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Managing highly complex inventories in large-scale retail: an integrated model for multi-criteria classification, demand forecasting, and service level optimization.

High-complexity inventory management in large-scale retail: an integrated model of multicriteria classification, demand forecasting, and service-level optimization

Highly complex inventory management in large-scale retail trade: an integrated model for multi-criteria classification, demand forecasting and service level optimization

Leandro Sabino

SUMMARY

Large-scale retail inventory management demands differentiated decisions for thousands of inventory units, subject to heterogeneous patterns of demand, value, movement frequency, and criticality. This article proposes an integrated model that combines ABC–XYZ–FSN classification, demand profile-driven forecasting, replenishment policies, and differentiated service level targets. The research is applied in nature, quantitative in approach, and exploratory-descriptive in purpose, articulating literature review, conceptual modeling, and a case study with simulated data. The model organizes the decision-making process into six layers: data quality, segmentation, forecasting, parameterization, execution, and learning. In the illustrative scenario of 10,240 SKUs, the simulated application increased the weighted fill rate from 94.1% to 96.8%, reduced the average inventory by 11.7%, and increased the GMROI from 2.34 to 2.68. The results do not represent a real organization, but they demonstrate how capital reallocation and hedging across segments can reconcile availability and return. It is concluded that complexity should be managed through segmentation, exception governance, and integrated assessment of service, risk, and capital.

Keywords: inventory management; large-scale retail; ABC–XYZ–FSN classification; demand forecasting; service level; GMROI.

ABSTRACT

Inventory management in large-scale retail requires differentiated decisions for thousands of stock-keeping units exposed to heterogeneous patterns of demand, value, movement frequency, and criticality. This article proposes an integrated model combining ABC–XYZ–FSN classification, demand-profile-oriented forecasting, replenishment policies, and differentiated service-level targets.

The study is applied, quantitative, and exploratory-descriptive, combining literature review, conceptual modeling, and a case study with simulated data. The model organizes decision-making into six layers: data quality, segmentation, forecasting, parameterization, execution, and learning. In an illustrative scenario involving 10,240 SKUs, the simulated application increased weighted fill rate from 94.1% to 96.8%, reduced average inventory by 11.7%, and raised GMROI from 2.34 to 2.68.

These results do not represent a real organization; rather, they demonstrate how reallocating capital and protection across segments can reconcile availability and return. The study concludes that complexity should be managed through segmentation, exception governance, and the integrated assessment of service, risk, and capital.

Keywords: inventory management; large-scale retail; ABC–XYZ–FSN classification; demand forecasting; service level; GMROI.

1 INTRODUCTION

The expansion of product range and increased competition have transformed inventory into one of the

The most sensitive decisions in large-scale retail. Operations that manage thousands of units.

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Stock-keeping units (SKUs) coexist simultaneously with
Regular, seasonal, erratic, and intermittent demands. In this environment, apply the same rule of
Replacing all products tends to produce two undesirable results: excess capital.
Fixed assets in low-contribution items and unavailability of goods relevant to the
Revenue and customer experience. Inventory management, therefore, ceases to be an activity
It is merely a registration process and becomes a decision-making architecture that articulates commercial strategy.
Statistics, logistics, and finance.

Operations management literature describes inventory as a decoupling mechanism between
distinct rhythms of supply and consumption, but also as a source of costs, risks and concealment of
inefficiencies. Silver, Pyke, and Thomas (2017) show that inventory policies should balance costs.
of ordering, maintenance, shortages and obsolescence, recognizing the particularities of the standard of
demand and replenishment time. In retail, this balance is more complex because the level of
Service influences not only immediate response, but also brand switching,
Loyalty, pricing, and the perceived reliability of the store. Thus, availability
It needs to be treated as an economic outcome, not as an isolated goal.

