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Effectiveness of applying the pareto principle in optimizing business processes and expenses

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Abstract

The article is devoted to assessing the effectiveness of the Pareto principle (the 80/20 rule) as a tool for rationalizing costs and business processes in the context of the current economic situation and accelerating digital transformation. The purpose of the study is to systematize the theoretical foundations and practical approaches to the application of this principle and to propose a concept for its integration with current technologies. The methodology includes a systematic literature review, comparative analysis of case studies (Toyota, DB Schenker, Apple), and content analysis of industry-specific analytical reports. The results obtained confirm a persistent asymmetry: approximately 20% of efforts, assets, or problem areas consistently generate about 80% of the effects whether in terms of results, revenues, or failures in production, logistics, and marketing. The proposed and empirically supported hypothesis is that the highest return from applying the principle is achieved when it is dynamically combined with Process Mining and Robotic Process Automation (RPA), forming a continuous cycle of identifying and automating the most significant operations. Based on this approach, practical recommendations have been formulated for executives on implementing a technologically integrated solution to ensure sustainable competitive advantage. The material is addressed to researchers in strategic management, as well as top managers and business analysts responsible for increasing operational efficiency.

Keywords: Pareto Principle; 80/20 Rule; Cost Optimization; Business Process Optimization; Strategic Management; Case Study; Process Mining; Robotic Process Automation (RPA); Lean Production; ABC Analysis

1. Introduction

The contemporary global economy is undergoing a phase of turbulence, intensifying competitive pressure, and chronic margin compression. Management teams face a dual challenge: simultaneously restraining the growth of operating costs and offsetting the deceleration in revenue momentum [1]. In this environmental configuration, across-the-board budget cuts prove low-yield and often detrimental, as they affect areas that are critical to future growth trajectories [2].

In parallel, technological transformation is unfolding, requiring capital expenditures. Deloitte's estimates record an expected increase in global information technology spending in 2023 [3, 10]. McKinsey data confirm that AI ranks among the priorities for executives across industries [4]. This creates a managerial paradox: how to reduce costs while simultaneously increasing investments in expensive yet strategically necessary technologies?

The solution to this paradox lies not in total austerity but in targeted reallocation of resources. Within this logic, a key methodological pillar is the Pareto principle (rule 80/20): in numerous systems, the preponderance of outcomes is driven by a minority of causes. This principle provides a rigorous basis for identifying the vital few that generate the bulk of value and the trivial many whose reduction does not lead to significant adverse effects for the business [5].

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Despite widespread recognition, application of the Pareto principle in companies is often limited to static, retrospective analysis for example, annual customer profitability segmentation or post hoc analysis of defects—which narrows its potential. In the context of digitalization, when operational data are accumulating in unprecedented volumes, the principle should be used not as a one-off instrument but as a foundation for dynamic, proactive management. At the same time, a problem persists in the scholarly discourse: the Pareto principle is seldom conceptualized as an element integrated into the organization's modern technology stack, enabling a shift from episodic optimizations to a continuous improvement loop.

The purpose of the study is to systematize the theoretical foundations and practical approaches to applying this principle and to propose a concept for its integration with current technologies.

To achieve this goal, the following tasks were formulated

- To systematize the theoretical and methodological foundations and refine the boundaries of applicability of the Pareto principle; to operationalize the dynamic approach through an adaptive threshold by ΔROI and a multiobjective cost–service–risk–fairness framework with noncompensatory constraints (AMPI);

- To develop and validate an integrated Process Mining → Pareto prioritization → RPA cycle: data and metric requirements, algorithms for isolating the vital few (including the client×product portfolio and NLP of rare deviations), and causal evaluation of effect relative to static slices;

The authorial hypothesis is that the maximum strategic payoff from the Pareto principle is achieved not through static snapshots but through its dynamic integration with process analytics technologies (Process Mining) and robotic process automation (RPA). Such a synthesis forms a continuous cycle of identification and automation of the vital processes, ensuring a sustainable competitive advantage.

