complexity** of projects, in part due to managerial practices adopted, much **variability** exists in construction **resource flows**.

Production system design can be used to eliminate at least some **unwanted variability** and then reduce the impact of **remaining variability** by using **buffers** in order to improve such flows.

INTRODUCTION 2

More strategic in nature and of concern at the organizational level



more operational in nature and of concern at the project level

time and money being the resources of concern

So **what are buffers** and **why** should we use them?

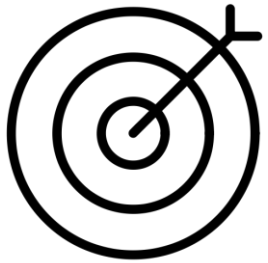
INTRODUCTION 3

What have buffer **types** and **methods of deployment** been used for buffer management?

A common practice in construction is to add time buffers to a project schedule using a deterministic approach, not considering the dynamic nature of projects "a **trial-and-error process** with dubious results" (González et al. 2011)

An alternative is to use **systematic, adaptive, data-driven methods**, based on probabilistic mathematical models to define buffers and adjust them in real-time as needed.

RESEARCH AIM



The aim of this paper is to categorize buffering methods used in construction as presented in the literature.

RESEARCH METHOD 1

(1) Science Direct
(2) ASCE
(3) Taylor & Francis Online
(4) IGLC

Search terms:
{"buffer" OR "contingency" OR "slack"} (in the title, abstract, and keywords) AND "planning" AND "control" AND "management" AND "construction project" (anywhere in the paper).