The ABC classification, typically based on annual consumption value, remains widespread due to its...
simplicity. However, a one-dimensional analysis may assign similar treatment to items that
They have radically different operational behaviors. A high-value, high-demand product.
A stable product does not require the same forecasting or protection as a product of equal value whose demand...
It occurs sporadically. Flores and Whybark (1986) demonstrate that multicriteria classification
It expands the managerial utility of segmentation by incorporating factors such as criticality, time of
Replacement and possibility of substitution. The integration of the ABC, XYZ, and FSN dimensions constitutes,
In this sense, a more consistent basis for differentiating policies.

The research problem of this article is formulated as follows: how to structure a model
Integrated system capable of segmenting highly complex inventories and selecting forecasting methods.
compatible with demand patterns and establish economically justifiable service levels.
In large-scale retail? The overall objective is to propose an applicable decision architecture.
to extensive portfolios of SKUs. Specifically, the aim is to: establish classification criteria;
Relate segments to forecasting techniques; define replacement parameters; integrate indicators.
operational and financial aspects; and demonstrate the application of the model through an illustrative study.
with simulated data.

The research adopts an applied nature, a quantitative approach, and an exploratory-descriptive purpose.
The method combines a narrative review of inventory management literature with conceptual modeling.
and deterministic scenario simulation. The illustrative study does not represent real company data.

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nor are there any professional results attributable to the author; its function is to demonstrate the logic of the calculation and to allow the model to be reproduced. The expected contribution lies in the connection between four components often treated separately: multi-criteria classification, prediction by Demand profile, differentiation of service levels, and evaluation of capital employed.

The article is organized into seven sections. After this introduction, the complexity of the article is discussed. Retail inventory; then, the ABC-XYZ-FSN multi-criteria classification is presented; the fourth The fifth section examines demand forecasting by segment; the fifth section structures replenishment policies and... service levels; the sixth develops an integrated governance model and indicators; and the seventh This presents a simulated case study. The conclusion summarizes the results, limitations, and possibilities. for future research.

2. INVENTORY COMPLEXITY AND RETAIL PERFORMANCE

The complexity of inventory doesn't stem solely from the quantity of items. It results from the interaction between... variety, heterogeneity of demand, margin differences, space constraints, deadlines Delivery, promotional calendars, shelf life, replaceability, and reliability of records. Fisher (1997) argues that functional and innovative products require distinct supply chains: the The former favor physical efficiency, while the latter demand responsiveness. In Within the same retail network, both can coexist, which makes uniform policies unfeasible and requires... Segmentation driven by economic and operational behavior.

Extensive portfolios also widen the asymmetry between value and managerial effort. A small A single segment of SKUs can concentrate a large part of the revenue or margin, whereas thousands of Slow-moving items absorb storage capacity, counting, replenishment, Parameterization and purchases. The so-called proliferation of SKUs can increase the attractiveness of assortment, but it increases the likelihood of registration errors, fragments demand, and makes obtaining more difficult. of efficient scales. Kök, Fisher and Vaidyanathan (2009) observe that assortment planning must consider both consumer preferences and the physical and economic constraints of operation.

Accuracy of records is a prerequisite for any replacement algorithm. DeHoratius Raman (2008), while investigating stores in a large chain, identified widespread discrepancies. between physical inventory and system records. When the system records a non-existent quantity, the Replenishment may not be triggered and the stockout remains invisible; when physical inventory exceeds the Unnecessary registration and requests increase the excess. Digitization, therefore, does not in itself eliminate the... Deviations: receiving controls, cycle counting, transactional discipline, and audit-based processes.

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Those at risk remain indispensable.

Stockouts should be measured from more than one perspective. The rate per SKU indicates how many items...
They became unavailable; the sales-weighted rate estimates economic relevance; and the
Shelf availability captures gaps between the warehouse and the point of display. Corsten and Gruen
(2003) demonstrate that causes of disruption are distributed along the chain, but a portion
Expressive performance is associated with in-store execution and order processes. This means that raising the bar...
Indiscriminately building up safety stock can increase capital employed without addressing shortcomings.
registration, internal replacement or presentation.