The scientific novelty lies in substantiating the evolution of the Pareto principle from a static analytical tool to a dynamic, technologically integrated concept of strategic process optimization in the context of business digital transformation.

2. Materials and methods

Research on the Pareto principle in the context of optimizing business processes and expenditures falls into several complementary strands from classical operational lean manufacturing to digital process analytics and multiobjective trade-offs in algorithms. In applied operations work, the 80/20 principle serves as a mechanism for rapid prioritization of bottlenecks and costs, especially under heightened uncertainty. Thus, in the field of lean manufacturing for a developing economy Basu P. et al. [1] demonstrate that economic volatility modulates the effect of implementing Lean and related prioritization tools: a critical few types of losses/processes account for a disproportionate share of outcomes, and the persistence of this effect depends on the phase of the cycle. Van Nguyen T. A., Nguyen K. H., Tucek D. [5] examine features of the transformation of TQM toward Industry 4.0, noting that digitization of process control makes possible a finer identification of the vital few on the basis of sensor data streams and cyber-physical systems. Ali K., Johl S. K. [7]; Pyzdek T. [26] consider that within TQM practices Pareto analysis figures as one of the critical successes factors a means of ranking defects/nonconformities and concentrating resources on the top bars of the Pareto chart. Classic manufacturing cases confirm that even simple diagrams and ABC classifications provide a disproportionate contribution to improvements in OEE/end-to-end performance, which is reflected in the following sources: Karim R., Rahman C. M. L. [19]; Webthesis [18]). Similar conclusions translate to logistics: prioritizing nomenclature and operations according to the Pareto law reduces inventories and unlocks working capital by focusing on A-positions by demand/cost [27].

The digital turn of this agenda is associated with process/task mining and robotic automation of operations. Using the digital traces of event logs, it is convincingly shown that the Pareto principle naturally manifests itself in the structures of work flows: a small share of trace variants generates the main workload and delays, and is therefore suitable for targeting by bots and improvements (Wil M.P. van der Aalst [11]). Wang Y. et al. [14] note that extending classical diagrammatic analysis toward automated identification of priorities demonstrates a transition from Pareto to NLP: prioritizing deviations using natural language processing and decision rules makes it possible to systematically select the critical few among textual nonconformities. These approaches show that 80/20 can be taught to data: with a stable disproportionality in the incident flow, the system maintains management focus without manual recalibration.

In parallel, quantitative decision-support methods are developing that combine the Pareto principle with hierarchical weighting of criteria. Prototypes 80/20 your organization propose using AHP as a formalizer of the importance of the

few and translating the intuitive law into comparable weights for portfolios of improvements, risks, or costs (Kharub M., Kattekola S., Pendyala S. K. [6]; Sari D. P., Khanza S., Bakhtiar A. [25]). In logistics service, AHP helps prioritize quality drivers (time, reliability, cost), materializing the rule of the few into a ranking of factors (Riliandini P. et al. [20]). Even in software engineering, the 80/20 effect is used as a heuristic for structural complexity: a few connections provide the greater part of module coupling, which offers a guide for refactoring (Counsell S., Swift S., Tahir A. [21]).

In marketing and the management of revenue/marginality, the Pareto principle is empirically confirmed and refined. Kim B. J., Singh V., Winer R. S. [12] note that in the market for frequently purchased consumer goods, a stable strong Pareto structure is documented: a small share of SKUs or buyers brings the lion's share of volume, but the parameters depend on the category and horizon. The question of focusing on profitable customers or profitable products is examined by Nguyen H. [23], noting that under a static view customer concentration appears more pronounced, but in cohorts and considering cross-elasticities the priorities change. The demand contour itself is changing: the both-and world in consumer goods (a mix of value/price/sustainability/personalization) leads to multicriteria decision frontiers where the critical few drivers may differ by segment [24]. In e-commerce, bibliometric analysis records a shift toward platform innovations and data, which strengthens the usefulness of the Pareto approach in prioritizing features and catalogs (Legito L., Andriani E. [9]). Loan F. A., Mushtaq R. [22] reconceptualize the 80/20 law as a principle for forming the core of a collection and rejecting the long tail of low-use series. At the level of managerial practices, popular reviews continue to replicate applied 80/20 heuristics for entrepreneurs (Abyad A. [17]).