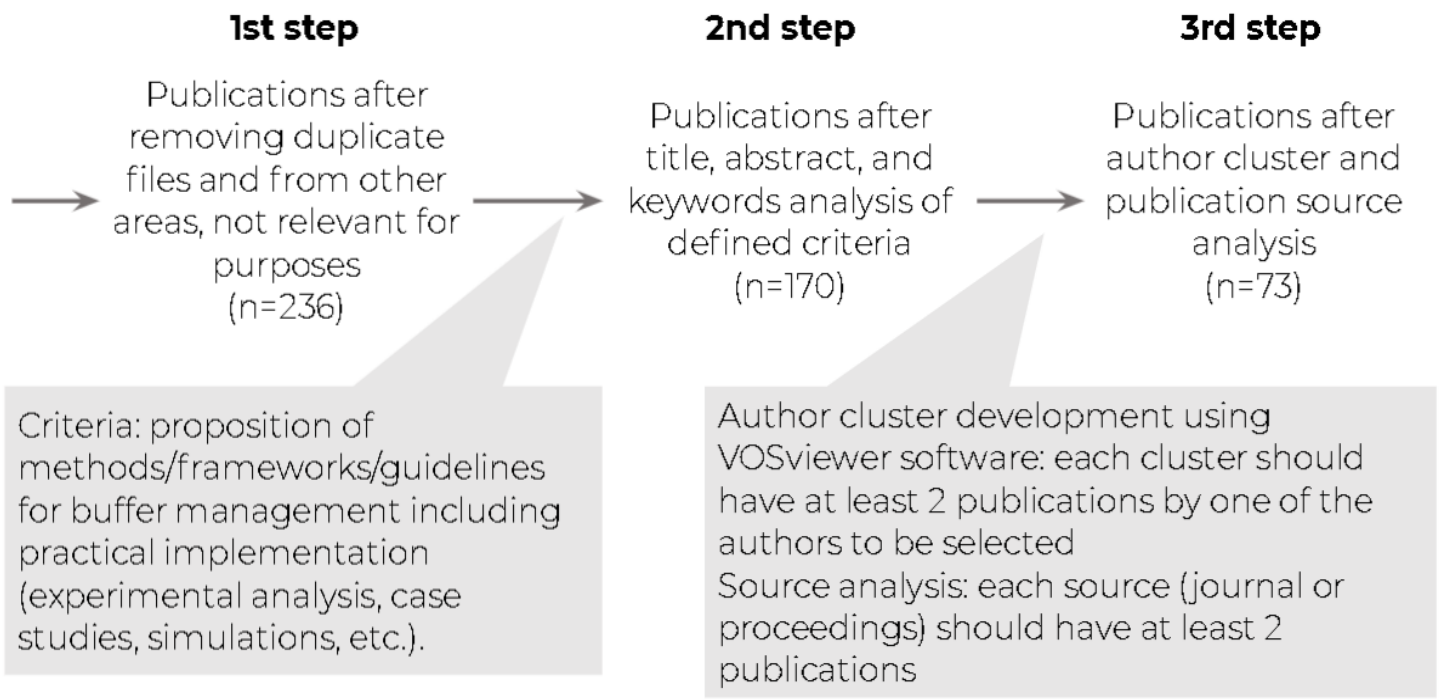


Figure 1. Steps of the systematic literature review

RESEARCH METHOD 2

- Assuming that authors (incl. teachers and students) may develop not one but several papers along a similar line of thought, we organized the papers by author cluster.

- For brevity of this IGLC paper, we report only the analysis of clusters with at least 3 papers and at least 3 authors per cluster (circled in Figure 2), which represent approximately 64% of all papers identified in the SLR.