Financial performance requires observing the relationship between margin and speed. Turnover in isolation can
to favor products with high turnover and low profitability, while the isolated percentage margin
It can favor slow-moving items that consume capital over long periods. The Gross Margin Return on
Gross Marginal Return on Investment (GMROI) combines monetary gross margin and average inventory to indicate how much
Margin is generated for each monetary unit invested in inventory. Gaur, Fisher and Raman
(2005) demonstrate that turnover varies systematically between retail companies and should be
interpreted in light of margins, sales growth, and business composition.

Consequently, managing highly complex situations must preserve multiple objectives:
availability of relevant items, reduction of excess, stability of operations, productive use
of capital and quality of information. These objectives may conflict. A level of service
A very high level reduces the likelihood of shortages, but demands increasing safety stock; a
An aggressive inventory reduction policy improves cash flow, but may increase lost sales.
The solution does not consist of maximizing an indicator, but in defining decision boundaries by segment.
and to monitor the cross-effects.

3. Multicriteria Classification ABC–XYZ–FSN

The ABC classification derives from the principle of concentration and organizes items according to a measure of...
economic importance, generally the annual consumption value, calculated by the product of demand
annual and unit cost. Class A typically includes a few items that account for a large portion of the cost.
value; class B occupies an intermediate position; and class C includes a large number of items with
Reduced individual contribution. The percentages are not universal laws. They must be defined.
after inspecting the cumulative curve and in accordance with the company's management capacity, avoiding
Automatic cuts that do not represent the actual distribution.

While useful for prioritizing capital and control, ABC does not describe predictability. The XYZ dimension
It adds the coefficient of variation of demand, expressed as the ratio between the standard deviation and the mean.

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Items X show relatively stable consumption; items Y exhibit moderate variation or
Identifiable seasonality; and Z items have high irregularity. This dimension alters the interpretation.
Regarding risk: an AX item deserves rigorous review for its value, but can be predicted with less error; a
AZ combines economic importance and uncertainty, requiring analytical intervention and collaboration with
suppliers and most frequent decisions.

The FSN dimension classifies items by speed or frequency of movement: fast-moving,
Slow-moving and non-moving. It complements XYZ because variability and frequency are not...
Equivalent concepts. An item may have low but steady demand, or alternate between long periods.
Periods with low demand followed by significant peaks. Identifying stagnant items is...
particularly relevant for discontinuation, transfer, return, markdown or other actions
Clearance sale. Without this filter, products with no prospect of consumption remain included in the targets.
availability issues distort the necessary capital.

Combining the three matrices generates up to 27 cells, but governance does not need to create 27 policies.
distinct. The proposed model consolidates the cells into four decision-making families: strategic,
Predictable, volatile, and residual. The strategic family includes A-class items, especially AX, AY, and AZ, and
This requires managerial supervision. The predictable family focuses on X or fast-moving items with
Intermediate value. The volatile family includes Y/Z items with economic or operational relevance. A
The residual family includes slow-moving or zero-moving C items, in which simplification, purchase under
Demand or assortment review may outweigh maintaining high availability.

The classification should incorporate criticality exceptions. A low-value item may be essential.
to complete a basket, enable the sale of another product, meet a regulatory obligation or
to preserve the store's value proposition. Flores and Whybark (1986) argue that multiple criteria
They avoid inappropriate decisions resulting from a single monetary variable. In the model, criticality
It functions as an overriding rule: critical items are promoted to a control family.
superior, with documented justification, expiration date, and person responsible for the decision. This discipline
It prevents exceptions from turning into permanent preferences without evidence.

Segmentation needs to be recalculated in defined cycles and whenever events change the
Item behavior. Promotions, price changes, competitor entry, substitutions,
Prolonged ruptures and launches can modify means and variances. To avoid instability
For classification purposes, it is recommended to use movable windows, persistence rules, and human review of the data.
most relevant transitions. Classification is not a static label, but a mechanism of
Governance that guides the intensity of analysis, the frequency of review, and the degree of automation.
Allowed.

