COMPOSITION AND IMPACT OF REASONS FOR NONCOMPLETION IN CONSTRUCTION PROJECTS

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AGENDA

- CONTEXT

- STATE OF THE ART AND PRACTICE

- SCOPE AND METHODOLOGY

- RESULTS AND DISCUSSION

- CONCLUSSIONS

CONTEXT

- Construction projects are complex endeavors prone to deviations due to uncertainty, variability and management deficiencies (Alsehaimi et al., 2014)

- 50% to 70% of projects experience cost and time deviations averaging 10% to 30% of their planned scope (Assaf, 2006; Ullah, 2017).

- Researchers have assessed 10 main sources of deviation (Arditi 1985, Assaf 2006, Prasad, 2017) which correspond to the seven flows from Lean Construction (Koskela, 2008)

Main cited reasons:

- Design

- Inexperience
- Subcontractor compliance
- Communication

- Lack of Resources

- Equipment

- Planning
- Labour Productivity

- Interference

- Financing

Seven flows:

- Information

- People

- Materials

- Equipment

- Prior Work

- Space

- External Conditions

STATE OF THE ART

The **Last Planner System** proposes systematic short cycles of planning and control that allow to stablish and trace **commitments**, measure workflow reliability and finding actionable **Reasons of Noncompletion**

Research has shown its potential to **assess and improve performance** during execution (Kim, 2019; Lagos et al., 2019)
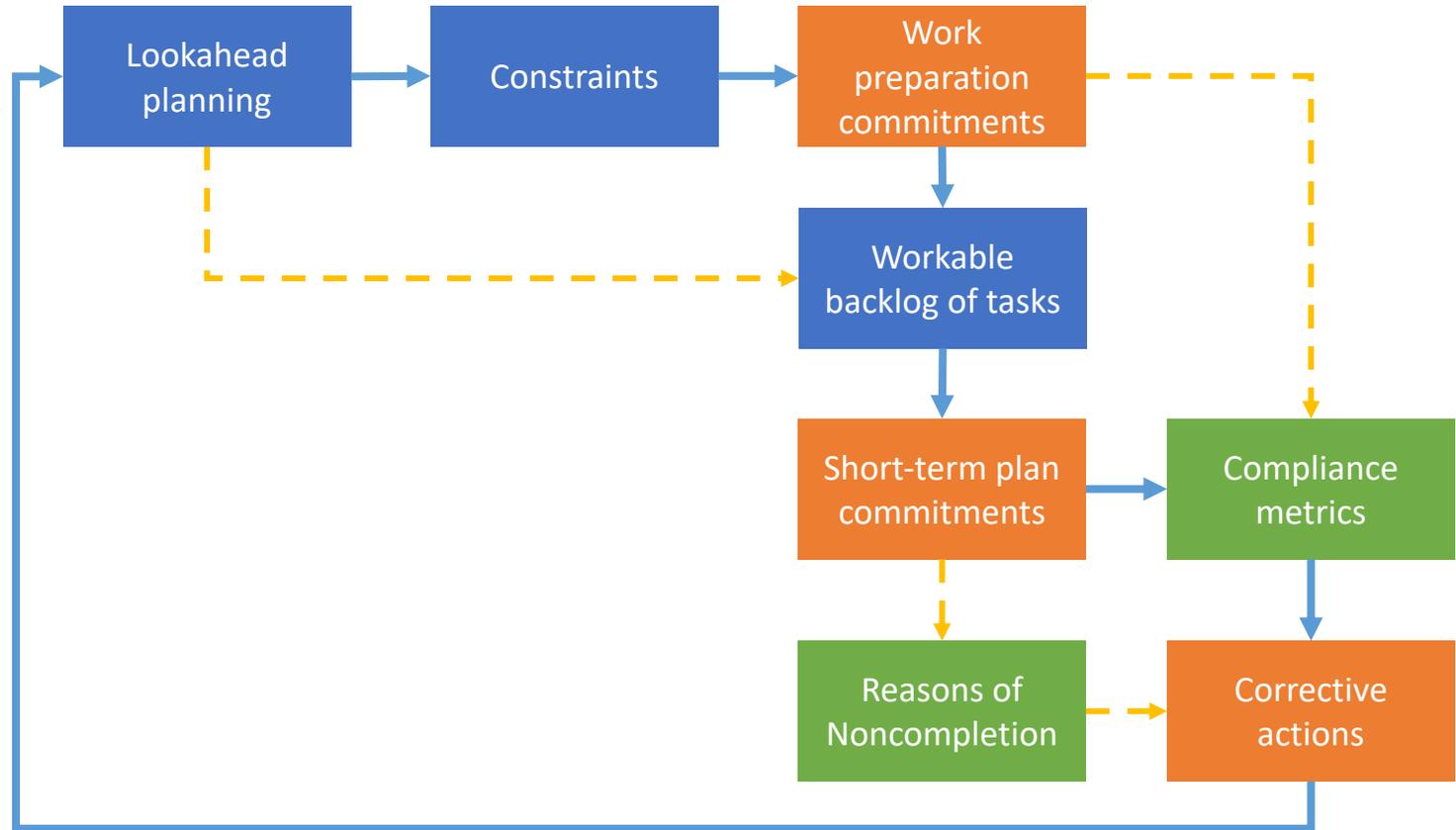