The macro and industry context are important for translating Pareto prioritization into sustainable cost solutions. Volatility of prices, interest rates, and demand changes who exactly enters the 20% of critical items and how often this composition should be reassessed [4]. Industry-level technology cycles form new critical few technological bets — cloud/AI/cybersecurity in the ICT sector with a disproportionate influence on competitiveness [3]. At the same time, popular practical guides on cost optimization often propose universal schemes for focusing expenditures, which, however, are rarely accompanied by statistical tests of the stability of 80/20 in specific data [2].

There is also a line that brings the Pareto principle closer to data and algorithms in a broad sense. In talent selection and assessment, AI makes it possible to extract hidden factors of potential, which transforms the very object of prioritization (França T. J. F. et al. [10]). In recommender systems, the task is posed of a Pareto-efficient fairness–utility compromise: strengthening the few top positions by utility may conflict with criteria of equality of exposure, and therefore it is necessary to search for the Pareto frontier in the space of policies (Ge Y. et al. [16]). Thus the 80/20 heuristic receives a rigorous multiobjective formalization.

The theoretical underpinnings suggest that 80/20 is not a dogma but a heuristic compatible with competing principles. Kaplow L. [15] notes that in normative economics the Pareto principle coexists with priorities of equality/fairness, and therefore optimality is not always identical to acceptability of a managerial decision. In the measurement of welfare, the noncompensatory Mazziotta–Pareto index is used as an alternative to aggregates where the few poor indicators should not be offset by many good ones this reinforces the intuition about the need to focus on critical failures without compensations (Mazziotta M., Pareto A. [13]).

Finally, interdisciplinary applied studies demonstrate how digitalization increases the effectiveness of focus on the few: combining Lean methods with machine learning for equipment makes it possible to identify a handful of modes/causes that account for the main share of downtime and energy, and to target them first [8].

Thus, the analysis of studies conducted shows that there are contradictions and understudied problems, namely:

- Universality and contextuality. Empirics across markets and processes confirms disproportions, but the 80/20 ratio is not universal: it varies by categories, time windows, and phases of the macrocycle [1, 4, 12]. Nevertheless, practical guides often assume the stability of a fixed threshold [2] — this is a contradiction between a heuristic and statistical verifiability.
- The prioritization metric. The literature diverges on what to count as the main share: revenue, margin, risk, cycle variability, or social utility. The choice of metric radically changes the composition of the critical few [20, 23, 26].
- Interpretability and automation. Process mining/NLP/RL expand the Pareto framework but carry it into the space of black boxes, where transparency of prioritization and controllability become a challenge [11, 14, 16].

In sum, the literature demonstrates that the Pareto principle remains a powerful foundation for optimizing processes and expenditures, but its effectiveness is maximal when it relies on statistically verifiable disproportions in specific

data, is embedded in multiobjective and adaptive decision-making models, and takes context into account — from macroeconomic volatility to the requirements of fairness and transparency.

3. Results and Discussion

The Pareto principle manifests itself in numerous business contexts; however, its heuristic power becomes especially evident in marketing and product portfolio management. The key premise is as follows: the contributions of customers, products, and channels are asymmetric. Systematic identification and prioritization of the ~20% that deliver the primary outcome increase the efficiency of resource allocation.