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Table 1 – Decision-making families of the integrated model

Family	Combinations predominant	Management policy	Priority
Strategic	Class A items critics	Continuous review, analysis of exceptions and collaboration with suppliers	Service and risk
Predictable X and	fast B/C items	Automation, periodic review and consolidated lots	Efficiency
Volatile	Y/Z with relevance	Specific forecast, protection calibrated and flexible	Uncertainty
Residual	C slow or without movement	Buy under demand, rationalization or discontinuation	Capital

Source: author's own elaboration

4. Demand forecasting driven by item profile.

Demand forecasting is an estimate contingent on available information, not a definitive answer.
promise of accuracy. Its usefulness depends less on the nominal sophistication of the algorithm than on the
Adequacy between method, horizon, granularity, and series pattern. Hyndman and Athanasopoulos
(2021) recommend evaluating models through out-of-sample validation and using simple benchmarks.
In retail, observed sales can also be a censored measure of demand: when it occurs
In a breakdown, the historical record shows what was sold, not what the consumer wanted to buy.
Data processing should precede model selection.
Items X, with stable demand, can be predicted using moving averages and simple exponential smoothing.
or trend models when there is persistent growth. The choice should consider error,
Parameter stability and maintenance cost. For Y items, seasonal components and effects of
Calendars are gaining relevance. Holt-Winters methods, ETS models, or regressions with variables are becoming more relevant.
Explanatory factors may represent patterns of seasonality, promotions, and holidays. The use of data
Promotional measures are indispensable when the price substantially alters demand, otherwise...
Confusing commercial effects with structural trends.

Z items and items with intermittent demand require specific treatment. Croston (1972) proposed estimating

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separately the size of positive demands and the interval between occurrences. Syntetos and Boylan (2005) demonstrated the bias of the original method and developed a widely used correction.

The indiscriminate application of averages or continuous models to series with many zeros tends to This produces forecasts that are difficult to interpret and excessive inventory. For low-value, high-value items Intermittent production, on-demand purchasing policies, or assortment review can be economically viable. preferable to complex predictions.

Error assessment must be consistent with the portfolio. MAPE becomes unstable in the face of values Real numbers equal to or close to zero, a recurring situation in intermittent series. Hyndman and Koehler (2006) propose the Mean Absolute Scaled Error (MASE), which allows comparison between series and avoids There are some limitations to percentage measurements. In retail operations, WAPE can offer a reading... The aggregate is accessible, but strategic items should be examined individually. It is recommended. Combining bias, absolute error, error per segment, and monetary impact, since small errors in Expensive products can account for large percentage errors in residual items.

The forecast needs to be reconciled with business decisions. Launches have no history. own products; promotions generate uplift; substitutes divide demand; and changes in exposure alter sales. In these situations, structured judgment and causal information complement the models. The The Sales and Operations Planning process, adapted to retail, can bring together purchasing, operations, Finance and sales departments are responsible for recording assumptions and resolving discrepancies. Manual adjustments should be made. documented and subsequently evaluated, allowing for a comparison of the value added by the intervention. human error in relation to the initial statistical prediction.

The proposed model establishes a prediction championship by item family. Simple methods and Advanced models are re-evaluated in mobile windows, and the winner is selected based on performance outside of that window. Sample size, stability, and computational cost. Machine learning is not assumed to be superior. For short, unstable series or those with structural changes, its flexibility can increase the Overfitting. Governance should maintain a reference method, track versions, and prevent overfitting. Changes in algorithms should be mistaken for operational improvements resulting from other initiatives.

5 POLICIES FOR REPLACEMENT AND OPTIMIZATION OF SERVICE LEVELS

Transforming a forecast into a decision requires defining when and how much to replenish. In a policy of Continuous review (s, Q), an order for quantity Q is issued when the stock position reaches the point s. In periodic review (R, S), the stock is examined at each R interval and raised to the level S. Silver, Pyke, and Thomas (2017) highlight that the choice depends on the item's value and cost.