Figure 1. LPS Planning and control cycle

STATE OF THE ART

Quantitative and qualitative LPS research:

- Implementation impacts on workflow reliability, productivity and time reduction (Daniel et al., 2015)

- Correlation between adoption, performance and outcome (Daniel et al; 2015; Lagos et al., 2019)

- Significant differences which allow to assess expected outcome based on LPS information (Kim, 2019; Lagos et al., 2020)

Current limitations of LPS research:

- Lack of large study samples with comparable data (Hamzeh et al., 2019)

- Partial adoptions focused on short-term (Dave, 2015)

- Lack of quantitative transversal studies (Hamzeh, 2015)

Oportunity:

- Quantitative and qualitative assessment of LPS information gathered through use of IT support tools (Lagos et al., 2020)

STATE OF PRACTICE

Adoption levels:

- Focus on short-term compliance instead of stabilizing workflow through work preparation

- Lack of use of historical data to implement better corrective actions

- Lack of understanding of the value of **Constraint** and **Reasons of Noncompletion** information

- Lack of adoption of new process-oriented metrics, besides de Percent Plan Complete

(Daniel et al., 2015; Dave et al., 2015)

Information Technologies opportunities:

- LPS based support software

- Increasing standardized databases

- Data Science and Machine Learning Techniques

- Quantitative use of qualitative data

(Hamzeh et al., 2019; Kim, 2019; Lagos et al., 2020)

