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Economic and operational sustainability in composite manufacturing pharmacies: activity-based costs, production capacity, and decision indicators.

Economic and Operational Sustainability in Compounding Pharmacies: Activity-Based Costing, Production Capacity, and Decision-Making Indicators

Economic and operational sustainability in computing pharmacies: cost based on activities, production capacity and decision indicators

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Summary

This article analyzes the economic and operational sustainability of compounding pharmacies in the face of a high product mix, low volumes, and quality requirements. Through a structured narrative review, it integrates activity-based costing, capacity, pricing, indicators, and quality costs. It argues that raw materials and percentage margin are insufficient to explain the cost of serving; time, complexity, controls, losses, and idle capacity also consume resources. A conceptual map connecting resources, activities, cost objects, and a balanced panel is proposed. The study does not present primary data or a universal pricing formula.

Keywords: compounding pharmacy; activity-based costing; pricing; capacity; indicators; operational sustainability.

Abstract

This article analyzes the economic and operational sustainability of compounding pharmacies operating with high product variety, low volumes, and demanding quality requirements. A structured narrative review integrates activity-based costing, capacity, pricing, performance indicators, and quality costs. Raw-material cost and percentage margin alone are insufficient to explain the cost to serve; time, complexity, controls, losses, and idle capacity also consume resources. A conceptual map links resources, activities, cost objects, and a balanced dashboard. The study presents no primary data or universal pricing formula.

Keywords: compounding pharmacy; activity-based costing; pricing; capacity; indicators; operational sustainability.

Introduction

Compounding pharmacies operate under an economic combination that is not very compatible with conventional models.

Traditional mass production methods. The variety of formulas is high, the batches are small, and each

The request may require interpretation, calculation, separation, preparation, control, documentation and

Specific guidance. Indirect costs assume significant weight, while simple multiplication...

Using a margin factor to calculate the value of inputs tends to mask differences in complexity and consumption.

capacity.

Financial sustainability cannot be separated from quality. Reducing controls, training, or

Maintenance can improve short-term accounting results, but it can also reduce rework and losses.

Complaints and risk in the following period. The World Health Organization estimates this at US$42 billion.

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The annual overall cost associated with medication errors, given that it encompasses the entire medication use system.
medications and should not be specifically attributed to compounding (WHO, 2017). Still,
The magnitude illustrates that failures also have an economic dimension.
Activity-based costing seeks to explain how resources are consumed by processes and
cost objects. Kaplan and Cooper (1998) advocate integrated systems that connect information
financial and operational learning. In a compounding pharmacy, this logic allows one to distinguish
formulas that require different times, controls, equipment, or skills, reducing
invisible cross-subsidies between products and customers.
The goal is to propose an educational framework for cost, price, capacity, and decisions.
performance. The article does not use data from any specific company, does not recommend trading values, and
The text does not report the author's professional experiences. The central thesis is that sustainability depends on...
Understanding the cost of service, preserving capacity for essential controls, and balancing indicators.
financial, operational, quality and learning.

Methodology

A structured narrative review of the literature on management accounting, operations, was conducted.
quality and drug safety. The question required integrating concepts developed in
Distinct fields were studied without estimating the combined effect; therefore, the label "systematic review" was not used.
Justification, research, referencing, and scientific reasoning were guided by the SANRA domains.
(BAETHGE; GOLDBECK-WOOD; MERTENS, 2019).
Original works and institutional sources were prioritized: Kaplan and Cooper on cost-sharing.
activities; Kaplan and Norton on balanced performance; Little on the relationship between inventory in
Process, flow rate and time; Hopp and Spearman on operational dynamics; ISO 9001 on management by
processes; and WHO on harm and cost associated with medication errors. Commercial materials of
Pricing was excluded. The survey adopted a time limit of December 31, 2025;
Therefore, ISO 9001:2015 was considered in its current edition within the documentary scope, without
incorporate revision projects or subsequent publications.
The analysis was organized into six axes: cost architecture; capacity and variability; pricing;
Quality costs; indicators; and investment and growth decisions. For each axis, the following were considered:
Separate accounting metrics, operational relationships, and managerial choices. This distinction avoids
transform descriptive measures into automatic recommendations or present correlation as
causality.

Figure 1 summarizes the link between resources, activities, cost objects, cost of service, and price.

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and a balanced panel. The design is conceptual and does not prescribe a mandatory accounting method. Drivers, allocation criteria, capacity cost, and pricing rules should be defined with Local data, professional review, and compliance with applicable accounting and health regulations.