A large-scale analysis of a consumer panel by Kim B. J., Singh V., Winer R. S. confirms the applicability of the 80/20 rule to the consumer-packaged goods (CPG) market [12]. Although specific proportions depend on the category, a stable regularity persists: on average, the top 20% of the most loyal and active buyers account for 73% of a given brand's revenue. This knowledge enables a shift from undifferentiated mass promotion to targeted initiatives — loyalty programs, personalized offers, and service quality enhancements for the critically important customer group — which, in turn, increases customer lifetime value (Customer Lifetime Value) and the marketing return on investment [6, 12].

Empirical cases confirm the effectiveness of such a focus. In 2014 Procter & Gamble reduced its portfolio by more than half, dropping approximately 100 brands and concentrating on 65 key ones. As a result, the remaining brands began to generate 85% of sales and 95% of profit for the company, demonstrating the soundness of the chosen concentration [23]. Similarly, Apple's success is determined not by the breadth of its assortment but by deep attention to a limited set of flagships (iPhone, MacBook), which generate the bulk of the corporation's revenue and profit [11, 21]. Such concentration allows significant resources to be directed toward improving key products, sustaining technological leadership and exceptional quality.

Quantitative indicators confirm the presence of a Pareto distribution across different product groups, with expected variations observed, as reflected in Table 1.

Table 1 Summary data on the Pareto ratio in various categories of consumer goods [12, 13]

Product category	Average Pareto ratio (PR)*	Standard deviation of PR
Carbonated soft drinks	0.77	0.04
Light beer	0.75	0.07
Coffee	0.74	0.03
Frozen pizza	0.72	0.02
Orange juice	0.69	0.02
Laundry detergents	0.64	0.02

*PR (Pareto Ratio) — the share of revenue generated by the top 20% of a brand's most active buyers.

The graphical representation of the data (Fig. 1) convincingly demonstrates that the canonical proportion 80/20 is not always reproduced literally; what remains stable is the principle of unevenness itself: a comparatively small share of customers generates a disproportionately large share of revenue in the consumer goods market. Consequently, Pareto analysis functions not as an abstract idea but as a practical tool for strategic segmentation and prioritization.

