Comparative Analysis Between Reengineering and Continuous Improvement in the Textile Sector

Alamilla García Alan Johan[1], González García Liliana[1], Montiel Hernadez Christian[1], Pérez Pérez Ana Italia[1], Urrutia Muñoz Montserrat[1]

[1]Industrial Engineering, Instituto Tecnológico de Pachuca (Tecnológico Nacional de México), Pachuca, Hidalgo, Mexico

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ABSTRACT

This research addresses a common problem in manufacturing operations management: the difficulty that companies face when selecting between two process improvement strategies, continuous improvement and business process reengineering. Frequently, organizations choose inadequate solutions, leading to unnecessary costs, organizational resistance, or limited results. To solve this problem, the study proposes and validates a multicriteria decision matrix that integrates statistical process capability indicators (Cp and Cpk), qualitative organizational variables (maturity, resource availability, strategic impact), and a traffic light system (green, yellow, red zones) to determine the most suitable strategy. The matrix was applied in a case study at PESA Uniformes S.A. de C.V., a company dedicated to the production of industrial fabrics and uniforms, specifically in the textile finishing process in the state of Hidalgo, Mexico. Results showed a statistically capable process (Cp = 2.04, Cpk = 2.01) that was well-centered, leading to the recommendation of a continuous improvement strategy rather than a costly reengineering. The comparative economic analysis demonstrated estimated savings of 1,032,000 MXN by avoiding unnecessary investments, as well as a reduction in material waste from 3.2% to 2.4%, equivalent to monthly savings of approximately 39,000 MXN. The research is further justified by the economic relevance of the textile sector in Hidalgo, which ranks fourth nationally according to the Monthly Industrial Activity Index by Federal Entity (IMAIEF) published by INEGI (February 2026). It is concluded that the proposed matrix constitutes an objective, low-cost, and easy-to-implement tool that reduces uncertainty in strategic decision-making and contributes to strengthening the competitiveness of the Mexican textile industry.

Keywords: continuous improvement, business process reengineering, multicriteria decision matrix, process capability (Cp, Cpk), textile industry

INTRODUCTION

In an industrial environment characterized by intense competition, market globalization and constant pressure to reduce costs and increase quality, manufacturing companies must continuously optimize their production processes. Within operations management strategies, two approaches have gained particular relevance: continuous improvement, based on incremental and sustainable changes, and business process reengineering (BPR), which proposes radical and structural transformations. However, organizations often find it difficult to select the most suitable alternative and opt for solutions that do not correspond to the reality of their processes. This indecision generates unnecessary costs, resistance to change and limited results, affecting both productivity and business competitiveness.

In the textile sector, continuous improvement (Lean Manufacturing, Kaizen, Six Sigma) is based on gradual and sustained changes (Imai, 1986), whereas BPR proposes radical redesigns to obtain drastic improvements in cost, quality and speed (Hammer & Champy, 1993). There is, however, confusion about when to apply each one: some companies implement continuous improvement in structurally obsolete processes, while others undertake costly reengineering in processes that only required adjustments. The literature has analyzed both approaches separately, without offering systematic comparisons that identify critical success factors and

specific conditions for each methodology. This problem mainly affects small and medium-sized textile manufacturing companies (SMEs), which lack the resources to experiment with unvalidated approaches. Managers, operations heads and improvement leaders are pressed to act without analytical support, which leads to intuitive or imitative implementations made without a prior diagnosis of the nature of the problem (structural or incremental) or of the organizational capacity to undertake radical or gradual change.

Against this background, this study aims to contribute to better strategic decision-making in textile companies through a comparative analysis of continuous improvement and process reengineering. To that end, an objective and structured tool is proposed: a multicriteria decision matrix that integrates statistical process capability indicators (Cp and Cpk), qualitative organizational variables (maturity, resource availability and strategic impact) and a traffic light system that guides the decision toward a specific strategy. The matrix was validated through a case study at PESA Uniformes S.A. de C.V., located in the state of Hidalgo, Mexico, specifically in the textile finishing process, demonstrating its usefulness for avoiding unjustified investments and optimizing resource allocation.

The textile sector was chosen because of its strategic economic relevance. According to the Monthly Industrial Activity Index by Federal Entity (IMAIEF) published by INEGI in February 2026, textile manufacturing drives industrial growth in Hidalgo, placing the state in fourth place nationwide (INEGI, 2026). Strengthening the decision-making capacity of textile companies in the region therefore benefits not only each organization but also regional competitiveness and industrial development.