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Monitoring of order constraints and system capacity. Items A justify control.
continuous; C items can be grouped into periodic cycles and simplified rules.
The reorder point can be expressed as the expected demand during the lead time plus the
Safety stock. Under usual assumptions, ROP = ÿL + zÿL, where ÿL represents the average demand.
during the replenishment time, ÿL, its standard deviation, and ez, the factor associated with the service level of
cycle. The formula is conceptually simple, but its application requires simultaneous estimation.
Demand and lead time uncertainties. Use the contractual deadline instead of the actually observed deadline.
It artificially reduces safety stock and transfers risk from the supplier to the store.
Cycle level of service and fill rate are not equivalent. The former measures the probability of not...
The first represents a shortage in a cycle; the second represents the fraction of demand met directly by...
Inventory. Two items may share the same probability of stockout, but have different volumes.
There are very different shortages. For retail, the service rate is usually closer to...
Economic experience, although measurement depends on uncensored demand data. The
The model recommends associating fill rate targets with decision-making families and verifying the marginal cost of
raise every goal.

Economic optimization requires estimating the cost of shortages, which is often difficult to observe. Not all
A stockout results in a definitively lost sale: the consumer can replace the item, postpone the purchase, or simply replace it.
buy or look for another store. Campo, Gijsbrechts and Nisol (2000) show that the answer depends
based on the product characteristics, the store, and the occasion of purchase. Thus, destination products, items without
Substitutes and essential components of a basket justify superior protection. Products that are easily...
Replaceable options can operate with lower targets, provided the alternative is available and the decision
Do not jeopardize relationships with strategic brands.
Supplier and purchasing restrictions alter the theoretical solution. Minimum quantities, multiples of
Packaging, discounts, receiving capacity, and delivery frequency can all affect the batch.
Great classic. The policy should consider the total cost of ownership, not just the unit price.
Discounts that increase average inventory and obsolescence can negate acquisition gains. For
volatile items, frequent replenishment agreements, reduced lead time, volume flexibility or
Consignment sales can produce more value than price negotiation alone.
In the integrated model, the initial fill rate targets are differentiated: 98% for the strategic family,
96% for the predictable, 93% for the volatile, and 88% for the residual, subject to economic calibration.
These values do not constitute universal standards; they function as starting parameters for the
Simulation. The company must test cost-service curves and establish capital limits. The review
Monthly comparisons include availability, stockouts, excess inventory, and GMROI, while critical exceptions are...
monitored on a weekly or daily basis.

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Table 2 – Initial parameters by family

Family	Revision	Initial fill rate	dominant decision
Strategic	Continuous/weekly 98%		Availability with control of risk
Predictable	Weekly/periodic 96%		Automation and efficiency
Volatile	Weekly and by exception	93%	Flexibility and information
Residual	Monthly/under demand	88%	Reduction of capital employed

Source: author's own elaboration. Illustrative goals, subject to economic adjustment.

6. Integrated Governance and Measurement Model

The proposed model is organized into six layers: data quality, segmentation, prediction, parameterization, execution, and learning. The first validates registration, balance, lead time, calendar, and Sales history. The second classifies items into ABC–XYZ–FSN and applies criticality rules. The third selects forecasting methods based on behavior. The fourth calculates policies and targets. service. The fifth controls orders, receiving and shelf restocking. The sixth compares results, It investigates deviations and updates parameters. The sequence avoids automating decisions based on data. defective.

Governance requires clear decision-making rights. The data team maintains definitions, lineage, and... Quality; purchasing is responsible for suppliers and conditions; operations ensure physical execution; Sales records promotions, replacements, and new product launches; finance establishes the cost of capital and... Budgetary constraints. A stock committee resolves exceptions that cross areas, but should not. Manually review all items. The principle is management by exception: algorithms handle them. Routine situations, while people focus their attention on strategic items, abrupt changes and conflicts of purpose.

The control panel should separate leading and following indicators. Among the leading indicators... These include registration accuracy, lead time stability, forecast coverage, and adherence to parameters. and supplier punctuality. Consequences include fill rate, stockouts, and lost sales.

Estimated values, average inventory, turnover, obsolescence, and GMROI. Reading them together prevents misinterpretations.

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Precipitous causal factors. An improvement in availability accompanied by disproportionate growth.
The lack of inventory may indicate that the result was purchased with excessive capital, and not obtained through greater means.
efficiency.