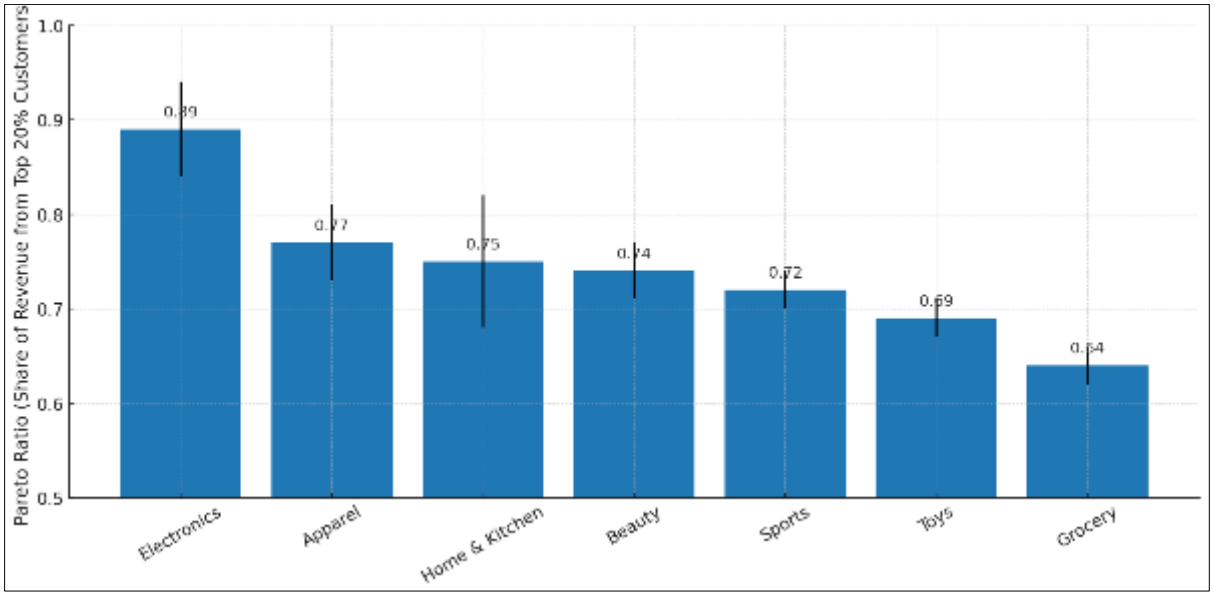

Figure 1 Distribution of the Pareto ratio by product categories [12, 14, 26, 27]

In the service and logistics sectors, where the result is inseparable from the manner of its attainment, Pareto analysis serves as a high-precision diagnostic approach. It shifts attention from treating symptoms to the systematic elimination of the few root causes that contribute most to the deterioration of customer experience and the increase in operating costs [7, 26, 27].

A telling case is the evaluation of sea freight service quality at DB Schenker GBS Bucharest [20]. Confronted with the task of improving the satisfaction of key customers, the company analyzed 60 categories of complaints and, instead of distributing efforts across numerous minor issues, applied the principle of the vital few. As a result, three factors accounted for the largest share, which are shown for clarity in Fig. 2.

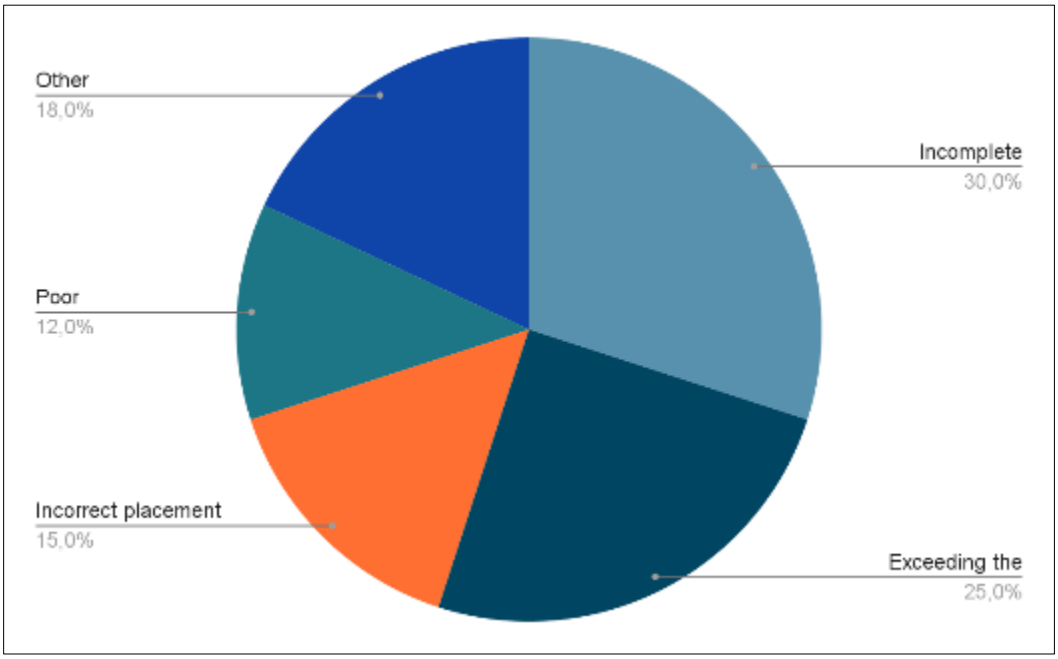

Figure 2 Factors influencing customer satisfaction [20]

Consequently, a rational improvement strategy consists in concentrated action on three–four key drivers, rather than dispersing resources across seven disparate types of problems; such focus ensures a sharp increase in service quality and strengthens customer loyalty [8, 20].