The study contributes in four dimensions. Methodologically, it proposes an original multicriteria matrix that combines quantitative and qualitative data with a traffic light system, which facilitates interpretation and decision-making. Practically, it offers companies a concrete, applicable and validated tool that reduces strategic errors, optimizes resources and improves competitiveness. At the sector level, it generates contextualized knowledge for the textile industry of Hidalgo. Theoretically, it integrates and compares two approaches, continuous improvement and reengineering, that are usually addressed separately, helping to close a gap in the operations management literature. The proposal benefits textile SMEs, managers and operations heads, industrial engineers and process management specialists, and academics and researchers who may replicate or adapt it.

The general objective was to analyze the critical success factors, application conditions and characteristic results of continuous improvement and process reengineering in textile sector companies, in order to establish criteria that guide the selection of the most appropriate methodology according to the state of the production processes and the available organizational resources. The five specific objectives were: (1) to identify the critical success factors of continuous improvement (Lean Manufacturing, Kaizen and Six Sigma) and of process reengineering through a review of specialized literature on the manufacturing sector; (2) to compare both methodologies in terms of investment, risk, implementation time and expected results in textile companies; (3) to determine the organizational and operational conditions that favor each approach, considering process maturity, available resources and competitive level; (4) to design a decision matrix that relates the state of the production processes and the organizational resources to the most convenient improvement methodology; and (5) to evaluate the applicability of the matrix through the analysis of a textile sector case or hypothetical scenarios based on real information.

The paper is structured as follows: it first presents the literature review and the theoretical framework that support both improvement approaches; second, it describes the methodology used to build the multicriteria matrix; third, it presents the case study and the results obtained; and finally, it discusses the conclusions and offers recommendations for future applications.

LITERATURE REVIEW

The review is organized around four themes: applications of reengineering, applications of continuous improvement, comparative approaches, and the gap that remains unresolved. In recent decades, process improvement has gained great relevance in industrial engineering and operations management, particularly in highly competitive manufacturing sectors such as the textile industry. Several studies have addressed

methodologies aimed at increasing productivity, reducing costs and optimizing quality, with continuous improvement and process reengineering standing out as strategic approaches to organizational transformation.

Hammer and Champy (1993) laid the conceptual foundations of BPR, defining it as the radical redesign of processes to achieve dramatic improvements in critical indicators such as cost, quality, service and speed. The approach has been widely used in manufacturing industries when processes present structural failures or low performance levels. Applied studies in the textile sector illustrate its scope. In an Ecuadorian textile plant, reengineering addressed unnecessary preparation operations, excessive material travel, poor workstation layout and inadequate conditions through process sheets, standard times and optimized routes, which produced a 38.16% increase in productivity (Paullán & Cabay, 2009). Baldeón (2012) linked strategic diagnosis (SWOT analysis) to the need to redesign production processes and showed that the absence of planning and strategic redesign limits the competitiveness of textile SMEs in Ecuador. González and Orozco (2012) applied the SCOR model to the supply chain of an industrial supply company, detected a lack of coordination among purchasing, production and dispatch, and proposed a collaborative inventory system that improved inventory turnover, costs and the synchronization of demand with supply. Chandi and Villamar (2015) analyzed the value chain of an underwear company and showed that process redesign should also address support activities such as human resources, technology and procurement.

Other reengineering studies report quantified results. In a garment factory, the reengineering of production lines increased productivity by approximately 45% through the redesign of operations and the optimization of workflow (Palasri & Boonsiri, 2022). Calderón-Andrade et al. (2020) integrated reengineering and simulation in the footwear industry, a manufacturing sector with characteristics similar to the textile sector, and found that process redesign accompanied by analytical tools contributes significantly to operational efficiency. Ortiz Bolaños (2020) integrated Design Thinking with Business Process Redesign in an Ecuadorian textile company and obtained a 19.77% increase in output per hour worked, validating the results through computer simulation. Reengineering has also been applied to a single critical process and to administrative processes: Gregorio Morales (2021) addressed the insufficient capacity of the warping process, which generated unmet demand and the loss of customers (12 dissatisfied customers in five years) and proposed renewing machinery and redesigning the process, while De la Gala (2024) proposed updating the flowchart of a slow and inefficient process, implementing supplier databases and redesigning purchase orders, showing that reengineering is also applicable to logistics and cost-related administrative processes.