RESEARCH SCOPE

Combining qualitative and quantitative approaches over standardized empirical project information to assess the composition, frequency and impact of project RNCs
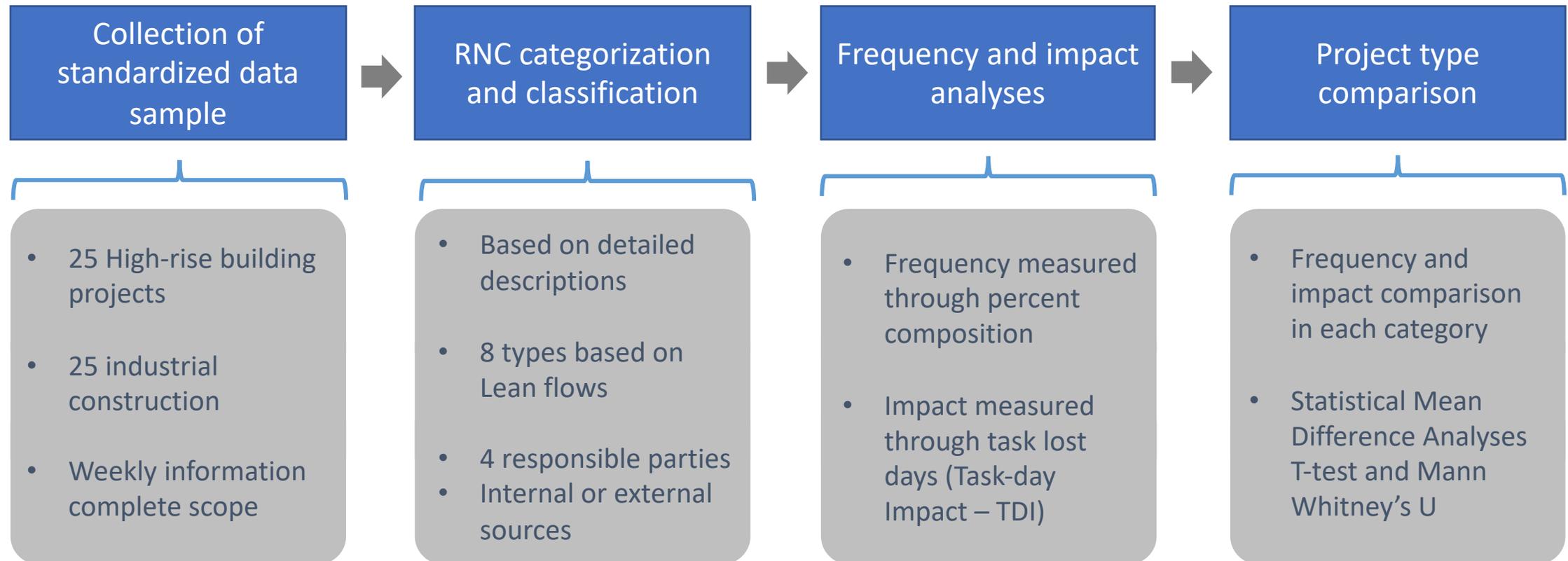
Obtaining **empirical insight** for **better corrective** and **preventive** LPS **actions**

AIM: Determining the main types, sources and responsible parties of project RNCs

Research questions:
- Which are the most relevant types of RNCs?
- What is the impact of project parties on RNCs?
- What percent could be prevented by the team through LPS use?

METHODOLOGY

| Collection of standardized data sample | → | RNC categorization and classification | → | Frequency and impact analyses | → | Project type comparison |

Collection of standardized data sample
- 25 High-rise building projects
- 25 industrial construction
- Weekly information complete scope

RNC categorization and classification
- Based on detailed descriptions
- 8 types based on Lean flows
- 4 responsible parties
- Internal or external sources

Frequency and impact analyses
- Frequency measured through percent composition
- Impact measured through task lost days (Task-day Impact – TDI)

Project type comparison
- Frequency and impact comparison in each category
- Statistical Mean Difference Analyses T-test and Mann Whitney's U

Figure 2. Research stages and methodology

RESULTS AND DISCUSSION

Frequency and impact presented a correlation of $R^2 = 0,98$, hence most results will be presented using the Relative Impact Index (RII) based on Task-days lost.
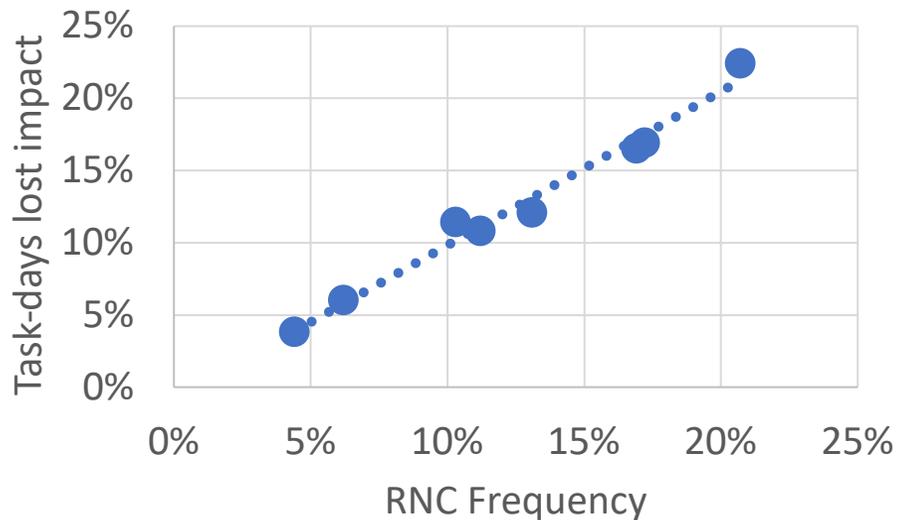