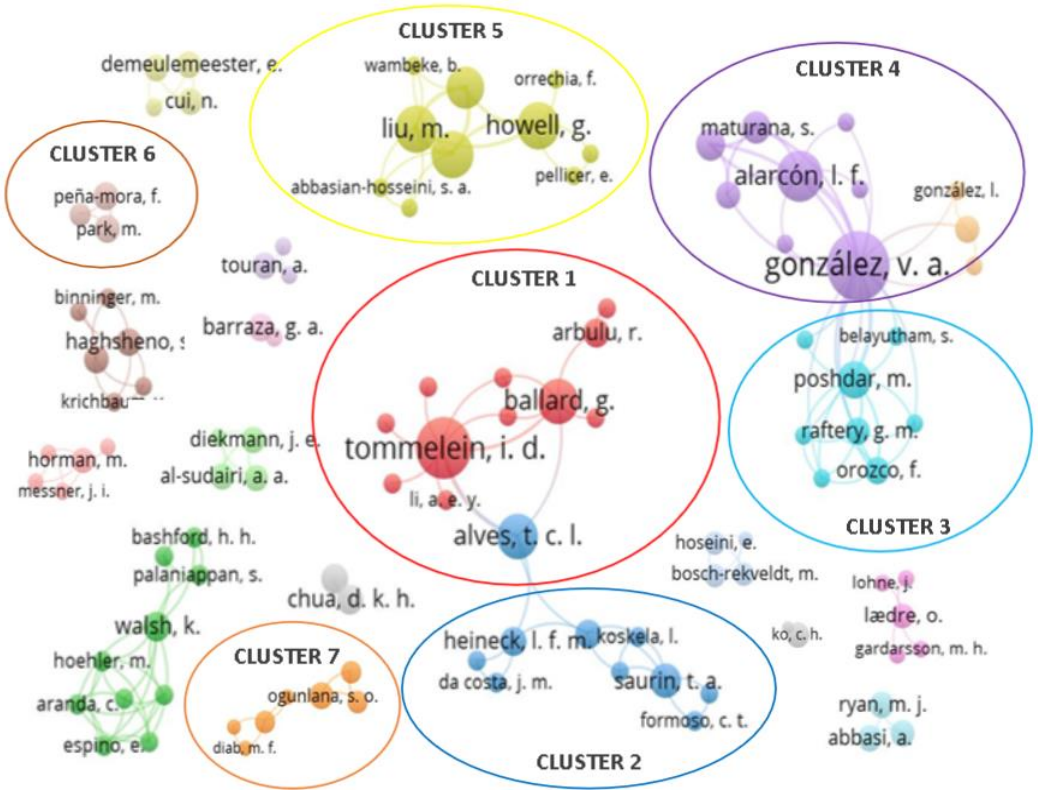


Figure 2. Network and clusters visualization

RESEARCH FINDINGS 1

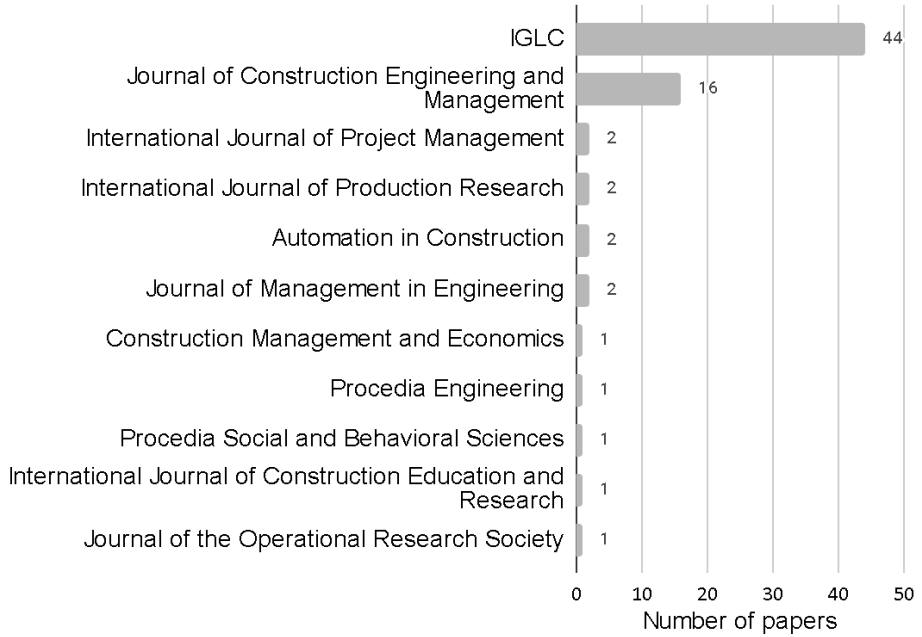


Figure 3. Distribution of papers by journal and conference proceedings

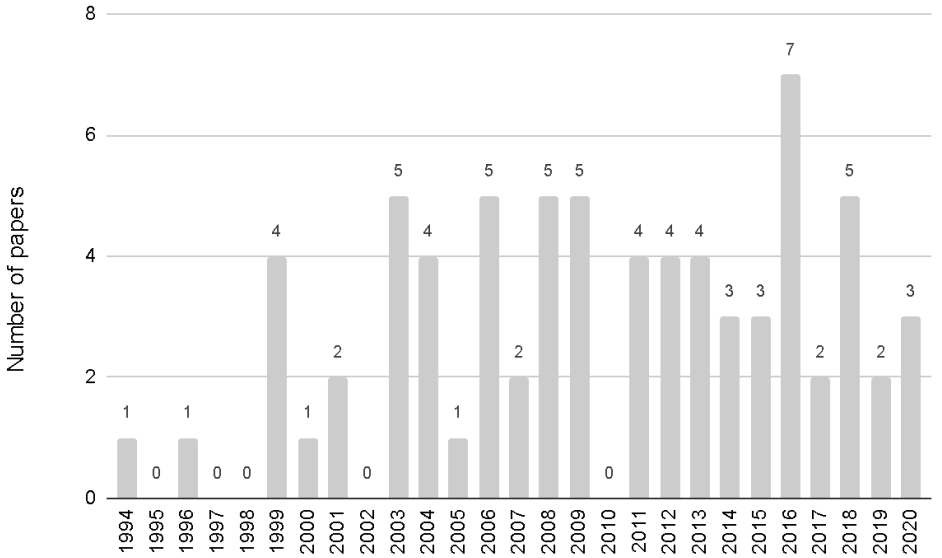


Figure 4. Distribution of papers per year

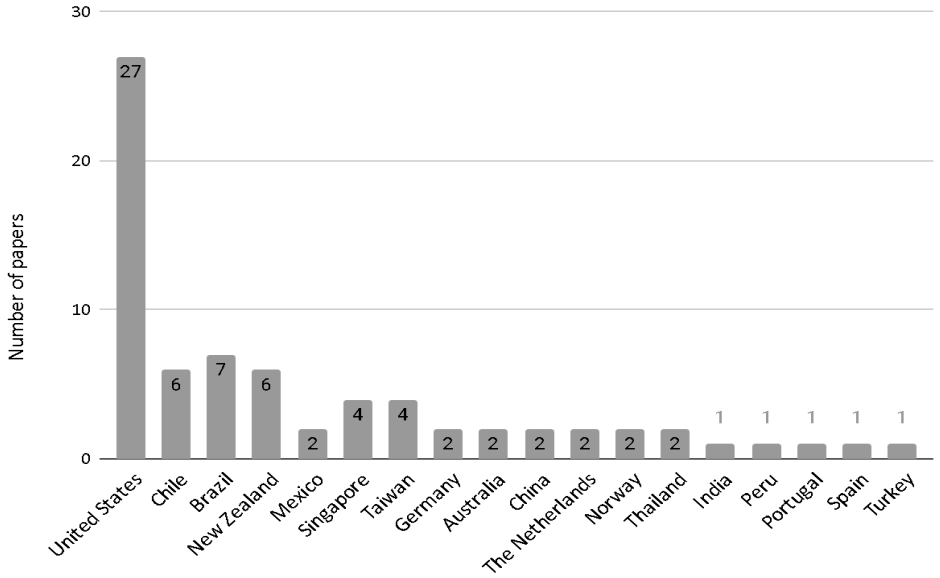


Figure 5. Country of first authors

BIBLIOMETRIC INFORMATION

RESEARCH FINDINGS 2

- **Buffering methods of deployment** are related to **buffer types** (space, capacity, information, time, inventory, and financial) based on the **type of resource** (space, workers, equipment/tools, material, information, time, and money).