In parallel, the literature on continuous improvement, grounded in philosophies such as Kaizen, Lean Manufacturing, Six Sigma and Total Quality Management (TQM), proposes incremental and sustainable improvements. Comparative research indicates that continuous improvement is especially effective in organizations whose processes are already relatively stable and that seek to eliminate waste, reduce variability and raise operational efficiency through gradual changes (Sharma, 2016). León Muñoz (2016) applied management systems to reduce occupational accidents in a textile plant, linking continuous improvement with risk prevention. Dávila (2018) applied line balancing, time study, value stream mapping (VSM) and simulation at the company Acuarela Tex, reducing manufacturing times, increasing productivity and eliminating non-value-adding activities, with an estimated economic benefit of $11,880 per month. Malpartida et al. (2021) showed that Six Sigma, through the DMAIC methodology (Define, Measure, Analyze, Improve, Control) applied to critical processes such as cutting and sewing, can raise quality, reduce waste and increase competitiveness in textile companies in Lima. Vásquez and Zuñiga (2024) also applied Six Sigma with DMAIC to reduce fabric waste, the most costly input, proposing fabric optimization software, the implementation of 5S and a machine maintenance schedule.

The cultural and organizational side of continuous improvement has been documented as well. Gómez (2023) applied the 5S methodology (Seiri, Seiton, Seiso, Seiketsu, Shitsuke) at Manufactura de Pilar S.A., improving order, cleanliness, discipline and safety in the production area, reducing errors and increasing operator motivation. Cirillo (2023) evaluated the continuous improvement maturity level of a textile SME and proposed a structured system based on Kaizen, PDCA and maturity models (CMMI, CIMM), with implementation phases, improvement teams and coaching. Oviedo (2025) found a significant relationship between process

management and continuous improvement (Deming cycle, PDCA) in the sewing area, validated through surveys and statistical analysis.

Comparative studies between reengineering and incremental improvement are scarcer. Bhaskar (2015) carried out a comparative analysis between BPR and TQM and concluded that both approaches are adequate for different organizational contexts and that their selection depends on the maturity level of the processes and the magnitude of the change required. In sum, although studies analyze continuous improvement and reengineering separately, few investigations compare both approaches specifically in the textile sector and, at the same time, propose a practical decision tool for their application. This gap is the one addressed by the present study.

THEORETICAL FRAMEWORK

Choosing between reengineering and continuous improvement. The choice depends mainly on the organization's current performance level and on the magnitude of the change required. To determine whether an organization requires process reengineering or continuous improvement, it is essential to rely on quantitative performance indicators, especially those related to process capability. Among the most relevant are the Cp index (potential process capability) and the Cpk index (actual process capability), which evaluate how well a process meets the established specification limits. According to the National Institute of Standards and Technology (NIST, 2026), Cp represents the relationship between the specification range and the natural variability of the process, while Cpk considers, in addition, the centering of the process with respect to the target (Hessing, 2014). The indices are computed as follows, where USL and LSL are the upper and lower specification limits, μ is the process mean and σ is the process standard deviation:

$$Cp = (USL - LSL) / 6\sigma$$

$$Cpk = \min [(USL - \mu) / 3\sigma , (\mu - LSL) / 3\sigma]$$

Values greater than or equal to 1.33 indicate capable and stable processes, for which continuous improvement strategies are more appropriate for optimizing performance, whereas values below 1.0 reflect incapable processes with high variability or misalignment, which suggests reengineering because the problems are structural and cannot be solved with incremental adjustments. Complementary indicators such as defect levels, cycle times, overall equipment effectiveness (OEE), costs of poor quality and delivery compliance make it possible to identify whether deviations can be controlled through gradual improvements or require a radical redesign, so that the decision rests on objective evidence rather than on subjective criteria alone.

Operations management concepts. Operations management comprises the activities aimed at designing, administering and improving the production systems of an organization, transforming inputs such as raw material, labor, capital and information into goods or services with added value (Heizer & Render, 2014). Productivity measures the relative efficiency between the results obtained and the resources used and is expressed as the relationship between output and inputs (Sumanth, 1990). Efficiency refers to the optimal use of available resources, effectiveness to the degree to which established objectives are achieved, and effectivity integrates both; Drucker (1967) distinguishes efficiency as "doing things right" from effectiveness as "doing the right things." A process is a measured and structured set of activities designed to produce a specific output for a customer (Davenport, 1993), and process management seeks to align operational activities with the strategic objectives of the company. Competitiveness, the ability of a company to remain and position itself favorably in the market, is determined by productivity, innovation, quality and operational efficiency and, in the textile sector, is influenced by globalization, cost pressure and the need to reduce response times (Porter, 1985). Process innovation can range from gradual improvements to complete redesigns (Davenport, 1993), which links it directly to continuous improvement and reengineering.

