

A STRUCTURED FRAMEWORK FOR SELECTING AND PRIORITIZING ROBOTIC PROCESS AUTOMATION PROJECTS

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ABSTRACT

Organizations increasingly adopt Robotic Process Automation (RPA) to enhance operational efficiency; however, many initiatives fail due to misaligned strategic priorities, insufficient understanding of process characteristics, and lack of structured prioritization methods. This paper introduces INSIGHT-RPA, a practical framework that integrates the Balanced Scorecard (BSC), Process Mining (PM), and Multi-Criteria Decision Making (MCDM) to guide the structured selection of automation opportunities. A proof of concept was conducted in a Brazilian university undergoing digital transformation. Using real operational data and applying the FITradeoff method under budget constraints, the framework supported transparent and objective prioritization of RPA projects. Results highlight the framework's potential to optimize decision-making, ensure alignment between automation and strategic goals, and enhance the overall effectiveness of RPA implementation.

KEYWORDS. Robotic Process Automation; Process Mining; Multi-Criteria Decision Making.

Paper topics (SE-FITradeoff)

1. Introduction

In the era of Digital Transformation (DT), organizations increasingly leverage technologies such as Big Data, Cloud Computing, Internet of Things (IoT), Artificial Intelligence (AI), and Robotic Process Automation (RPA) to boost operational efficiency. Recent studies indicate that, as digital transformation advances, RPA has evolved through the integration of AI, Machine Learning (ML), and Natural Language Processing (NLP), expanding its role beyond simple task automation and fostering intelligent initiatives [Bhardwaj, 2023].

Despite advances in AI and analytics enhancing RPA technologies, many automation initiatives still encounter substantial barriers. According to KPMG, the primary reasons for failure include a lack of clear strategic direction, fragmented end-to-end process visibility, weak governance structures, unrealistic expectations, and an insufficiently embedded digital culture within organizations [KPMG, 2024].

To overcome these challenges, an integrated approach is required, one that connects strategic alignment, process analysis, and structured decision-making. The BSC supports alignment with organizational goals [Kaplan & Norton, 1996]; PM offers data-driven insights into real process execution [van der Aalst et al., 2012]; and MCDM provides a systematic framework for evaluating and prioritizing alternatives [Belton & Stewart, 2002].

This study proposes a unified framework combining BSC, PM, and MCDM to improve the prioritization of RPA projects by ensuring strategic relevance, operational feasibility, and efficient resource use. The remainder of this paper is structured as follows: Section 2 presents the methodological approach; Section 3 describes the case study; and Section 4 discusses the results.

2. Methodological Approach

This study adopts the INSIGHT-RPA framework, a structured methodology for identifying and prioritizing automation opportunities in a strategic and data-driven manner. The framework integrates three key components: BSC, PM, and MCDM (see Figure 1).



Figure 1 - INSIGHT-RPA

INSIGHT-RPA unfolds across four structured phases. Phase I involves the registration of automation proposals, followed by an initial evaluation of strategic alignment using the BSC [Kaplan & Norton, 1996] and a simplified process maturity assessment inspired by CMMI levels [CMMI Institute, 2010]. Phase II selects proposals that demonstrate high strategic relevance and sufficient maturity for further analysis. In Phase III, real event logs are analyzed [van der Aalst et al., 2012], offering an objective view of process behavior. Phase IV applies the FITradeoff method [de Almeida et al., 2016; Frej et al., 2019], a flexible MCDM approach designed to support decision-making under partial preference information, combining qualitative and quantitative data while minimizing cognitive overload during the elicitation process. In this study, a specific portfolio selection variant of the method is employed [Frej et al., 2021], which addresses resource-constrained decision problems by selecting a subset of alternatives based on their Benefit-to-Cost Ratio (BCR). Given that the INSIGHT-RPA framework involves considerable effort in data collection and analysis across multiple dimensions, adopting a method capable of producing not only a ranking but also a feasible project portfolio within budgetary limits proved especially advantageous to maximizing the value of the effort invested.

3. Case Study

The INSIGHT-RPA framework was applied in a Brazilian private university undergoing DT to enhance operational efficiency and service delivery. In Phase I, a pilot project collected ten automation proposals submitted by various departments. Participants completed structured forms covering process description, strategic alignment (BSC), and process maturity. All inputs were centralized in a digital repository to ensure traceability and enable structured analysis.

In Phase II, the proposals were evaluated across two key dimensions: strategic relevance and process maturity. Strategic alignment was measured through a standardized questionnaire aligned with the four BSC perspectives, while maturity was assessed using a five-level scale. Six proposals demonstrated high alignment and sufficient maturity and were selected for further evaluation. The remaining four were excluded from the next steps due to lower scores in both dimensions, and their sponsors received feedback along with suggested next actions.

Phase III applied Process Mining (PM) methods to evaluate the six shortlisted initiatives. Event logs were extracted with mandatory fields such as Activity, Case ID, Timestamp, and Resource. Initiatives were assessed across five criteria: process complexity, data structure, digitalization, execution frequency, and rule-based behavior. Each criterion was scored on a five-point scale to support a structured, data-driven prioritization.