1. Economic structure of small-batch customization

Personalization changes the economic unit of analysis. A capsule, cream, or solution is not... It represents only raw materials and packaging; it incorporates customer service, analysis, and other activities. Preparation, cleaning, checking, control, and documentation. The cost of service varies with complexity, urgency, potency, pharmaceutical form, batch size and need for specific equipment or environments.

Direct costs can be associated with the order relatively easily. Supplies, packaging, and labor. Directly identifiable work costs are examples. Indirect costs — supervision, rent, technology, Qualification, maintenance, and quality—require guiding principles. Allocations based solely on Volume tends to penalize simple preparations and underestimate formulas that require more effort. intensive.

Kaplan and Cooper (1998) propose observing resources, activities, and cost objects. The model does not Eliminates judgment: requires choosing activities with useful granularity and drivers that explain Consumption. Counting each micro-task makes the system expensive; grouping too many destroys capacity. Explanatory. Architecture should support decisions, not exhaustively reproduce the process.

Capacity costs deserve separate consideration. People and facilities are contracted before their arrival. Full utilization. When demand falls, part of the cost remains. Imputing all idle capacity to... Orders lead to rising prices and can further reduce volume. Separate utilized capacity. And when not used, it allows for clearer discussion of scale, agenda, mix, and investments.

Economic understanding must also acknowledge health constraints. Not all capacity is... Fungible: a room, equipment, or qualified professional may not be transferable between processes. Nominal capacity differs from practical capacity because it includes breaks, cleaning, maintenance and Ignoring these needs and controls turns apparent efficiency into operational weakness.

2. Activity-based costing and cost of service

Activity-based costing is based on the idea that products consume activities and activities consume resources. In compounding pharmacies, possible drivers include the number of weighings, minutes of equipment, processed orders, conferences, cleaning, analysis and deliveries. The choice depends

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based on a plausible causal relationship and data availability, not on mathematical convenience.

Time can act as a driver when resource intensity is relatively low.

homogeneous. However, minutes from a specialist, a critical room, and common equipment.

They are not equivalent. Models need to distinguish between capacity rates and special conditions.

Measurements must be precise enough for decision-making, without creating unproductive surveillance or

to interrupt the work.

Losses, rework, and returns shouldn't disappear in averages. When incorporated...

Regardless of the standard cost, they fail to signal opportunities for improvement. Management can separate

The expected cost of the process and the cost of non-compliance, while preserving visibility. This separation

This doesn't mean excluding losses from the financial results, but rather avoiding treating them as inevitable.

The cost of service includes activities related to the channel and the customer: clarifications, documentation.

Additional information, splitting, logistics, billing, and support. Two orders with the same value of supplies.

They may require different levels of effort. Understanding this difference allows for the redesign of processes and guidance.

Establish transparent channels and policies, without assuming that all costs should be passed on.

individually.

Models should be updated when prices, wages, technology, volume, or processes change.

A spreadsheet that is correct at the initial stage quickly becomes invalid. Periodic reviews are necessary.

Check drivers, rates, and capacity. The goal is not to produce absolute true cost.

but a consistent and explainable estimate for comparison and decision-making.

3. Capacity, flow and demand variability

Productive capacity depends on the limiting resource. Increasing the number of people at one stage does not increase the...

Flow management when the bottleneck is in the equipment, the conference, or the environment. Map queues and times.

It helps to distinguish between busyness and productivity. Overused resources can lead to waiting times.

excessive and render the system incapable of absorbing emergencies or normal variations.

Little's Law relates average work-in-process inventory, turnover rate, and average dwell time.

in stable systems (LITTLE, 1961). The relationship is a mathematical identity under its conditions, not

performance target. It helps to realize that increasing orders in process, without an increase

Corresponding flow rate extends deadlines. Reducing simultaneous work can improve flow without

to speed up individual tasks.

Variability stems from irregular arrival times, varying complexity, rework, absences, and failures.

Supply. Hopp and Spearman (2008) show that variability and high utilization increase queues.

Planning capacity exactly equal to the average leaves little room for maneuver. Operational slack can be...

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Rationality is key when it protects deadlines, quality, and the ability to respond to unexpected events.
Promised deadlines should take into account available capacity and confirmed product mix. Unique rules may apply.
Hide differences between preparations. Scheduling, compatible grouping, and work limits.
In the process they help, as long as they don't create unnecessary waiting or conflict with stability and
Clinical priority. The timeline indicator needs to separate internal delays from external dependencies.
Investments in automation should be evaluated within the entire workflow. Accelerating one step can...
relocating the bottleneck and increasing subsequent queues. Relevant benefits include a reduction in
Variability, traceability, ergonomics, and quality, as well as speed. The decision should compare...
Total cost, integration, training, maintenance, and risk of technological dependence.

