

# Menu Engineering: Mathematical Models to Restructure Your Offering by Popularity and Marginal Profitability

By  **Diego F. Parra** · Updated 2026-07-06 · Expansion & Franchising

**MASTERRESTAURANT®**

White Paper

## Ingeniería de Menús: Modelos Matemáticos para Reestructurar tu Oferta po...

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### QUICK VERDICT

The error I see over and over: scaling a menu designed by the chef's intuition. Before opening the second unit, restructure by two measurable axes —popularity (menu index >70%) and contribution margin in absolute dollars, not percentage— and classify every dish in the Star / Plow-horse / Puzzle / Dog matrix. Without that mathematical model, the replicable operations manual propagates marginal inefficiency to every franchise. With it, an F&B group recovers 3-6 contribution-margin points per unit before committing expansion CapEx.

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Menu engineering isn't a pretty color board: it's a two-variable optimization model that decides which dishes sustain your EBITDA when you move from one unit to a network. In 2026, with volatile input inflation and tight unit economics, scaling without restructuring the menu multiplies the error, not the win. This technical document

—signed by Diego F. Parra and the Masterrestaurant methodology— treats the menu as a financial portfolio under a CFO's discipline, not the cook's hunch.

Each dish is an asset with a return (contribution margin in dollars) and a demand (popularity index). A restaurant group leader's goal is not the 'highest-percentage-margin' dish —a classic trap— but the mix that maximizes absolute margin per guest at replicable scale. Food cost stays the dish's only direct cost (32% maximum target); payroll, rent and utilities live in the break-even, not on the dish card.

I've seen it in dozens of operations: the menu that worked in the pilot unit gets frozen and copy-pasted into the franchise manual. When theoretical vs actual cost diverges in the second kitchen, no one has the model to diagnose it. Here we build that model, chapter by chapter, with the formulas, the three vector tables and the stress tests a head of expansion can take to the board and to due diligence.

## SIDE-BY-SIDE COMPARISON

### Side-by-side comparison

	<b>INTUITION-BASED MENU (INHERITED)</b>	<b>MATHEMATICAL-MODEL MENU (MTIE)</b>
<b>Decision criterion</b>	✗ Chef's taste / margin %	✓ Contribution margin in \$ × popularity
<b>Average contribution margin per guest</b>	✗ \$4.10	✓ \$6.80
<b>Active 'Dog' dishes on the menu</b>	✗ 31%	✓ 8%
<b>Weighted food cost</b>	✗ 34%	✓ 29%
<b>Theoretical vs actual cost variance</b>	✗ 6.2%	✓ 1.8%
<b>Replicability in franchise manual</b>	✗ Low (tacit)	✓ High (documented algorithm)
<b>EBITDA impact per unit (12 months)</b>	✗ Baseline	✓ +7.4 pts

### Chapter 1 — The macroeconomic context that forces restructuring before scaling

The 2026 context makes scaling an intuition-designed menu unviable: three macro indicators squeeze margin at once. Food-away-from-home inflation reported by USDA and BLS has run above headline CPI in most recent quarters, moving prime cost by 4 to 9 points in 18 months. The National Restaurant Association documents that operators absorb much of those hikes for fear of losing traffic. And spending on food away from home, per [ers.usda.gov](https://www.usda.gov), already tops at-home spending: the guest is there, but price-sensitive. In this setting, every mis-assigned food-cost point multiplies by the number of units. The mistake I see again and again: the pilot menu gets

frozen and replicated without recalculating. Diego F. Parra insists at Masterrestaurant: menu engineering isn't aesthetics, it's macro-level margin defense before any expansion CapEx is committed. Treat each dish as a portfolio asset: it has a return (contribution margin in dollars) and a demand (menu index).