Finally, Phase IV focused on selecting the most valuable set of automation initiatives under a fixed budget. This step was supported by the FITradeoff method, part of the MCDM family designed to handle partial preference information and reduce cognitive effort in elicitation [Frej et al., 2019]. Adopting a benefit-to-cost portfolio perspective enabled the identification of a subset of projects that maximized strategic value within resource constraints [Frej et al., 2021].

The method produced both a ranking of the alternatives and a portfolio of RPA projects built based on such ranking, considering the available budget constraints. The decision relied on structured information consolidated in previous phases and on estimated implementation costs. The decision-maker was the university's Digital Transformation Manager, selected for his technical expertise and strategic insight regarding automation priorities.

The objective was to compose a project portfolio within a fixed budget limited to R\$150.000,00, characterizing a classical portfolio selection problem. The three evaluation criteria: **Strategic** Alignment, Process **Maturity**, and Process **Mining** Score are summarized in Table 1 and reflect multi-dimensional assessments from earlier phases.

Criterion	Description	Objective	Scale	Levels
Strategic	Degree to which the initiative supports the organization's strategic objectives	Maximization	Discrete	5
Process	Level of standardization, control, and readiness of the process for automation	Maximization	Discrete	5
Mining	Technical feasibility based on event log analysis	Maximization	Discrete	5

Table 1 – Criteria information

To operationalize the decision, the Benefit-to-Cost portfolio module available at www.fitradeoff.org was used. Six alternatives and three evaluation criteria were entered into the platform, along with their performance scores and estimated costs (see Table 2).

Alternative	Alternative Name	Strategic (C1)	Process (C2)	Mining (C3)	Cost (R\$)
Alt 1	RPAPJ1	5	5	5	25000
Alt 2	RPAPJ2	4	4	3	35000
Alt 3	RPAPJ3	3	3	2	22000
Alt 4	RPAPJ4	5	4	4	35000
Alt 5	RPAPJ5	3	2	2	45000
Alt 6	RPAPJ6	4	3	3	75000

Table 2 – Consequence Matrix

Consequences were entered using structured data consolidated from earlier phases. All criteria were represented on a normalized ordinal scale from 1 to 5. While Strategic Alignment and Process Maturity were based on direct assessments, the Process Mining Score resulted from the aggregation of technical feasibility sub-criteria.

For intra-criterion evaluation, a linear value function was adopted for all criteria. This decision assumed that the impact of moving between adjacent performance levels is perceived as constant by the decision-maker, ensuring simplicity and consistency in value assignment.

The next step involved pairwise comparison of criteria, resulting in the following order of importance: Strategic > Maturity > Mining. This reflects the organization's emphasis on aligning automation with strategic objectives before considering readiness and technical feasibility. With all inputs defined, the method was executed to produce the final recommendation.

4 Results and Discussion

The updated application of the FITradeoff method resulted in a recommended portfolio composed of four RPA projects: RPAPJ1, RPAPJ4, RPAPJ3, and RPAPJ2. These initiatives collectively utilize R\$117k of the R\$150k budget, achieving 78% of the available resources. The remaining amount can be strategically reserved for future automation opportunities or enhancements to ongoing projects, reinforcing the adaptive character of the proposed methodology.

The system generated a ranking of the six alternatives based on their benefit-to-cost performance, aligned with the decision-maker's declared preferences. RPAPJ1 and RPAPJ4 stood out for combining high strategic relevance with relatively low costs, followed by RPAPJ3 and RPAPJ2, which also demonstrated strong performance within the remaining budget. Projects RPAPJ5 and RPAPJ6, although offering potential benefits, were excluded due to higher costs and lower benefit-to-cost ratios within the imposed constraint.

Figure 2 summarizes the alternatives, individual and cumulative costs, and their inclusion in the selected portfolio, illustrating the FITradeoff method's effectiveness in balancing decision-maker preferences and cost-efficiency. Rather than ranking projects individually, the model identifies a strategically sound portfolio, enhancing transparency and reducing cognitive load.

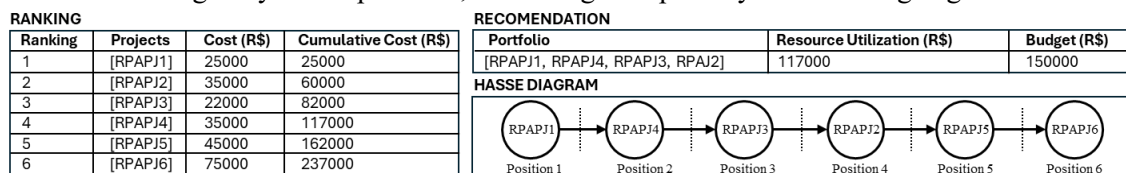


Figure 2 – Results and recommendation

By integrating qualitative insights with structured quantitative evaluation, this approach supports decisions that are not only budget-compliant but also strategically aligned and technically feasible. Nevertheless, the study's scope was limited to a pilot application in a single organization, suggesting that broader validation in diverse contexts remains a promising avenue for future research. This reinforces the practical utility of the INSIGHT-RPA framework for guiding automation investments with rigor and clarity.

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