This demonstrates a shift in the managerial paradigm: from reactive firefighting to proactive, data-driven quality management. The Pareto chart (Fig. 3) clearly captures the disproportion in the significance of causes, facilitating the setting of priorities and the mobilization of efforts precisely where marginal return is maximal.

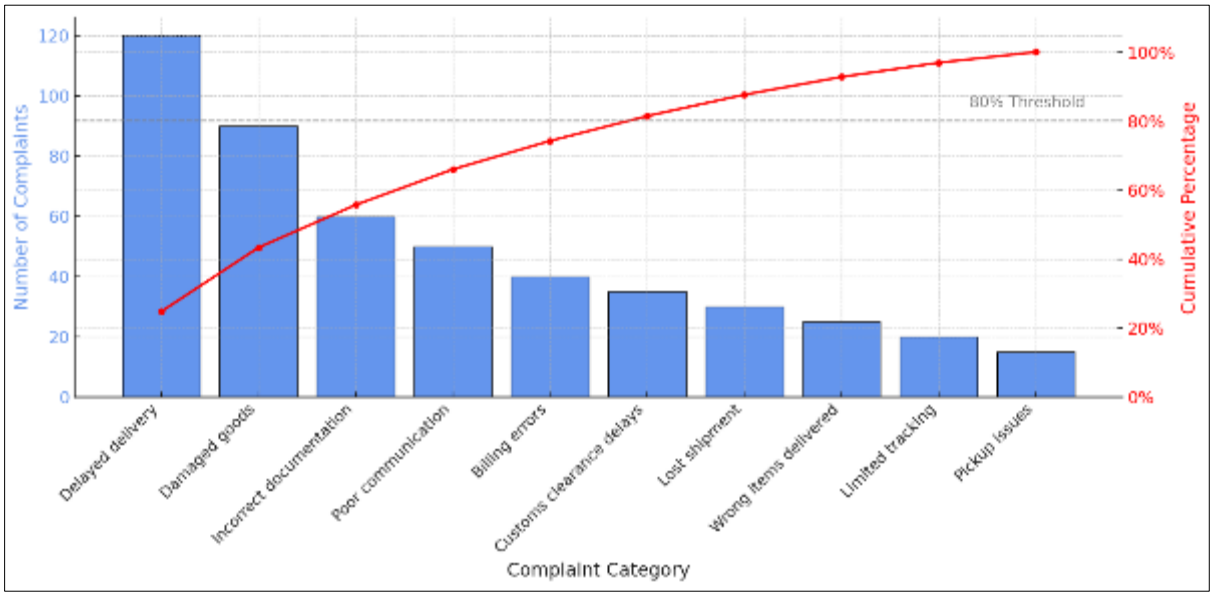

Figure 3 Pareto diagram for analyzing the causes of customer complaints at DB Schenker [19, 24, 25]

The Pareto principle is one of the key philosophical and methodological frameworks of lean manufacturing, whose most representative embodiment is the Toyota Production System (TPS). The Lean ideology is based on the purposeful identification and elimination of waste (muda) — any operations that consume resources without creating customer value [19]. In this logic, Pareto analysis serves as an indispensable diagnostic tool: it makes it possible to quickly single out the vital few sources of waste from the trivial many and to focus improvement efforts precisely where the payoff is maximal.

The practice of leading industrial corporations confirms this heuristic. Thus, Toyota, investigating its own production flows, recorded that roughly 80% of delays and downtime are caused by only 20% of critical bottlenecks in the value-creation chain [17]. A similar regularity was observed in high technology: at Microsoft, in the course of improving the stability of software products, it was established that about 80% of failures and operating system freezes are caused by only 20% of the identified software defects [17]. Concentrating developers' work on this compact group of critical errors made it possible to significantly increase product reliability in a short time.

The most direct and well-known embodiment of the Pareto principle in production and logistics management is ABC inventory analysis. The method presupposes dividing the entire nomenclature of goods and materials by cost magnitude or contribution to turnover into three categories

- Category A: approximately 20% of items account for about 80% of the aggregate inventory value.
- Category B: an intermediate cluster — roughly 30% of the nomenclature and 15% of the value.
- Category C: a mass segment — about 50% of items with a total value share not exceeding 5%.