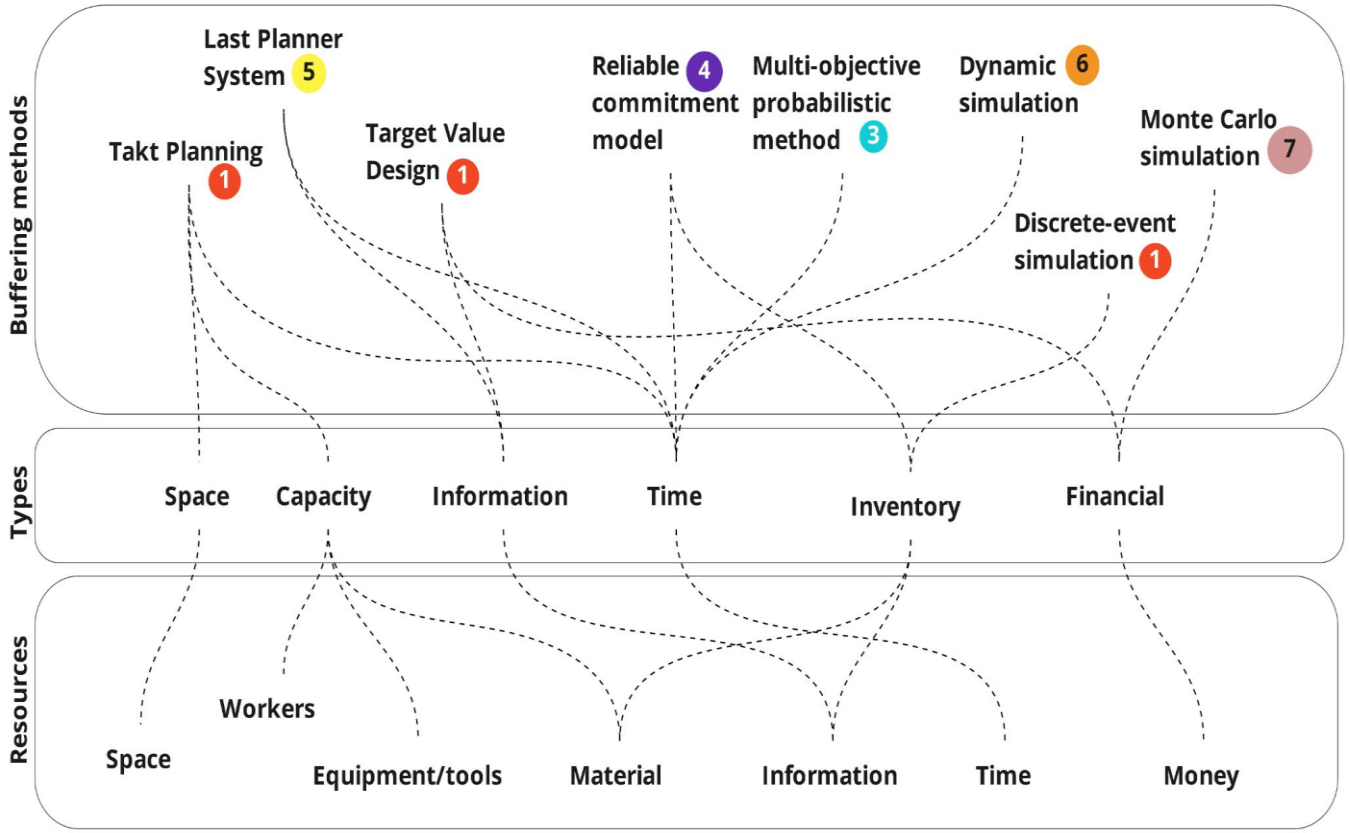


Figure 6. Buffering methods, types, and related resources

RESEARCH FINDINGS 3

Proactive methods – to anticipate possible problems and help to make decisions:

- methods focused on planning and control (Cluster 1);
- probabilistic and statistical models (Clusters 3 and 4);
- simulations (Clusters 1, 6, and 7).