## Chapter 1 — The menu as a financial portfolio, not the cook's taste

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A restaurant group leader's goal is not the highest-percentage dish—a classic trap—but the mix that maximizes absolute margin per guest, replicable across 5, 10 or 40 units. In consulting I find 40-60 item menus where 20% of dishes deliver 60-70% of margin and the rest only add complexity. Statista and Datassential agree that 2026's most profitable menus are cutting references, not adding them. Cutting well isn't impoverishing: it's concentrating demand on the assets that pay payroll and rent. Implication for the operator: freeze 90 days of POS history before deciding anything, and calibrate the food-cost ceiling by segment. That's where the real money begins, and where the network decides to scale margin or dilute it unit by unit. Percentage margin lies when you scale; dollar contribution margin is what pays payroll and rent. A real cash example: dish A sells at 12 USD with 68% margin, leaving 8.16 USD per unit; dish B sells at 24 USD with 55% margin, leaving 13.20 USD.

## Chapter 2 — Why percentage margin is the flaw that bleeds the network

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The chef's intuition pushes A because its percentage shines, but B generates 62% more dollars per guest. Multiply that by 180 covers a day across 30 units: roughly 27,000 USD/day of added contribution the pretty menu leaves on the table. Diego F. Parra repeats it in every Masterrestaurant audit: the board does not collect percentages, it collects dollars. The cost of not acting is measurable: in a 10-unit network at 4.2M USD per unit, 5 food-cost points on 42M USD is 2.1M USD of margin evaporating each year. Optimizing for the lowest food cost, blind to the absolute dollar, is the bias that destroys most margin at scale. The cost of inaction is brutal and countable. An inherited menu typically drags a weighted food cost of 34% versus an achievable 29%: on 42M USD of network sales, those 5 points are 2.1M USD a year.

## Chapter 2 — The quantified cost of not restructuring

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Add the theoretical vs actual cost variance: in kitchens without a documented algorithm, that gap runs 4-6 points—waste, theft, inconsistent portioning—versus a mature target of 1.5-1.8. Add the opportunity cost of keeping 31% Dogs active, consuming mise en place, line time and menu space without paying rent. Implication for the operator: stop defending dishes by percentage and defend them by dollars per guest weighted by popularity index. Reorder the conversation with the chef—cook optimizes flavor, operator optimizes replicable contribution. That single shift changes the unit economics of the entire network, and it's the difference between funding your own expansion with cash and borrowing to plug an undiagnosed leak. The MTIE model crosses two measurable variables with explicit formulas. First, the popularity index:  $\text{Menu index} = (\text{dish units sold} \div \text{total units}) \div (1 \div \text{number of dishes}) \times 100$ ; popularity threshold = >70% of the expected category average.

## Chapter 3 — The theoretical framework: two variables and their formulas

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Second, absolute contribution margin:  $\text{CM} = \text{selling price} - \text{theoretical portion cost}$  (from the standardized recipe), in dollars, never percentage. A dish is 'high margin' if its CM beats the menu's weighted average CM. With those two coordinates, each item lands in a quadrant. The third formula governs the franchise:  $\text{Variance} = (\text{Actual Cost} - \text{Theoretical Cost}) \div \text{Sales}$ , in percentage points. Diego F. Parra uses it as a discipline thermometer: without a written formula the franchisee improvises; with it, they reclassify with the same criterion in any city. The model demands no data a modern POS doesn't already capture—but it demands hygiene. The model rests

on explicit assumptions you must declare to avoid fooling yourself. One: recipes are standardized and the theoretical portion cost is real, not a chef's estimate; without an audited spec sheet, absolute margin is fiction. Two: 90 days of real POS sales per dish, not perceptions.

### **Chapter 3 — Model assumptions and the dashboard it requires**

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Three: input prices updated at least monthly, because in 2026 a margin computed with last-quarter costs lies. Four: sales mix is relatively stable within the measured period; strong seasonality is modeled by season. Implication for the operator: build the dashboard before touching a single dish —one sheet per unit, seven columns (dish, 90-day units, menu index, price, theoretical cost, CM in dollars, quadrant) and, in franchise, an eighth for weekly variance. That table is what a CFO can audit and what turns a local win into a defensible network asset ready for due diligence. Garbage in, garbage expansion decision. The model's architecture is the four-quadrant matrix, component by component. Star: high popularity, high margin —protect it; usually the 20% of dishes delivering 60-70% of total margin, with recipe and menu position locked. Plow-horse: high popularity, low margin —redesign the recipe or raise 0.80-1.50 USD without touching perceived volume.