Business process reengineering. Hammer and Champy (1993) define BPR as the fundamental rethinking and radical redesign of processes to achieve dramatic improvements in costs, quality, service and speed, which implies questioning existing assumptions and breaking with traditional structures. It is characterized by the radical redesign of processes, a focus on results rather than tasks, the elimination of non-value-adding

activities, the integration of functions and the intensive use of information technologies; Davenport (1993) stresses that it implies deep structural changes, unlike incremental improvements. Several studies (Hammer & Champy, 1993; Davenport, 1993; Al-Mashari & Zairi, 1999) agree that the main critical success factors are top management commitment, effective change management, clear organizational communication, staff training, strategic alignment and the adequate use of technology; the lack of these elements is one of the main causes of failure in reengineering projects. In manufacturing, reengineering is applied when processes show structural deficiencies, high costs or low competitiveness and, in the textile industry, it allows production chains to be redesigned, cycle times to be reduced and operational efficiency to be improved under high competitive pressure.

Continuous improvement. Continuous improvement is a systematic approach oriented toward the progressive optimization of processes, products and services through incremental changes sustained over time. Imai (1986) defines continuous improvement (Kaizen) as a process that involves all levels of the organization in the constant improvement of processes; the approach is based on small improvements with the participation of all personnel and emphasizes discipline, teamwork and the standardization of processes. It is commonly implemented through eight steps: identification of the problem, analysis of the current situation, definition of the objective, root cause analysis, development of solutions, implementation of improvements, evaluation of results and standardization. TQM is a comprehensive approach that seeks to improve quality in all organizational processes, promoting customer satisfaction and continuous improvement as fundamental principles (Deming, 1986). The PDCA cycle (Plan-Do-Check-Act) is the operational basis of continuous improvement: problems or opportunities are identified and action plans designed (Plan), actions are implemented on a small scale (Do), results are compared against objectives (Check), and improvements are standardized or adjusted before restarting the cycle (Act) (Deming, 1986). Lean Manufacturing focuses on the systematic elimination of waste (muda) in production processes in order to maximize value for the customer using the minimum of resources (Womack & Jones, 1996). Its effective implementation requires a change-oriented organizational culture, active participation of personnel, committed leadership, constant performance measurement and a customer focus (Bessant et al., 2001), and it impacts productivity directly by optimizing the use of resources and reducing waste, which translates into sustained improvements in competitiveness.

Theoretical differences. The main difference between the two approaches lies in the magnitude and nature of the change: reengineering implies radical, discontinuous and high-impact changes, whereas continuous improvement relies on gradual, incremental and sustained changes. While reengineering seeks fast results through deep redesigns, continuous improvement focuses on constant optimization and on the stability of processes (Hammer & Champy, 1993; Davenport, 1993; Bessant et al., 2001).

METHODOLOGY

The research followed a model of internal consulting that adapts the DMAIC cycle to textile plants and serves as an objective guide to determine when it is viable to apply continuous improvement and when process reengineering is required. The model was developed in five phases: (1) definition of the problem; (2) data collection; (3) analysis and calculation of Cp and Cpk; (4) comparison and multicriteria decision matrix; and (5) advisory. It was validated through a case study in the finishing process of a textile company, as described below.

Research Design

The study was developed under a mixed approach with quantitative and qualitative variables, adopting a non-experimental and cross-sectional design. This approach made it possible to observe and analyze the production processes in their real environment, without altering their variables, collecting data in a single period of time in order to project the findings toward practical solutions in the textile sector (Hernández Sampieri et al., 2014). The central strategy is the DMAIC cycle (Define, Measure, Analyze, Improve, Control), a methodology widely validated in industrial engineering and in the Six Sigma philosophy for the optimization of operational environments (Pande et al., 2002; Harry & Schroeder, 2000), which was adapted to the particularities of textile plants.

In Phase 1 (definition of the problem), the 5W+2H tool was used, which breaks the situation down through seven key questions: What, Who, Where, When, Why, How and How much (Krajewski et al., 2019). Phase 4 contrasted continuous improvement and reengineering in terms of risk level, investment volume, execution times and scope of the change (Hammer & Champy, 1993; Imai, 1986) and built the multicriteria decision matrix. Phase 5 formulated the technical guidelines and an executive action plan derived from the diagnoses of the model; it is aligned with the Control stage of DMAIC and ensures the transition from theoretical analysis to actionable proposals for the company.