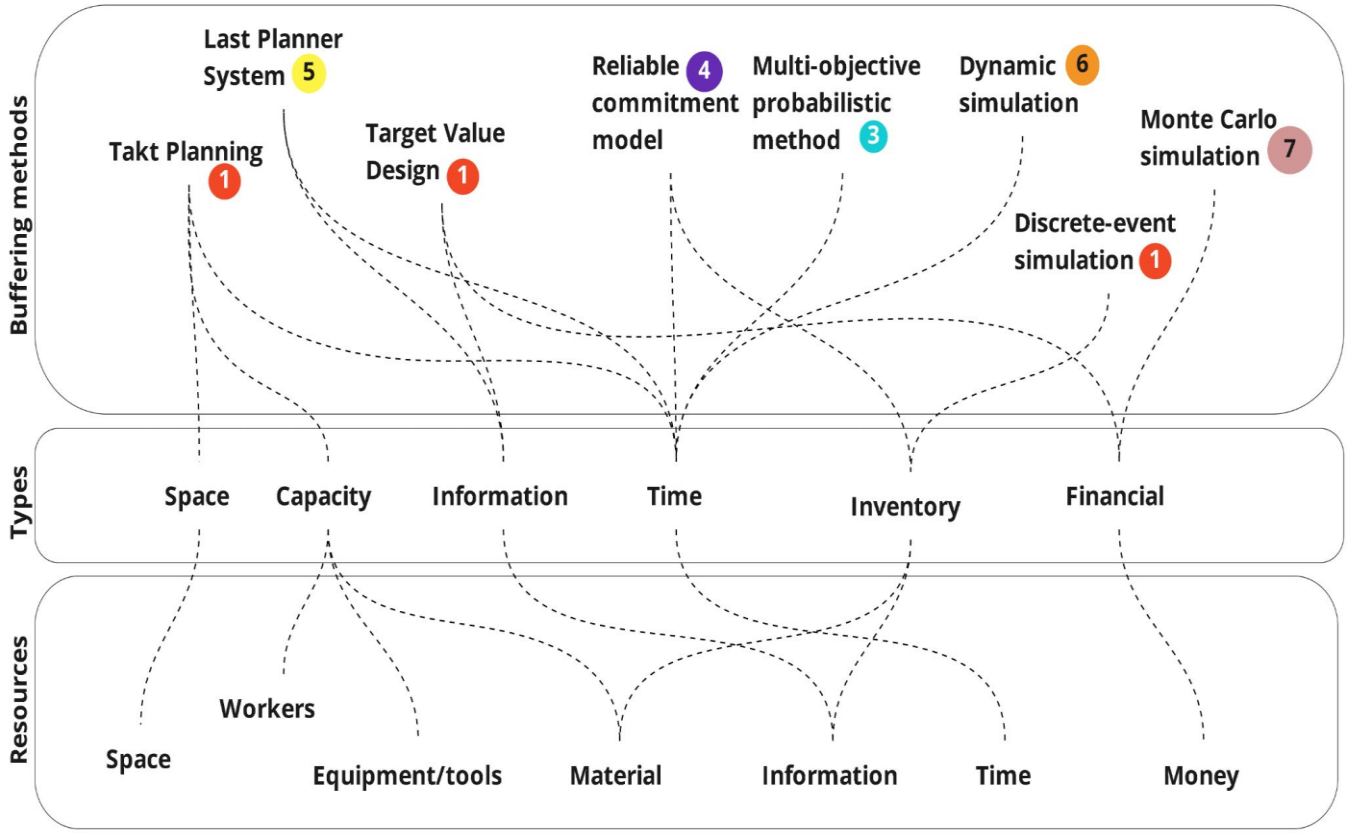


Figure 6. Buffering methods, types, and related resources

RESEARCH FINDINGS 4

Reactive methods – real-time performance analysis to determine a response based on how the results impacted the system performance (Cluster 5).

Results from production system performance analysis, if reliable and consistent, may be used to generate data and provide feedback into the system, acting as inputs for proactive methods