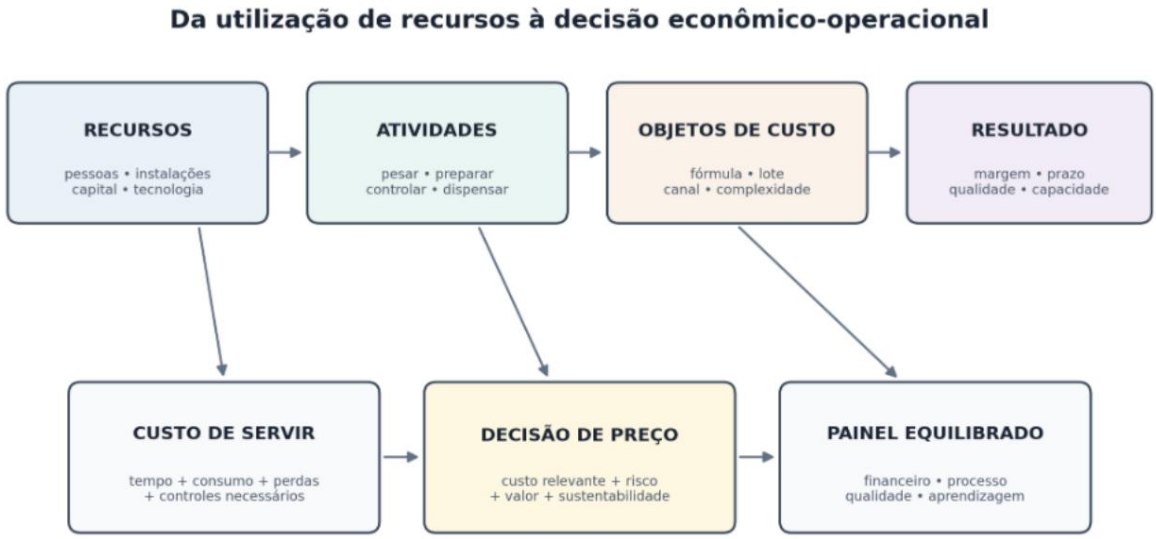


Figura 1 — Da utilização de recursos à decisão econômico-operacional.
Fonte: elaborado pela autora com base em Kaplan e Cooper (1998) e Kaplan e Norton (1992).

4. Pricing, margin and sustainability

Price is not synonymous with cost plus a percentage. It needs to take into account relevant costs.
Positioning, perceived value, risk, competition, and sustainability. A universal formula.
It ignores elasticity, complexity, and strategic objectives. Knowledge of cost establishes limits.
Informational; it does not, by itself, determine commercial value.
Percentage margins can lead to misinterpretations. Low-priced products may...
present a high percentage but an insufficient absolute contribution; expensive items may have a percentage.
smaller and relevant contribution. The analysis should separate revenue, variable cost, contribution, consumption.
Capacity and fixed expenses. Decisions based on a single index can deteriorate the mix.

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Cross-subsidies can be deliberate or invisible. In some cases, maintaining low service levels can lead to this.
The margin serves the clinical purpose or the relationship. The decision is legitimate when the cost is
known and consciously funded. When the subsidy arises from inadequate allocation, it
It distorts expansion, negotiation, and prioritization. Internal transparency does not require exposing structures.
Confidential to the market.

Adjustments need to reflect changes in cost and strategy, without being automatic. Variations in inputs,
Exchange rates, labor costs, and regulations may justify a review. The frequency should balance timeliness and...
Commercial stability. Scenario simulations help to assess volume, mix, and sensitivity, but
They cannot predict market behavior with certainty.
Discount policies should define their purpose and authority. Discounts without volume restrictions,
Payment method, channel, or strategy reduces results and can create inconsistency. Accurate evaluation is necessary.
Consider incremental contribution, capacity, and precedent risk. Sustainability protects the
continuity of service; it does not oppose accessibility, which requires explicit choices and models.
suitable.