Population and Sample

The model was applied in a case study at PESA Uniformes S.A. de C.V., a company located in the state of Hidalgo, Mexico, dedicated to the manufacture of fabrics and industrial uniforms for the manufacturing and service sectors. The analysis focused on the textile finishing process, because this stage directly affects the dimensional quality of the final product and compliance with customer specifications. The critical-to-quality (CTQ) characteristic was the width of the fabric. The quantitative sample consisted of 100 random samples of production taken under normal operating conditions; each unit was evaluated and classified as approved or defective according to the engineering tolerances of the organization, which established a lower specification limit (LSL) of 148 cm, an upper specification limit (USL) of 152 cm and a nominal target of 150 cm.

The qualitative component involved semi-structured interviews and surveys directed at operating personnel and managers, specifically the production head, the quality supervisor, the operations manager and the operators, as well as administrative and operating managers for the assessment of resources.

Instruments and Data Analysis

The diagnosis combined primary and secondary sources: internal production records, direct observation and measurements carried out in the plant, together with the interviews and surveys described above. Process capability was determined through the potential capability index (Cp) and the actual capability index (Cpk), which are promoted by the American Society for Quality (ASQ) to verify whether a production system operates within customer specifications (Montgomery, 2013), using the expressions presented in the Theoretical Framework. A goodness-of-fit test was performed to identify the distribution followed by the data, together with a normality test, as a basis for the capability analysis. According to the decision criteria of the methodology, $Cp \geq 1.33$ and $Cpk \geq 1.33$ identify a capable and well-centered process for which continuous improvement is recommended.

The multicriteria decision matrix combines four criteria: process capability (Cp/Cpk), organizational maturity, resource availability and expected strategic impact. Process capability was scored from 1 to 5 according to the Cp/Cpk value (greater than 1.67 = 5, highly capable; 1.33–1.67 = 4, capable; 1.00–1.32 = 3, acceptable; 0.67–0.99 = 2, at risk; below 0.67 = 1, incapable). The three qualitative criteria were assessed with a 1–5 Likert scale based on interviews, surveys and direct observation: maturity (culture of improvement, leadership, previous experience with Lean or Six Sigma and resistance to change), resources (financial, technological and human resources, time, personnel training and technological tools) and strategic impact (effect on costs, quality, productivity, delivery times and customer satisfaction, based on current performance indicators, bottlenecks, operating costs and strategic objectives). Each score was multiplied by its weighting (35% for process capability, 25% for maturity, 20% for resources and 20% for strategic impact), and the final result was obtained as the sum of the weighted scores: Final result = Σ (score × weighting).

The final result locates the company in a traffic light zone: green (4.0–5.0), continuous improvement is sufficient to optimize the process; yellow (2.5–3.9), a combination of continuous improvement and reengineering is suggested; and red (1.0–2.4), reengineering is required because of structural problems or high levels of inefficiency. Finally, a comparative economic analysis between two scenarios was developed: the direct application of reengineering and the application of the decision matrix oriented toward continuous improvement tools. The costs were estimated on the basis of average references of the Mexican manufacturing sector, specialized literature on reengineering and continuous improvement, and typical costs of training, industrial consulting, supervision and losses derived from operating stoppages.

RESULTS AND DISCUSSION

The results are presented following the phases of the methodology and in line with the specific objectives on the design and applicability of the decision matrix. First, the indicators and the capability of the finishing process of PESA Uniformes S.A. de C.V. are reported; second, the organizational criteria and the application of the matrix; and third, the comparative economic analysis, followed by the discussion in relation to the literature reviewed.

Main Findings

As part of the initial diagnosis, quality and operating performance indicators of the textile finishing process were collected from internal production records, direct observation and measurements in the plant (Table 1). The defect percentage is low (3 defective units in 100 samples, 3%), which indicates that the process is relatively stable and suitable for continuous improvement strategies. The results show a stable level of performance, with low percentages of defects and moderate variability, which suggests the existence of incremental optimization opportunities rather than critical structural problems.

Table 1: Quality and performance indicators of the finishing process at PESA Uniformes S.A. de C.V.