### **Chapter 4 — Solution architecture: the four-quadrant matrix**

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Puzzle: low orders, high margin —give visibility, reposition it in the highest-contact zone, train the server to suggest it. Dog: low popularity and low margin —cut it or redesign it; under intuition it survives on the chef's attachment, in the model it's decided by quadrant and elasticity. On a 40-item menu, purging 6 Dogs typically frees 11-14% of kitchen complexity without touching sales. This matrix becomes the franchise-manual page that standardizes the criterion across the whole network, so every unit restructures the same way. Real Masterrestaurant mini-case, anonymized figures from a 3-unit casual dining group. Before: 42 dishes, 31% Dogs, weighted food cost 34%, average contribution margin 4.10 USD per guest, theoretical vs actual variance of 6.2 points across kitchens. Intervention: we applied the matrix, cut 9 Dogs, redesigned 6 Plow-horses raising price 5% without losing volume, and repositioned 4 Puzzles into the menu's hot zone.

### **Chapter 4 — Quantified mini-case: from 42 dishes to a menu that scales**

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After 12 months: weighted food cost 29%, average margin 6.80 USD per guest (+66%), variance contained at 1.8 points, active Dogs at 8%. EBITDA per unit rose 7.4 points. Only then did the head of expansion open the third unit —and the manual shipped with the algorithm, not the frozen menu. Implication for the operator: audit Stars and Plow-horses weekly, cut Dogs in two waves 30 days apart, and document every decision with its number. The CapEx amplified a healthy business, not a silent leak. The benchmark shows the model calibrates differently by segment. In QSR, low ticket and high volume demand a stricter popularity threshold (>75%) with smaller per-dish margins but very high turnover; food-cost target 28-30%. In fast casual, engineering rewards Plow-horses with surgical price raises; target 29-31%. In full service, absolute margin per guest is higher but menus tend to bloat: purging Dogs frees more complexity and food cost can reach 32%, the recommended maximum.

### **Chapter 5 — Cross-segment benchmark and stress simulation**

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Circana and the National Restaurant Association confirm the fastest-growing 2026 chains cut references and concentrated demand. Then stress-test: conservative (+5% on three proteins), base (+12% —how many dishes drop from Star to Plow-horse?), and stress (+20% —which Plow-horses turn Dog?). At Masterrestaurant, Diego F. Parra opens no second unit unless the menu survives all three blows above a 68% weighted margin. The

rookie error: applying one threshold to all three formats. Implementation runs on a 90-day roadmap. Days 1-15: data hygiene —standardize recipes, audit theoretical portion costs, extract 90 days of POS sales per dish. Days 16-45: compute and classify —run the menu-index and absolute-margin formulas, place each dish in its quadrant, document the algorithm. Days 46-70: restructure —cut Dogs in two waves, raise Plow-horses surgically, reposition Puzzles, run the three stress tests. Days 71-90: institutionalize —write the matrix page into the replicable operations manual, train managers, stand up the weekly variance dashboard.

## **Chapter 6 — Implementation roadmap, KPIs and board-level ROI**

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KPIs to 3/6/12 months: food cost toward 30-31% then 29%, variance under 3 then 2 points, Dogs under 15% then 8%, EBITDA per unit +5 to +7.4 points. The ROI is direct: in a 10-unit network, 5 food-cost points on 42M USD is 2.1M USD recovered yearly against an implementation cost rarely above 3% of that. That number unlocks the mandate to restructure before the next expansion CapEx. Rigor requires stating the model's limits. One: the mini-case figures (42 dishes, +7.4 EBITDA points, food cost 34%→29%) come from a real 3-unit casual dining operation; they don't extrapolate to QSR or full service without recalibrating thresholds. Two: the food-cost (28-32%) and prime-cost benchmarks rest on USDA, BLS and the National Restaurant Association, but each market and purchasing structure varies —use them as reference, not universal truth.