Figure 3. Frequency and impact correlation
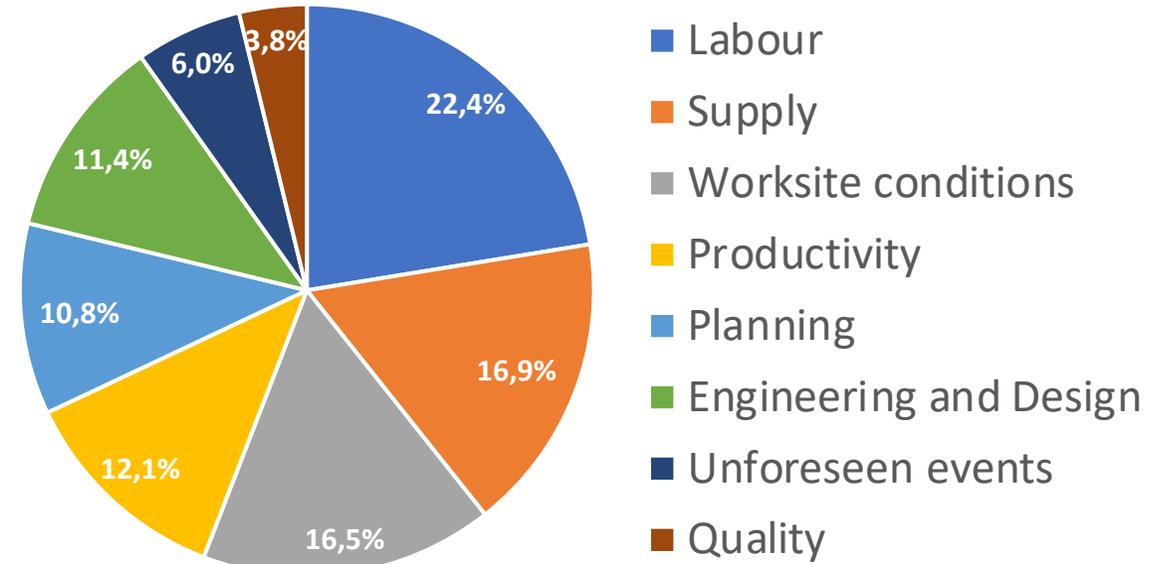
Figure 4. RNC composition by type across 50 projects

Labour, productivity, planning, quality and worksite conditions, (**i.e. controllable issues**) represent **66%** of issues according to the impact analysis
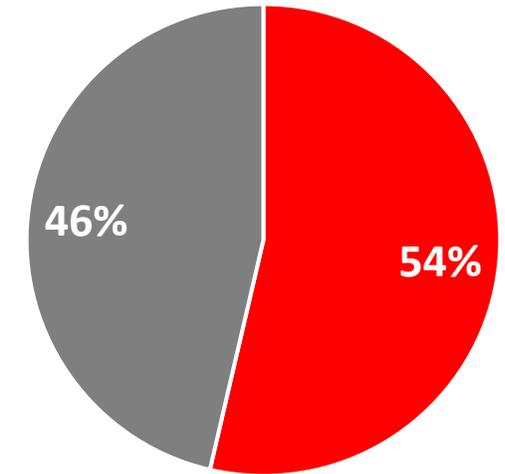
RESULTS AND DISCUSSION

RNC SOURCE ANALYSES:

- **Internal issues:** Problems that could be directly **controlled by the Main Contractor's direct team**

- **External issues:** Uncontrollable matters or subjects controllable by third-parties.