Indicator	Result
Daily production	4,500 meters of fabric
Shifts	2
Operators	18
OEE	84%
Average cycle time	1.8 min per batch
Average waste (merma)	3.20%
Rework	2.50%
On-time deliveries	96%
Estimated sigma level	4.1 σ
Number of defects	3
Number of samples taken	100
Percentage of defects	3%

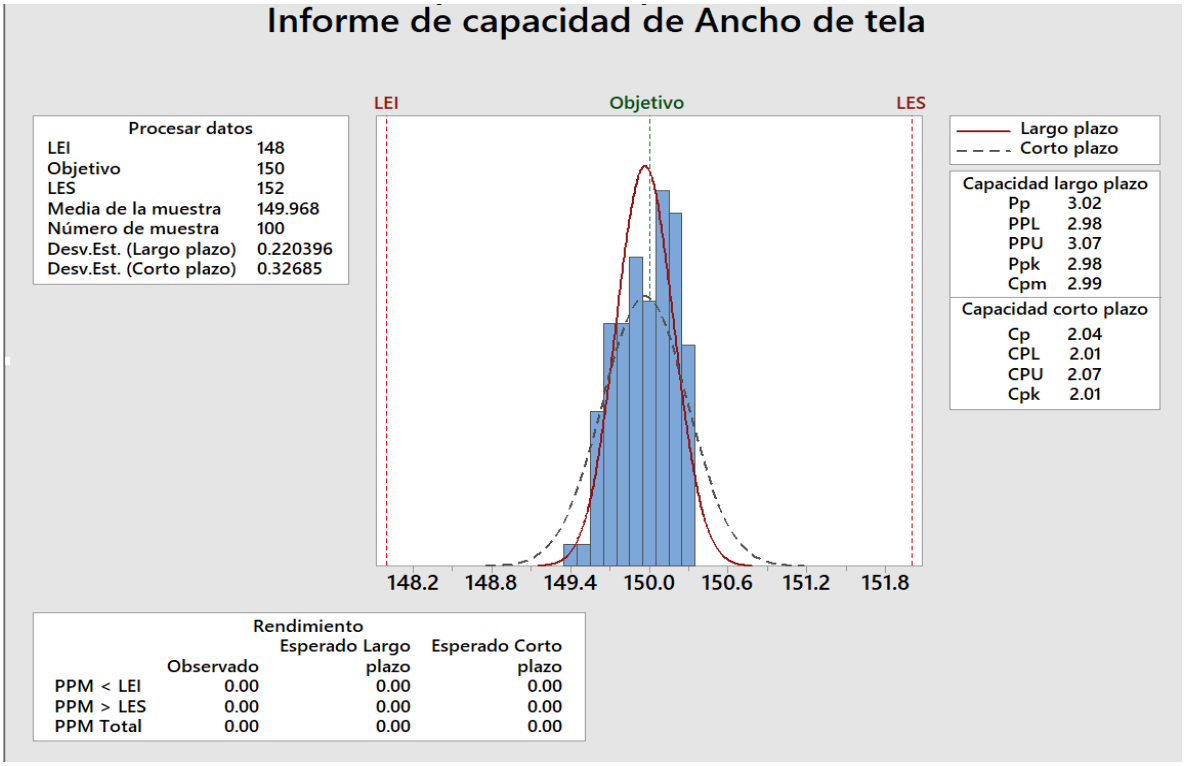
For the capability analysis, fabric width was selected as the critical-to-quality characteristic, given its relevance for product conformity and customer satisfaction. The samples showed an approximately normal behavior, which allowed a reliable analysis of the stability and capability of the process. The Cp index obtained (2.04) shows that the process has a capability that is amply sufficient to meet the tolerances established by the

customer, and the Cpk value (2.01) confirms that the process is not only capable but also correctly centered with respect to the specifications (Table 2 and Figure 1). The performance analysis showed 0 PPM out of specification, indicating that no defective pieces were detected in the analyzed sample. In accordance with the decision criteria of the methodology, Cp ≥ 1.33 and Cpk ≥ 1.33 correspond to a capable and well-centered process, for which continuous improvement is recommended.

Table 2: Process capability results for fabric width (n = 100)

Parameter	Value
Lower specification limit (LSL)	148 cm
Target	150 cm
Upper specification limit (USL)	152 cm
Sample size	100
Sample mean	149.968 cm
Standard deviation (short term)	0.32685
Cp	2.04
Cpk	2.01
PPM out of specification (total)	0.00

Figure 1: Process capability report for fabric width at PESA Uniformes S.A. de C.V.



