USING PERCENT PLAN COMPLETED FOR EARLY SUCCESS ASSESSMENT IN THE LAST PLANNER SYSTEM®

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Introduction

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Traditional management:

- Focused solely on transformation
- Result oriented control
- Planning in detail with extensive use of slack

Koskela et al., 2002

Limitations:

- Deviations are only detected after the fact
- Use of slack can hide deviations
- Aggregated indicators conceal variability
- Traditional methods fail to detect and prevent early signs of deviation

Sarhan and Fox, 2012; Alarcón et al., 2014

The Last Planner System ®

- Over 27 years of experience in several countries
- Focus on processes of work preparation and managing short-term commitments
- Well documented impacts of project performance and work stabilization
- Several metrics to trace work-preparation, short-term compliance and recurrent problems
- Connects short, mid and long-term scopes of planning and control
- Correlations found between management practices, LPS metrics and project KPI

Ballard and Tommelein, 2016; Castillo et al., 2018

Our aim and scope of research

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- How can quantitative LPS indicators such as Percent Plan Complete (PPC) can be used to assess project performance?

We will try to:

- Classify projects using quantitative outcome indicators
- Determine significant differences in quantitative LPS information
- Identify which differences manifest at early stages

Hypotheses:

1. PPC is significantly higher in successful projects across project execution
2. Successful projects have a significantly lower number of Reasons for Non-Compliances per short-term period.

Scope:

- 25 Chilean projects using technological LPS support system
- Standardized weekly information (PPC, progress, constraints, RNC) normalized into 10 progress intervals
- Projects were classified into sucess and failure groups using clustering algorithms

Methodology of research

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Stage 1: Literature review:

- Quantitative research and metrics
- Relationships LPS indicators and project KPI
- Relationships LPS metrics and project outcome

Stage 2: Collection of information:

- Data collection and filtering
- Result and process indicators
- Standardization and normalization

Stage 3: Project clustering:

- Construction of outcome metrics
- Clustering analysis
- Validation

Stage 4: Aggregated data analysis:

- Correlation analysis
- Statistical differences

Stage 5: Progress interval analysis:

- Representative progress curves
- Statistical differences of Means

Data sample:

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Base:

48 high-rise building projects using the same IT support system

Filters:

- Start prior to 20% progress
- Control until +99% planned progress
- Weekly LPS information from at least 80% of execution scope
- Projects that did not follow systematic LPS planning and control process were removed
- 25 projects were obtained

Result Indicators:

- Schedule Performance Index (SPI) at planned completion
- Schedule Deviation (SD) at project end

Aggregated LPS Indicators:

- Mean and Standard Deviation for PPC and PCR
- Total number of RNC and RNC per week (normalized per number of tasks)

Evolution indicators: 10% progress intervals:

- Accumulated and interval PPC average
- Accumulated and interval PPC standard deviation

Correlation analyses results:

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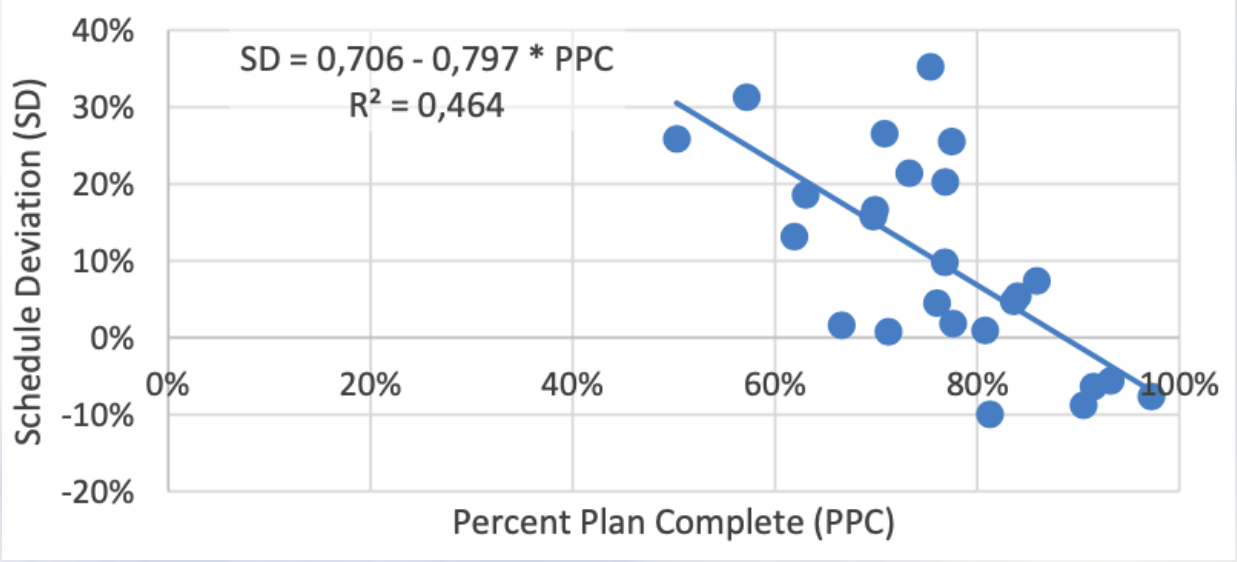
We tested correlations between:

- final SPI and SD
- PPC Mean
- PPC Standard Deviation
- Total number of RNC
- Number of RNC per week

Correlation coefficient r	SPI	SD
PPC Average	**0.58**	**0.68**
PPC Std. Deviation	0.24	0.5
Total RNC	**0.55**	0.5
RNC per week	**0.57**	0.49

- A greater PPC leads to lower expected project deviation.
- Each 10% increment in PPC reduces SD by 8%.



Performance clustering

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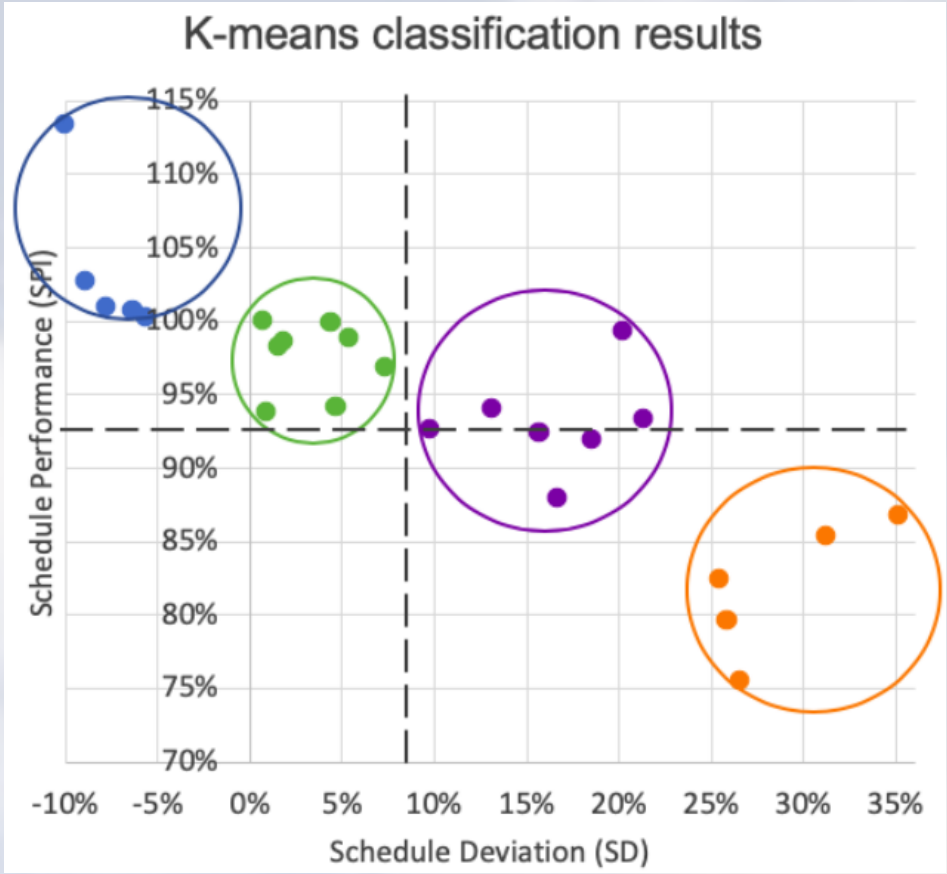
We used a recursive algorithm based on K-means, using the project SPI and SD as parameters.

- It minimizes the distance from each project to its cluster
- It maximizes the distance between cluster centers

We selected 4 clusters based on the algorithms results.