48% **52%**
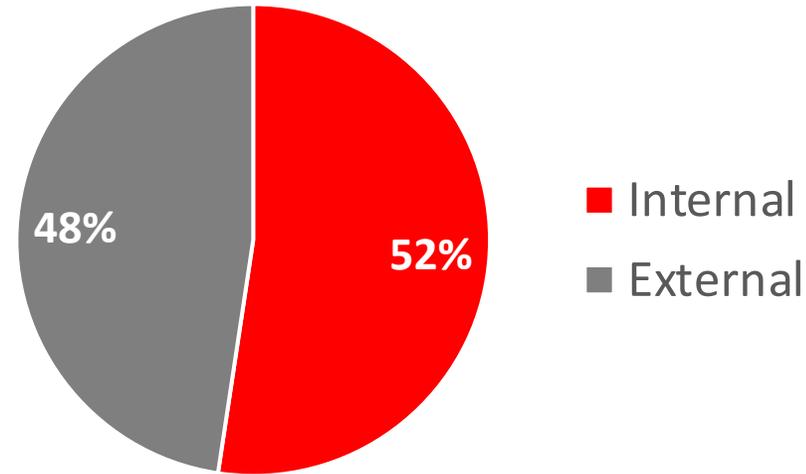
■ Internal

■ External

Figure 4. Internal to external RNC impact in **HR projects**

46% **54%**

Figure 5. Internal to external RNC impact in **IC projects**

The differences were not statistically significant in either of the project categories, although, results showed that at least **half of the issues' impact could have been prevented by the Main Contractor.**

RESULTS AND DISCUSSION
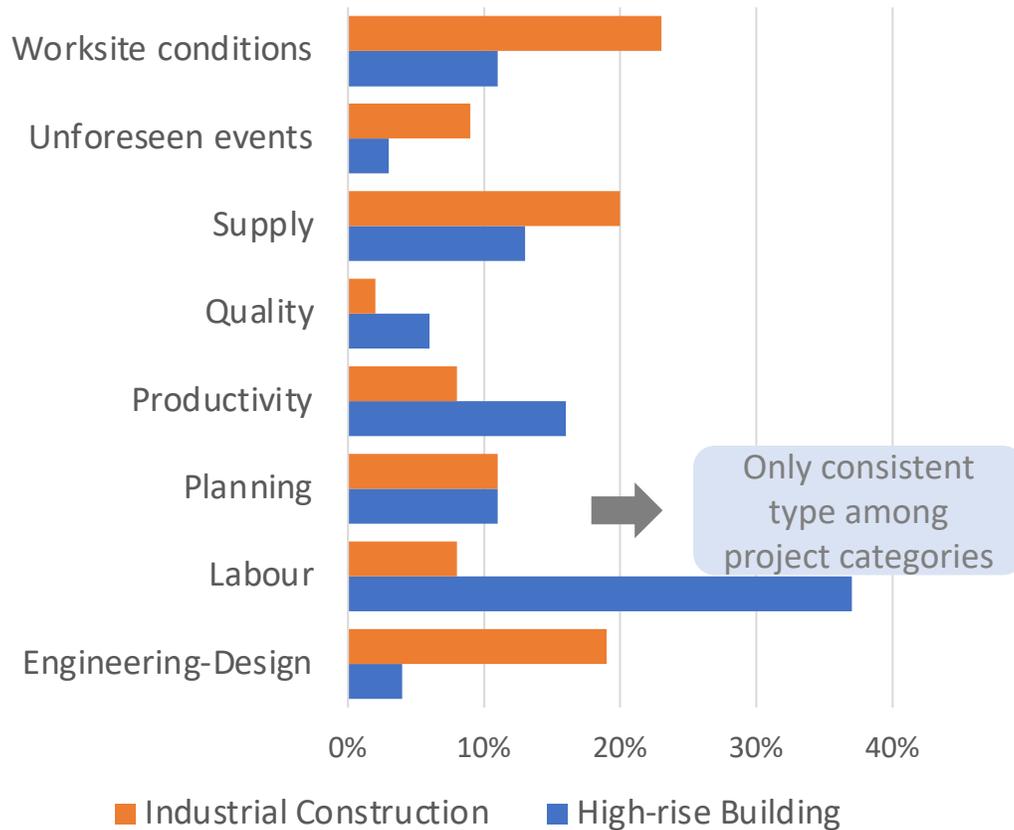
Figure 3. RNC Impact comparison by type between project categories