Organizational Criteria and Decision Matrix

After the capability analysis, the three organizational and strategic criteria were evaluated with information obtained from interviews, operating observation and a review of the general productive context (Table 3). Regarding maturity, interviews with the production head, the quality supervisor, the operations manager and the operators, together with direct observation, showed that the company has basic continuous improvement practices, partial use of performance indicators to monitor productivity and quality, and previous experience with Lean Manufacturing tools, mainly related to order, cleanliness and waste reduction in certain operating areas. The organization presents favorable conditions for continuous improvement because there is operating participation, functional leadership and openness to change (score assigned = 4). Regarding resources, the company has adequate infrastructure and personnel with operating experience, but there are limitations in the available time and in the budget for large-scale projects. It has sufficient resources to implement gradual and sustainable improvements but does not currently have the ideal conditions to execute a radical reengineering involving deep structural modifications (score assigned = 3). Regarding strategic impact, the evaluated process mainly influences the quality of the final product, although it is not currently a critical bottleneck in the company's operations. It has moderate strategic relevance and clear optimization opportunities, but it does not require radical changes in its operating structure (score assigned = 3).

Table 3: Results of the organizational assessment at PESA Uniformes S.A. de C.V.

Dimension	Aspect evaluated	Result
Organizational maturity	Culture of improvement	Medium-High
	Operating leadership	High
	Use of Lean/Six Sigma	Medium
	Resistance to change	Low
Resource availability	Budget	Moderate
	Technology	Adequate
	Trained personnel	Medium-High
	Available time	Limited
Expected strategic impact	Impact on quality	High
	Impact on costs	Medium
	Impact on deliveries	Medium
	Process criticality	Medium

The scores of the four criteria were multiplied by their weightings and added (Table 4). The matrix yielded a final result of 3.95, which indicates that the best option for the case is a combination of both strategies, closer to the use of continuous improvement tools; continuous improvement was therefore the recommended and viable option.

Table 4: Weighted results of the multicriteria decision matrix

Criterion	Weighting	Score obtained	Weighted result
Process capability (Cp/Cpk)	35%	5	1.75
Organizational maturity	25%	4	1.00
Resource availability	20%	3	0.60
Expected strategic impact	20%	3	0.60
TOTAL		**15**	**3.95**

Comparative Economic Analysis

In Scenario 1, reengineering was applied directly. Because reengineering implies deep modifications in work methods, operating structure and organization of the production system, this scenario contemplates high investments in specialized consulting, intensive training, process redesign and possible operating interruptions during implementation (Table 5). To estimate the economic impact of partial production stoppages, a temporary 15% decrease in productive capacity during seven days of operating intervention was considered. With an average daily production of 4,500 meters of fabric, the temporary reduction would be 4,500 × 0.15 = 675 meters per day; at an estimated average cost of 45 MXN per meter, the daily loss is 675 × 45 = 30,375 MXN and, over seven days, 30,375 × 7 = 212,625 MXN, approximately 210,000 MXN. This scenario also presents operating risks, namely possible production interruptions, organizational resistance to change, a temporary increase in variability and long stabilization times, with an estimated implementation time of approximately 4 to 6 months. Considering that the evaluated process already presents statistical stability and sufficient capability, the required investment would not be proportional to the real need identified in the diagnosis.

Table 5: Estimated costs of Scenario 1 (direct reengineering)

Concept	Estimated cost (MXN)
Specialized external consulting	$220,000
Intensive training	$140,000
Redesign of operating procedures	$75,000
Technological and machinery adjustments	$320,000
Partial production stoppages	$210,000
Supervision, administration and follow-up	$60,000
Indirect costs and contingencies	$95,000
TOTAL	**$1,120,000**

In Scenario 2, the application of the matrix made it possible to select a strategy better suited to the real behavior of the process. Instead of a complete reengineering, the organization was found to require mainly continuous improvement tools focused on statistical control, operating standardization and gradual optimization: implementation of statistical process control, monitoring of variability, basic training in Lean tools, partial update of procedures and minor operating adjustments (Table 6). The difference between the two scenarios was 1,120,000 − 88,000 = 1,032,000 MXN, so the use of the multicriteria matrix avoided an investment of approximately 1,032,000 MXN by selecting a strategy proportional to the real behavior of the process and to the organizational conditions of the company.

Table 6: Estimated costs of Scenario 2 (decision matrix oriented to continuous improvement)

Concept	Estimated cost (MXN)
Basic training in continuous improvement	$25,000
Implementation of statistical control	$18,000
Update of procedures	$12,000
Operational follow-up	$10,000
Minor operating adjustments	$15,000
Internal supervision	$8,000
TOTAL	**$88,000**

The impact on waste was also estimated. The process currently presents an average waste of 3.2%; with a daily production of 4,500 meters, the daily loss is 4,500 × 0.032 = 144 meters, equivalent to 144 × 45 = 6,480 MXN. With the continuous improvement tools selected through the matrix, waste is expected to fall from 3.2% to 2.4%, so the new daily loss would be 4,500 × 0.024 = 108 meters. The saving is 144 − 108 = 36 meters per day, equivalent to 36 × 45 = 1,620 MXN per day and, considering 24 working days per month, 1,620 × 24 = 38,880 MXN per month.