GMROI is calculated by dividing the annual gross margin by the average cost of inventory. A result
A value of 2.5 indicates that each monetary unit invested in inventory generated 2.5 units of margin.
gross during the period. The comparison must respect categories with distinct economic structures and
Consider seasonality. For short-term decisions, inventory days, sell-
through markdown. The goal is not to convert GMROI into an absolute indicator, but to integrate it into
Service level to simultaneously evaluate return on investment and availability.

Controlled experimentation enhances learning. New policies can be applied to groups.
Comparables from different stores or categories, preserving a control group whenever possible. Differences
In terms of differences, interrupted time series and staggered tests help to separate the effect of
The intervention of seasonality and general trends. The evaluation must be defined before the
Implementation, with assumptions, metrics, and a timeframe. Without this design, inventory reductions or
Sales increases may be incorrectly attributed to the model.

Change management completes the architecture. Technical parameters fail when they are not integrated.
to the routines of ordering, receiving, counting, and displaying. Training should explain not only the
The operation of the system, but also the rationale for the controls and the impact of errors, are important. Incentives are also needed.
to be balanced: exclusive sales targets can encourage overbuying, while other targets
Exclusive stock options can cause stockouts. Shared responsibility should combine...
Service, capital, margin, and quality of execution.

7. Illustrative Case Study with Simulated Data

To demonstrate the application, a simulated scenario of a retail operation was built with
10,240 SKUs, twelve months of historical data, and three fulfillment centers. The data was generated for
to represent different distributions of value, frequency, and variability. The baseline scenario used
Uniform bi-weekly review, 95% service target, and safety stock calculated by average.
historical data without differentiation. The proposed scenario applied the ABC–XYZ–FSN classification methods.
Forecasting by family, continuous review for strategic items, and differentiated fill rate targets. No.
This refers to empirical evidence about a specific company.

In the segmentation, 12% of the items were classified as A and accounted for 71% of the annual value of
consumption; 23% belonged to class B and accounted for 19%; and 65% were in class C, with 10%.
Regarding the value. Due to variability, 31% were X, 37% Y, and 32% Z. As for the movement, 46% were

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fast, 39% slow, and 15% with no relevant movement on the horizon. The crossover revealed that 4.8%
The portfolio combined Class A and Z profiles, constituting the main area of economic risk.
Items AX underwent exponential smoothing and continuous review; AY received models
Seasonal and weekly review; AZ combined probabilistic forecasting, management review, and agreements.
Flexibility. Fast-moving CX items were administered in periodic review batches.
Consolidated. Slow or stagnant CZ items were directed to assortment analysis, purchase.
on demand or discontinued. The procedure reduced the amount of routine manual decisions.
and focused human analysis on the segments with the greatest impact.
After twelve simulated monthly cycles, the weighted fill rate increased from 94.1% to 96.8%, while
The average inventory at cost decreased from 8.40 to 7.42 million monetary units, a reduction of 11.7%.
The sales-weighted stockout rate fell from 5.9% to 3.2%. Annual turnover increased from 6.1 to
6.8, and the GMROI increased from 2.34 to 2.68. The results represent the mechanics of the model under
Controlled assumptions and should not be interpreted as a promise of performance in applications.
real.

The decomposition indicated that the greatest capital gain occurred in the slow-moving C items.
While the greatest service improvement occurred in the A categories with stable and seasonal demand. In the A and Z categories,
The reduction in disruption was smaller and required more frequent review, confirming that the high uncertainty...
The problem isn't solved simply by increasing inventory. Reducing simulated lead time and increasing the flexibility of...
The batches contributed significantly. This shows that supply and quality policies of
This information complements statistical calculations.
A sensitivity analysis increased the cost of capital and amplified the variability of the lead time.
Despite higher capital costs, the optimal solution reduced residual item targets and accelerated the process.
Discontinuation of unmoved items. With a more unstable lead time, the safety stock of
Strategic items increased, and some of the financial gain disappeared. The result reinforces that
Parameters should be updated, and fixed targets should be avoided when disconnected from the economic environment.
and the performance of suppliers produce false accuracy.
This case illustrates three managerial conclusions. First, segmenting doesn't just mean organizing.
reports, but associate each class with a decision. Second, forecasting without a replacement policy and
Disciplined execution does not produce availability. Third, reduce inventory and improve service.
Simultaneously, it is possible when excesses and protections are reallocated between segments, but not
This constitutes an automatic result. Actual implementation requires a pilot program, reliable data, and measurement of...
Censored sales and statistical evaluation of the effect.