RNC TYPE COMPOSITION:

- Worksite conditions, supply and engineering-design caused 62% of impact in **Industrial Construction** projects

- Labour, productivity and supply caused 66% of impact in **High-rise Building** projects

- Labour, productivity, planning, quality and worksite conditions (i.e. **controllable issues**) represented **81%** impact in **High-rise Building** and **52%** in **Industrial Construction**
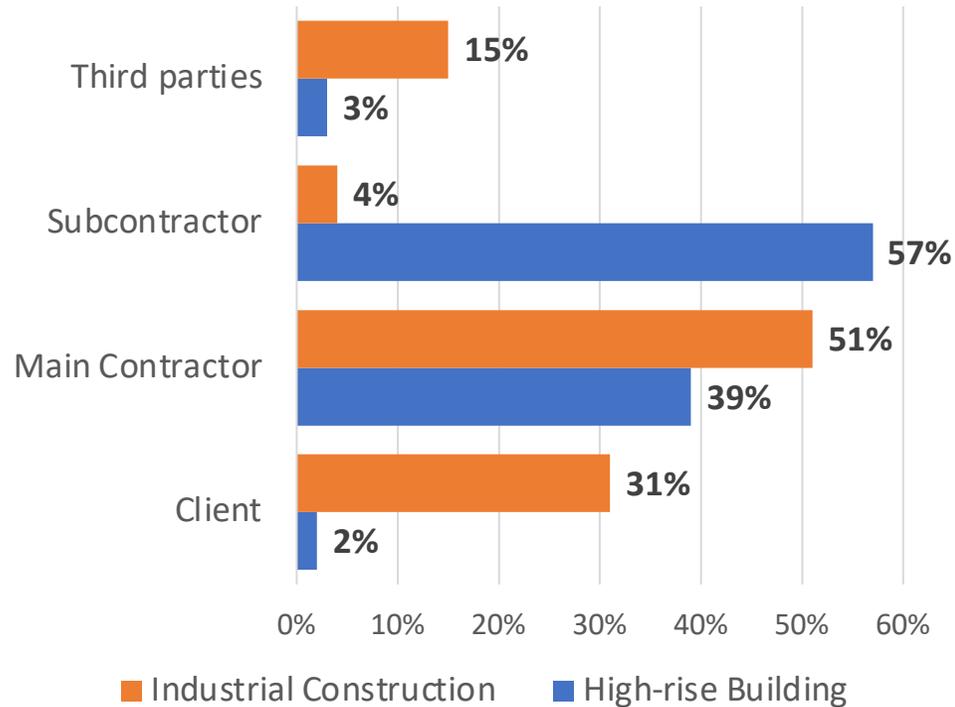
RESULTS AND DISCUSSION

Figure 3. RNC Impact comparison by party between project categories

RNC RESPONSIBLE PARTY COMPOSITION:

- The client was **15 times** more relevant in **Industrial Construction** than in **High-rise Building** acording to the impact results.

- In opposite, the subcontractor was **14 times** more relevant in **High-rise Building** than in **Industrial Construction**

- **96%** and **55%** of Task-days Lost (impact) could have been **prevented** by ensuring effective work **collaboration** through LPS **between** the **Main Contractor** and **Subcontractors** in **High-rise Building** and **Industrial Construction**, respectively.

CONCLUSIONS

Internally controllable issues such as productivity, quality and planning account for **66% of RNC impact**

Detailed RNC source analyses showed that at least **half** of the Task-days Lost **could have been prevented** by the **Main Contractor** in HR and IC projects

Close and effective **collaboration** between the **Main Contractor** and **Subcontractors** could help prevent up to **55%** and **96%** RNC **impact in IC and HR** respectively.

THANK YOU!

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