DISCUSSION

The results show that integrating the statistical analysis of process capability with organizational criteria provides an objective basis for choosing between continuous improvement and reengineering. The values obtained (Cp = 2.04 and Cpk = 2.01) are well above the 1.33 threshold that, according to the theoretical framework, identifies capable and stable processes for which continuous improvement is more appropriate. This is consistent with the antecedents reviewed, which indicate that continuous improvement is especially effective in organizations with relatively stable processes (Sharma, 2016) and that the selection between approaches depends on the maturity of the processes and on the magnitude of the change required (Bhaskar, 2015). While the capability criterion alone points to continuous improvement, the weighted result of the matrix (3.95) points to a combination of both strategies leaning toward continuous improvement, with resource availability and strategic impact (3 points each) moderating the final score.

The economic comparison shows that, for this case, reengineering would have been disproportionate: it implied an estimated investment of 1,120,000 MXN, operating risks and a stabilization period of 4 to 6 months, against 88,000 MXN for the strategy selected through the matrix. The matrix allowed the company to reduce potential implementation costs, minimize operating risks, avoid unnecessary investments, optimize

the allocation of resources and orient improvement actions toward continuous improvement tools with greater economic and operating viability, in addition to an estimated reduction in waste with a monthly saving of approximately 38,880 MXN. These findings show that the integration of statistical capability analysis with multicriteria tools is an effective alternative to support strategic decisions in the textile manufacturing sector. Considering that Hidalgo ranks fourth nationwide in industrial activity driven by textile manufacturing (INEGI, 2026), they may also be useful to other organizations of the region that face similar dilemmas.

CONCLUSION

This research started from a frequent problem in operations management: the difficulty that companies face in selecting adequately between continuous improvement and reengineering, which often leads to overcosts, resistance to change or limited results. The study developed and validated an objective and structured tool to guide this decision on the basis of quantitative and qualitative criteria. The results confirm that the proposed multicriteria decision matrix, made up of process capability indices (Cp and Cpk), organizational variables (maturity, resource availability and strategic impact) and a traffic light system, is a valid and useful tool for the textile sector. Its application at PESA Uniformes S.A. de C.V., in the textile finishing process in Hidalgo, showed that the methodology identifies when a process is statistically capable and centered, thus avoiding the unnecessary implementation of a costly reengineering.

In economic terms, the comparison between scenarios was conclusive. A process reengineering would have implied an investment above 1.1 million Mexican pesos (considering consulting, intensive training and operating stoppages), while the strategy selected through the matrix, oriented to continuous improvement, had an estimated cost of only 88,000 pesos, which avoided an investment of approximately 1,032,000 MXN. In addition, a reduction in waste from 3.2% to 2.4% was estimated, representing a monthly saving close to 39,000 MXN, so that not only is the initial investment optimized but operating efficiency is also improved in a sustained way. From a sector perspective, validation in a textile company in Hidalgo is especially relevant, since the state ranks fourth nationwide in textile manufacturing according to the IMAIEF of INEGI (February 2026), and the conclusions may be useful for other organizations in the region.

It is concluded that the integration of the statistical analysis of process capability with multicriteria decision tools represents an effective, low-cost and easy-to-implement alternative that reduces uncertainty in the selection of improvement strategies. Regarding limitations, the matrix was validated in a single case and the costs used in the economic analysis are estimates based on average references of the Mexican manufacturing sector. It is recommended that future research apply the matrix in other manufacturing sectors or in companies of different size, and incorporate additional criteria such as sustainability or digitalization. The research thus fulfills its objective of providing a practical, validated tool aligned with the real needs of companies, promoting more rigorous and strategic decision-making.

Ethical Approval

[To be completed by the authors: name of the ethics committee, approval number and date, or a justification if ethical approval was not required. The project document does not provide this information. The study included interviews and surveys with company personnel.]

Conflict of Interest

The authors declare that they have no conflict of interest.

Data Availability

[To be completed by the authors: state whether the data supporting the findings are available and, if so, provide the repository link; otherwise give a brief rationale. The project document does not provide this information.]

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