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Table 1 – Results of the simulated scenario

Indicator	Base scenario	Integrated model	Variation
weighted fill rate	94.1%	96.8%	+2.7 pp
Average inventory at cost	8.40 million	7.42 million	-11.7%
Balanced rupture	5.9%	3.2%	-2.7 pp
Annual turnover	6.1	6.8	+11.5%
GMROI	2.34	2.68	+14.5%

Source: own elaboration with simulated data.

CONCLUSION

Managing highly complex inventories in large-scale retail requires abandoning the assumption that...
that thousands of SKUs can be managed by a uniform policy. The heterogeneity of
Value, variability, frequency, margin, criticality, and replacement time create distinct risks and
This article proposes an integrated model that connects classification.
ABC–XYZ–FSN, demand profile-driven forecasting, replenishment policies, targets
Service economics and return on capital indicators.
The ABC classification retains its usefulness as an instrument for economic prioritization, but becomes
insufficient when used in isolation. The incorporation of the XYZ and FSN dimensions allows
Distinguishing between predictability and speed, while the criticality rule protects items whose role...
Strategic factors are not captured by the annual consumption value. The consolidation of the 27 combinations
Potential pooling of resources in four decision-making families reduces managerial complexity without eliminating differences.
Relevant factors. In this way, segmentation begins to guide the method, frequency of review, and level of...
Automation and responsibility.
Analysis of the forecast demonstrated that there is no universally superior method. Stable series.
These needs can be met by simple techniques; seasonal patterns require specific components; and
Intermittent demands require specific methods or alternative decisions to maintaining the...
Inventory. Out-of-sample validation, choosing appropriate metrics, and sales management.
Censored by rupture are fundamental conditions. The value of the prediction emerges when it is
converted into replacement parameters and revised in light of commercial decisions.

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The differentiation of service levels constitutes the economic core of the model. Maximum targets.
Indiscriminate application of these measures increases safety stock and masks the marginal cost of...
Availability. By relating fill rate, substitutability, margin, criticality, and stockout cost, the
The company can protect strategic items and simplify the handling of waste items. Stability
Lead time and supplier flexibility appear to be just as relevant variables as
Variability in demand expands management beyond the internal boundaries of the store.
The illustrative study demonstrated the logic of reallocation: reducing capital in slow-moving and non-renewable items.
A movement to expand protection and attention in the most impacted segments. The results
Simulations indicated a combined improvement in fill rate, turnover, and GMROI, but were presented
deliberately as a demonstration, not as business evidence. In real-world applications, effects
These should be identified by pilots, comparable groups, and quasi-experimental methods.
Caution is essential to separate the model's gains from price changes, seasonality, and promotions.
or overall market growth.
As limitations, the model does not explicitly incorporate pricing decisions, competition for space,
SKU substitution, multiple stochastic links, or granular capacity constraints.
Future research could integrate assortment and space optimization, and machine learning.
Probabilistic, promotional elasticity, sustainability, and multi-echelon policies. It also deserves...
investigating the relationship between record accuracy, work practices, and algorithm performance.
because the quality of execution remains crucial even in digital environments.
It can be concluded that excellence in inventory management is not simply about reducing quantities or increasing them.
Availability. It consists of allocating information, capital, and managerial attention according to risk.
and the contribution of each item. A highly complex system becomes manageable when its
Differences are recognized, their parameters are verifiable, and their results are evaluated in a way...
Integrated. Thus, inventory management is consolidated as a strategic competence capable of sustaining
Margin, service, and resilience in large-scale retail.

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