

# Waterfall-Agile challenges in software development projects

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## **Problem and Methodology**

Time and cost overruns remain all too common in the software industry, with specialized reports indicating that over two-thirds of software projects experience delays and budgetary overruns<sup>1</sup>. Project management holds immense potential for improvement, offering the prospect of significant cost savings in an industry that is predicted to surpass 1 trillion US Dollars in 2024.

Hybrid Agile project management methodologies has witnessed a surge in adoption over the past decade in software development (Křivánková and Remta, 2023). The Hybrid methodologies try to benefit from Agile's approach emphasizing an iterative, incremental, and adaptable approach, with feedback and validation throughout the project's lifecycle (Sarangee et al., 2022), while at the same time befitting from the safety of commitments regarding a scope, a project plan, and a cost from waterfall methodology. Waterfall-Agile inherits Agile's focus on customer involvement (Beck et al., 2001), engaging customers as active participants in the development cycle. Customers provide valuable business insights, test the software, and offer continuous feedback, validation, and guidance (Glaiel, Moulton and Madnick, 2014). This continuous interaction fosters the accumulation of relational capital, a valuable asset that marketing research defines as the network of personal relationships individuals develop with others over time (Cummings and Dennis, 2018). These relationships form an essential foundation for the success of Agile software development projects.

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<sup>1</sup> Ex: [Essential Software Project Failure Statistics in 2023 • ZipDo](#); [Project Management Statistics 2023: New Trends | TeamStage](#)

These relationships can evolve to good and close relationships (Aisyah, Sukoco and Anshori, 2019) influencing the behaviors and expectations of the team members (Villena, Revilla and Choi, 2011; Chan, Yim and Lam, 2010). These close relationships are known to generate positive experiences but can also generate negative experiences when they evolve into “cozy relationships” referring to close, often too familiar, and potentially inappropriate relationships between two or more individuals or entities (Villena, Choi and Revilla, 2020; Anderson and Jap, 2005).

Despite its central role in software development, relational capital remains an under-researched aspect of project success. The present research aims to fill this gap by conducting an in-depth investigation of relational capital development Waterfall-Agile projects, analyzing its impact on project outcomes, and exploring effective strategies for its management to improve projects’ results. The study employed a multi-method approach to test the theoretical framework. Project data from various project sizes enhanced the model's real-world applicability. Finally, building upon the theoretical framework, qualitative data, decision rules, and project data, a system dynamics simulation model was developed, allowing us to simulate project scenarios, evaluate management strategies, and identify performance improvement strategies.

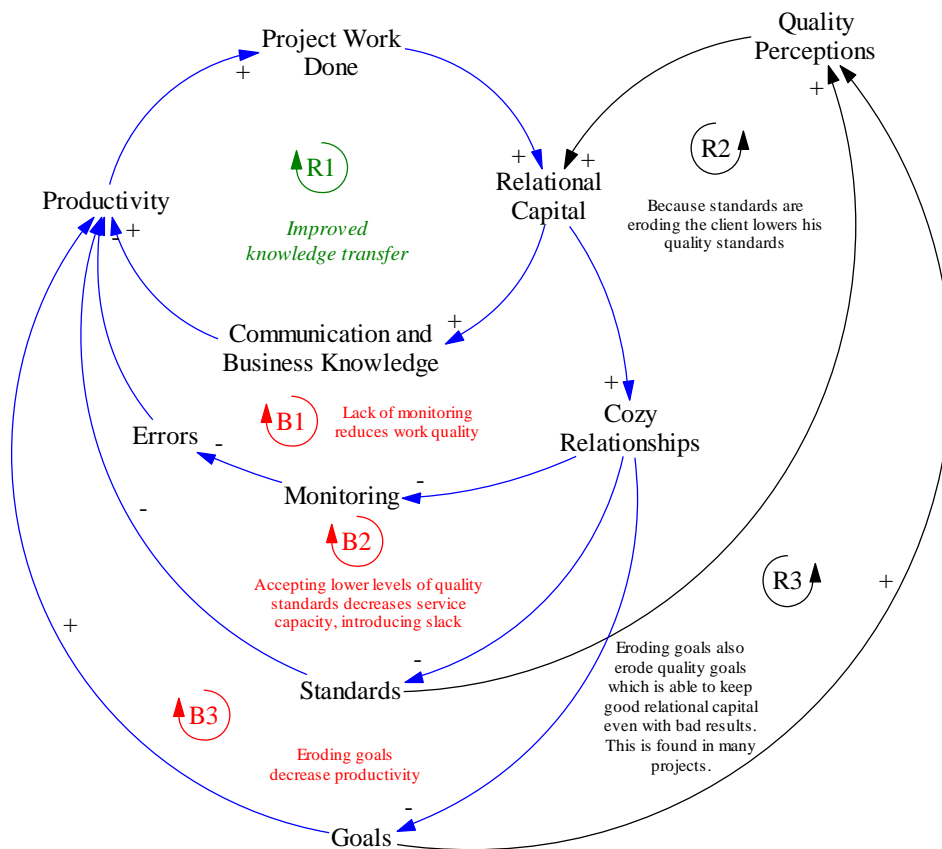


Figure 1 – Theoretical framework. Combination of Positive and negative effects of relational capital

## Results

Our results complement the traditional project responses using schedules, work intensity, overtime, and staff and enabled us to extract some strategic lessons:

- Operating near full capacity may hinder the organization's ability to grow. If an organization is working with all productive resources allocated to projects, every time the organization wins a new project it will need to relocate staff from one project to another, which takes time and can result in two projects understaffed.
- Experienced staff are crucial for software development projects. Their higher productivity and lower error rates compared to rookies necessitate a well-balanced staffing approach.
- Setting clear benchmark goals for service capacity, errors, and deadlines is crucial to prevent project decline.
- Monitoring systems need to evolve, integrating continuous comparisons between planned and actual values for service capacity, errors, and schedule.
- Enhanced monitoring systems should be complemented by policies that prevent "cozy relationships", fostering objectivity and higher levels of control and segregation. These policies can include:
  - External quality audits: Independent assessments of project quality.
  - External project management support: Utilizing outside expertise for project planning and control.
  - Matrix organizations: Establishing dedicated teams for development and quality assurance.
- Soft variables like relational capital offer significant potential for project improvement. While it fosters communication and knowledge transfer, unchecked relational capital can lead to detrimental "cozy relationships." Implementing policies like process standardization can ensure productivity gains even with moderate relational capital growth, mitigating the risks associated with "cozy relationships." Using positive relational capital to negotiate new project deadlines can benefit the project by lowering the pressure that leads to errors and consequently more pressure. However, this must be complemented with benchmarks to avoid its overuse and sliding into the spiral of eroding goals.

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