5 Costs of quality and non-quality

Quality costs encompass prevention, appraisal, and failures. Training, qualification, maintenance.
Process design and planning are preventative measures; inspections and tests are evaluative measures; rework and disposal are not.
Complaints and collection are flawed. The classification helps to show that saving money is important in prevention.
This can increase future costs, although there is no universal solution.
Internal failures consume materials, time, and resources before delivery. When only recorded...
As with inventory adjustments, their operational causes disappear. External failures add to this.
communication, logistics, reputation, and potential damage. The monetary cost does not fully capture the
Clinical, ethical, or regulatory consequences; therefore, prioritization cannot be limited to accounting value.
The WHO estimated the annual global cost associated with medication errors at US$42 billion (WHO,
(2017). This number encompasses various systems and stages and does not measure the compounding pharmacy sector. Its function
The purpose of this article is to demonstrate that security and economics are related on a systemic scale, not to serve as a basis for...
Financial projection for a company.
Investments in quality should have a potential benefit. Reduction of rework, downtime.
Investigation, variation, and complaints can be measured. Less direct benefits, such as trust.
Knowledge retention and efficiency require complementary indicators. The absence of immediate feedback
This does not make a control unnecessary when it meets a sanitary requirement or protects against a
serious risk.

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The optimal balance is not a fixed point. New formulas, volumes, suppliers, and technologies change it.
Risk and cost. Reviewing the composition of quality costs helps to shift detection resources.
Late implementation for prevention and robust design. The goal is not to minimize all quality spending, but
Reduce overall cost and exposure without compromising patient protection.

6 Indicators and decision governance

Financial indicators show consequences, but rarely explain causes. Revenue, margin and
Cash flow should be combined with deadlines, productivity, losses, deviations, complaints, maintenance and
people development. Kaplan and Norton (1992) proposed balancing financial perspectives,
of customers, processes, and learning. Adaptation to the compounding pharmacy sector must preserve requirements.
sanitary facilities and avoid copying generic panels.
Each indicator needs an operational definition, unit, frequency, source, and responsible party. Terms
Productivity, rework, or delays can vary between areas. Without a dictionary, trends...
They mix real changes and changes in the register. The denominator should track volume and
Complexity; isolated counts may penalize growth or mask deterioration.
Goals alter behavior. Pressure for speed can reduce documentation; few goals.
Deviations can encourage underreporting; maximum occupancy can increase queues. Indicators need to be accurate.
to be analyzed in pairs or sets that reveal trade-offs. The panel should generate questions, not
to reward numbers out of context.
Performance meetings need to end in traceable decisions. Significant deviation should produce...
Analysis, responsibility, deadline, and verification. Not every variation requires intervention; excessive reactions.
They increase instability. Action limits should consider trend, process capability, and...
As a result, distinguishing noise from signal.
The proposed structure connects cost, capacity, price, quality, and learning. It is not a system.
Validated accounting, pricing algorithm, or performance guarantee. The application requires data.
Local and accounting, pharmaceutical, and legal competencies. Future research may test
Drivers and relationships between mix, capacity, and failure costs in different contexts.

Conclusion

The sustainability of a compounding pharmacy depends on understanding the economics of variety.
Small batches and heterogeneous formulas mean that indirect activities represent a significant portion.
The relevant cost factor. Raw materials and percentage margin, in isolation, do not explain consumption.

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neither the resources nor the required capacity.

Activity-based costing provides a useful language for relating resources, processes, and cost objects.

Its value lies in its managerial explanation, not in the promise of absolute precision. Granularity

Excessive aggregation makes the system more expensive; excessive aggregation hides complexity. The design should be...

proportional to the decisions it needs to support.

Capacity should not be confused with occupancy. Operating close to the limit in a variable environment.

It increases queues and reduces response times. Slack can represent protection of deadlines and quality.

Investments need to be evaluated within the entire process to avoid creating bottlenecks.

Pricing requires more than just applying markup. Relevant costs, contribution, capacity, value,

Competition and positioning are the problem. Cross-subsidies can be strategic.

When they are conscious, they are dangerous, but they arise from divisions that no one understands.

Costs of quality demonstrate that prevention, appraisal, and failures compete for resources. Cuts

Indiscriminate actions can transfer expenses to rework, complaints, or risk. The managerial objective

The goal is to reduce overall cost and exposure while preserving mandatory controls and patient protection.

Balanced dashboards help connect financial results to processes and learning.

Indicators need stable definitions, denominators, and to be interpreted collectively. Isolated goals are not enough.

They encourage behaviors that may contradict the purpose of the system.

The decision to grow, automate, or expand the product mix should combine financial scenarios and capacity.

Operational. Projections do not eliminate uncertainty; they make assumptions visible. Governance needs

Monitor results and correct course when effects differ from what was expected.

It is concluded that economic and operational sustainability is built upon the integration of cost,

Flow, quality, and strategy. The synthesis presented serves teaching and planning purposes, without prescribing.

Price or universal accounting model. Its responsible application requires proprietary data and review.

periodic and in compliance with sanitary requirements.

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