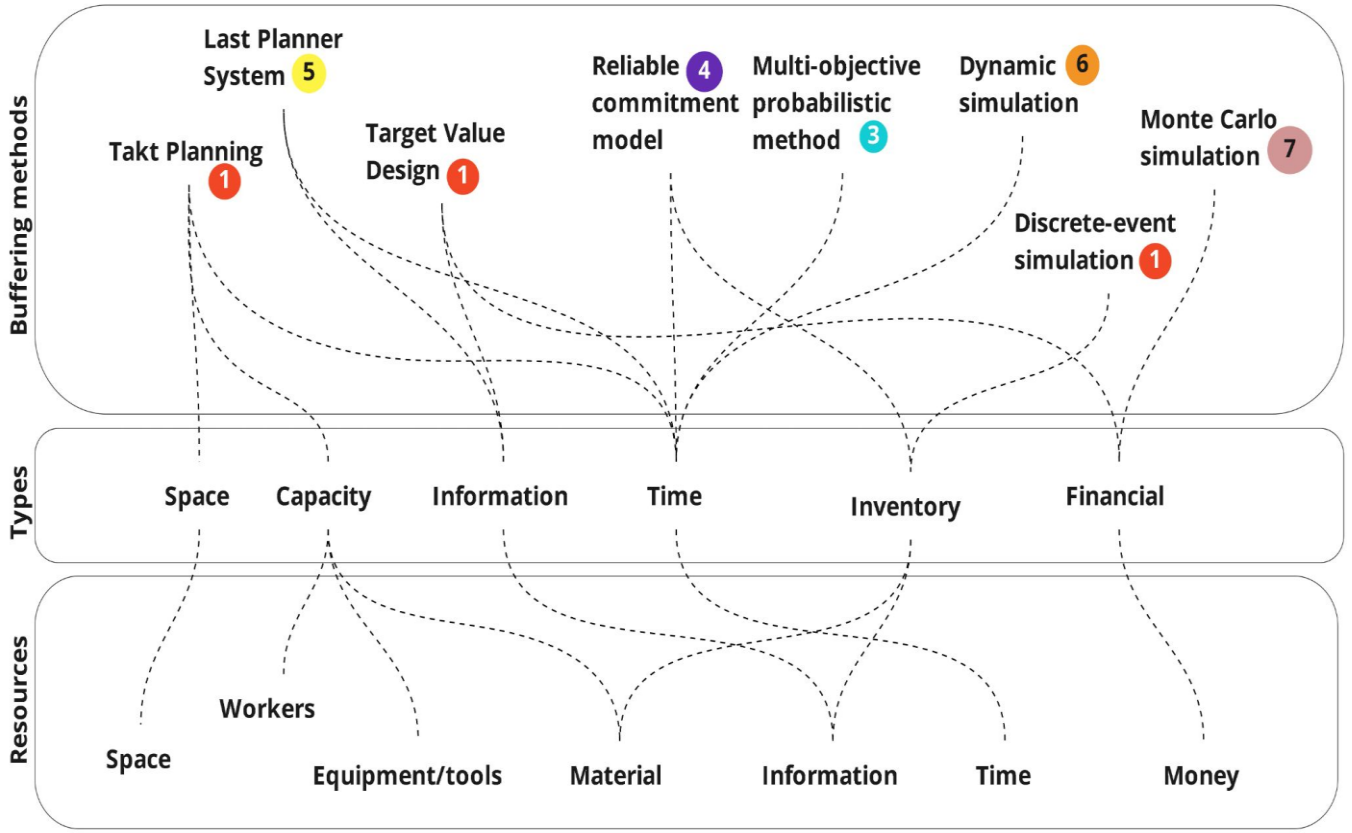


Figure 6. Buffering methods, types, and related resources

DISCUSSION

Scope for buffer allocation, following Shingo's (1989) definition:
(1) process (e.g., Takt Planning, Last Planner System)
(2) operation (e.g., underloading with capacity)

Based on the **level of the planning system** considered, buffer types will vary.
Lee et al. (2006) (Cluster 6) added time buffers to the master schedule, whereas
Alves and Tommelein (2004) (Cluster 1) added inventory buffers to the production schedule.

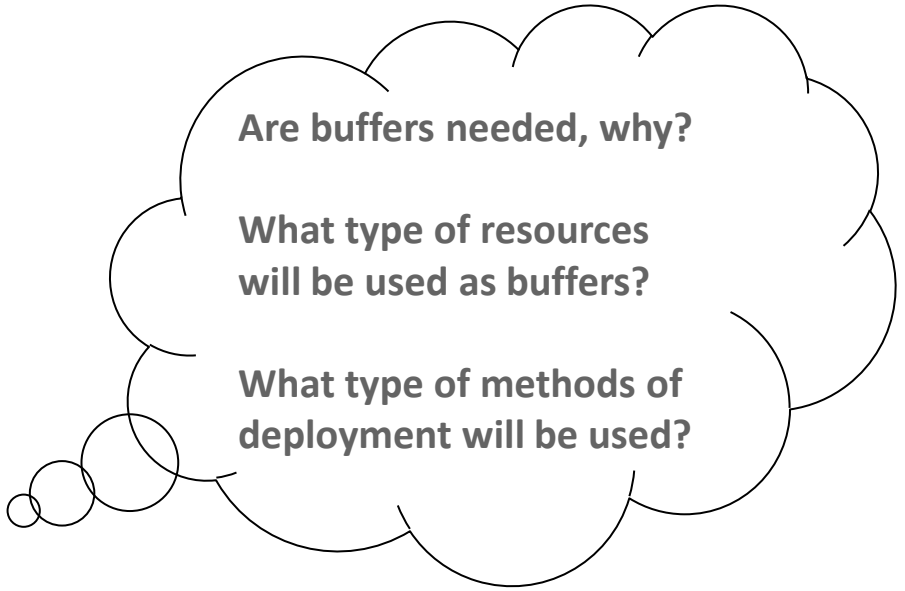
Some studies focused on a **specific type of buffer** (Clusters 3 and 4).
Others are more **wide-ranging** to allow decision-makers to choose what type of buffer they will prioritize (Cluster 2 focuses on slack).

CONCLUSION

The need for buffers is **context-dependent** and their use must be **adapted** to the nature of the system they pertain to.

A planner must **understand** the nature and functions in the system to decide where to invoke these functions' insights: in planning by adopting **proactive methods** or in **reacting to circumstances.**

If **buffers are not well-managed** they can be **wasteful instead of** being of value by serving as a **countermeasure** to the manifestation of variability. **Understanding sources of variability and removing unwanted variability** must be done before adding buffers to reduce the impact of remaining variability in production systems.



THANK YOU!

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