Such stratification substantiates a differentiated inventory management policy. For expensive and critically important items in category A, the most stringent control regimes are applied: accurate demand forecasting, frequent replenishment in small batches, and minimization of safety stocks to reduce holding costs. For the numerous and low-value items in category C, by contrast, simplified accounting and replenishment procedures are appropriate, since the costs of detailed control can exceed the economic gain from optimization [9, 22, 23].

Thus, a continuous loop of technological optimization is formed

- Diagnosis — Process Mining provides an objective, data-driven picture of the actual functioning of processes;
- Prioritization — Pareto analysis is applied to the obtained maps to single out the 20% of variants that make the largest contribution (by frequency, time, cost, or impact on the outcome) [18, 19];

- Action — the vital scenarios are automated by means of RPA, ensuring rapid and maximal ROI;
- Reallocation — people freed from routine are directed to the analysis and creative improvement of the remaining 80% of rare, complex, and nonstandard cases [15, 16].

This approach records a fundamental shift in managerial logic. The organization moves away from reactive problem solving (as in the classic DB Schenker case) toward proactive, data-based portfolio process management. Processes are viewed as a portfolio of assets: blue chips the stable, high-frequency 20% are handed over to robots for management in order to maximize efficiency, whereas the venture zone or long tail the remaining 80% remains in the hands of people for innovation, improvement, and adaptation to a changing environment. In this way it becomes possible to strategically balance two types of capital: automation capital for increasing productivity, and human capital for development and the formation of future competitive advantages.

4. Conclusion

The findings demonstrate that the Pareto principle, having withstood more than a century of practical application, is not merely an empirical heuristic but a universal and powerful analytical instrument applicable to the optimization of costs and business processes. Its effectiveness has been demonstrated across multiple industries and functional contours from marketing and product portfolio management to operations management and manufacturing quality control, as well as service processes in logistics. The use of the principle makes it possible to localize areas with the greatest improvement potential and to purposefully concentrate scarce resources, ensuring the maximum return on managerial effort.

The research hypothesis has been confirmed: in the contemporary digital economy, the strategic significance of the Pareto principle increases manifold when it is embedded into the technological control loop of organizational management. The proposed model a cyclical linkage of Process Mining, Pareto analysis, and Robotic Process Automation (RPA) shifts practice from static, retrospective consideration to dynamic, continuous, and data-driven optimization. This operating mode aligns with the requirements of the current market environment, which combines the demand for efficiency gains with the need for accelerated innovation.

On this basis, the following recommendations are formulated

- Cultivate Pareto thinking: build a data-based decision-making culture and institutionalize Pareto analysis as the standard for prioritizing tasks, projects, and investments at all levels from operational to strategic.
- Invest in process transparency: direct resources to Process Mining tools to obtain an objective, comprehensive view of actual work flows the necessary basis for any meaningful optimization.
- Approach automation strategically: use Pareto analysis as a filter to identify the most frequent, standardizable, and resource-intensive processes the primary candidates for robotization (RPA), delivering rapid and maximal returns on investment.
- Manage the trivial majority: do not exclude from consideration those 80% of processes or products that generate 20% of the result; treat them as a testbed for experimentation, a source of potential innovations, and a talent pool for future critically important areas.
- The limitations of the study should also be noted: the research is predominantly conceptual and qualitative, based on case analysis and theoretical synthesis. Promising avenues for further inquiry include the development of a comprehensive quantitative model to evaluate the aggregate economic effect (ROI) of implementing the integrated Process Mining – Pareto – RPA cycle in real enterprises, as well as the examination of the applicability and adaptation of the proposed approach in the nonprofit and public sectors, where performance criteria differ from purely commercial ones.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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