Classification rules represent the separation between the two center clusters

- Success rule: SPI ≥ 94% and SD < 8%



Aggregated indicators results:

- We used the averages in each group to perform the analysis of differences
- We used the Mann Whitney's U test to identify Mean differences

	Sucessful	Non-successful	Relative difference
Sample	13 projects	12 projects	
PPC Average	83%	68.5%	+21%
PPC Std. Deviation	10.9%	14.9%	-27%
Total RNC	478	1056	-55%
RNC per week	8.7	16.3	-47%

- All differences were significant at a 95% confidence level ($p<0.05$)

Interval indicators results:

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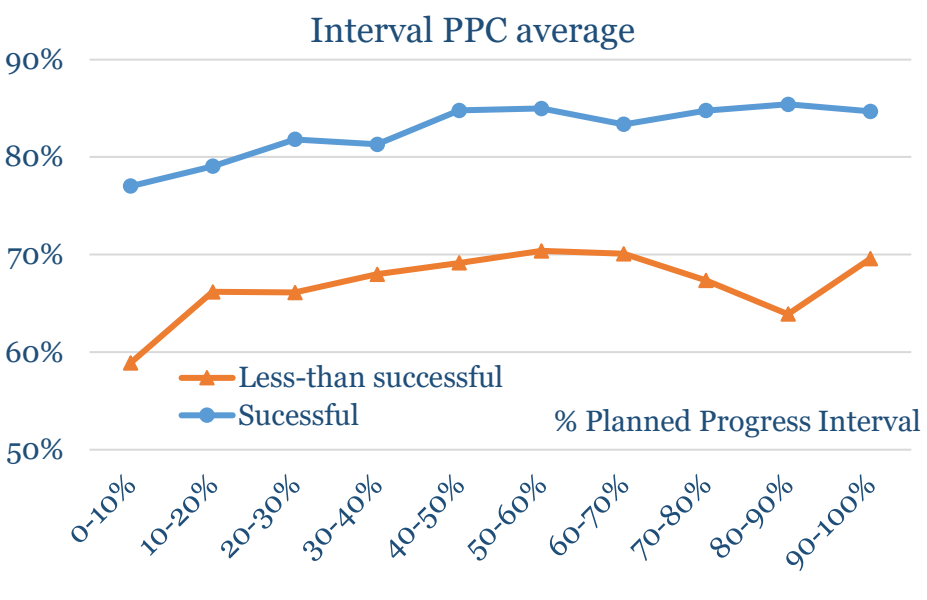
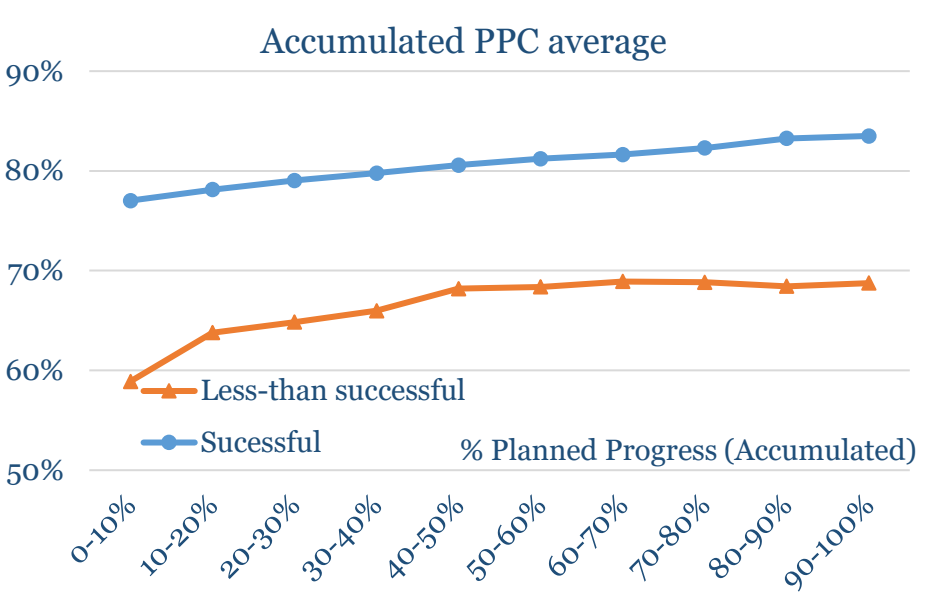
- We used the averages in each group to construct representative curves
- We used the Mann Whitney's U test to identify Mean differences





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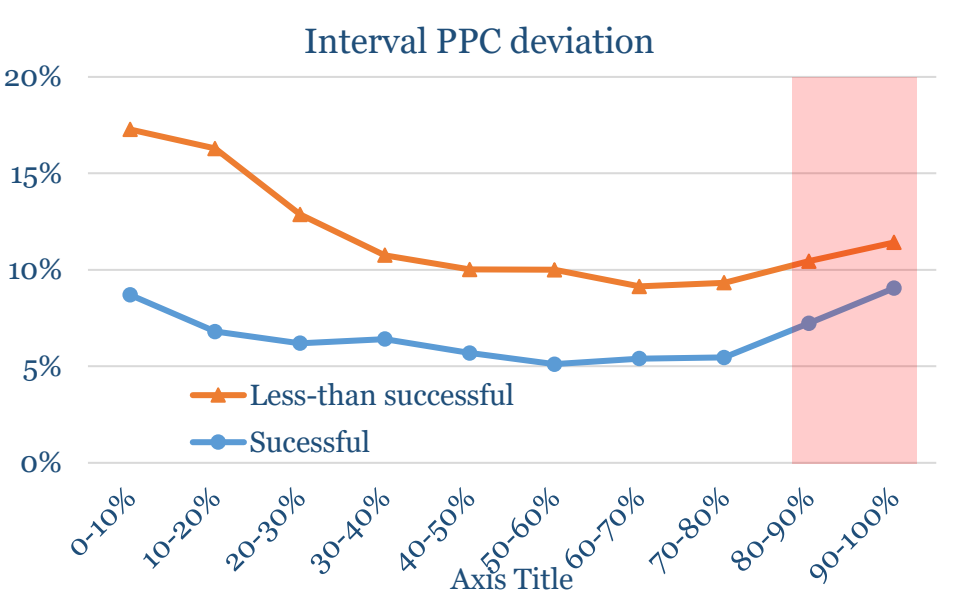

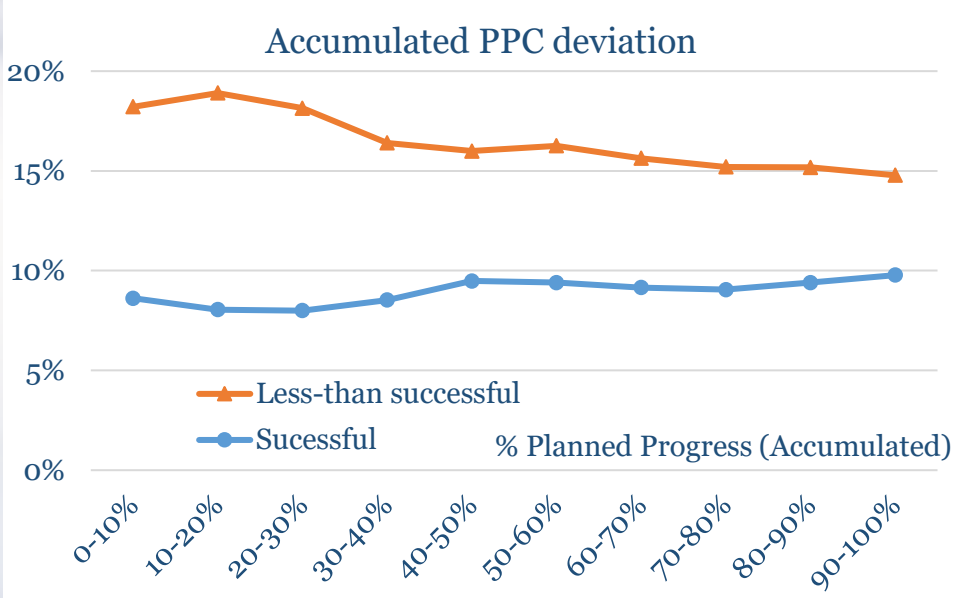

- All differences were significant at a 95% confidence level except PPC interval >80%

Conclusions

- Correlation between LPS metrics and project performance
- Projects with higher PPC had better results
- Successful projects present a stable increase in PPC throughout execution

- Opportunities:
  - LPS metrics can be used to assess expected performance at early stages
  - Data Science tools like Machine Learning can be used to develop success rules
- Needs:
  - More quantitative research with larger samples
- Limitations:
  - Small sample (25%) projects, using one IT support system and result classification is based on schedule performance