## **Chapter 11 — Limitations and assumptions of the analysis**

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Three: the model assumes standardized recipes and clean 90-day data; without that hygiene, the quadrants mislead. Four: price elasticity is estimated per quadrant, not by controlled per-dish experiment; an A/B price test sharpens the number. Five: the stress simulation models input inflation, not demand shocks or regulatory change. The model reduces risk before committing CapEx; it does not eliminate it. Diego F. Parra and Masterrestaurant present it as a discipline, not a guarantee. The intuition menu optimizes percentage margin; the mathematical model optimizes contribution margin in dollars per guest, which is what actually pays payroll and rent at scale. The inherited approach freezes the pilot menu and replicates it; the MTIE approach documents the classification algorithm so each franchisee restructures with the same criterion, not their own. In intuition, a 'Dog' dish (low popularity, low margin) survives out of emotional attachment; in the model it's removed, redesigned or repositioned based on its quadrant and price elasticity.

## **Chapter 12 — The differences that decide whether your network scales or bleeds margin**

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The traditional menu doesn't measure theoretical vs actual cost variance across kitchens; the model turns it into the KPI that detects margin leakage before it contaminates the network's EBITDA. Restructuring by popularity and marginal profitability shields unit economics: without that shield, every expansion CapEx amplifies a business that was quietly losing money.

### **POINT BY POINT**

## Comparative analysis: intuition vs mathematical model

### OPTIMIZATION VARIABLE

A · INTUITION-BASED MENU (INHERITED)

Dish percentage margin

B · MASTERESTAURANT Contribution

margin in \$ × popularity

**Verdict:** B wins: dollars per guest pay payroll and rent; percentage misleads at scale. A dish at 25% food cost leaving \$3 loses to one at 32% leaving \$9; at 180 covers/day across 20 units, that gap is 21,600 USD/day the percentage hides.

### FRANCHISE REPLICABILITY

A · INTUITION-BASED MENU (INHERITED)

Frozen pilot menu copied

B · MASTERESTAURANT Documented

classification algorithm

**Verdict:** B wins: you copy the criterion, not the result; each unit restructures with the same rigor. When a franchisee faces an input 15% costlier, they apply the formula and reclassify in hours, rather than improvise a parallel menu that breaks the brand.

### MARGIN-LEAKAGE DIAGNOSIS

A · INTUITION-BASED MENU (INHERITED)

No variance measurement across kitchens

B · MASTERESTAURANT Theoretical vs actual cost variance as KPI

**Verdict:** B wins: it catches leakage before it contaminates the network's EBITDA. Across 30 units, 3 points of variance on 4 million USD of annual sales is 120,000 USD that vanish with no explanation; the weekly KPI catches them before month-end.

## EXPANSION DECISION (CAPEX)

### A · INTUITION-BASED MENU (INHERITED)

Opened on intuition or commercial pressure

B · MASTERESTAURANT Opened with shielded unit economics

**Verdict:** B wins: CapEx amplifies a healthy business, not one bleeding in silence. A 450,000 USD CapEx on a menu with 31% Dogs multiplies the loss; on a menu optimized to 8% Dogs, it multiplies a proven contribution margin.

### SIDE-BY-SIDE COMPARISON

#### Intuition-based menu THE ERROR

- ✗ Decides by percentage margin, not dollars per guest
- ✗ Freezes the pilot menu and copies it into the franchise manual
- ✗ Fails to measure menu index or absolute contribution margin
- ✗ Ignores theoretical vs actual cost variance across kitchens
- ✗ Propagates marginal inefficiency to every new unit

#### Mathematical-model menu MASTERESTAURANT

- ✓ Classifies every dish in the Star / Plow-horse / Puzzle / Dog matrix
- ✓ Optimizes absolute contribution margin per guest
- ✓ Documents the restructuring algorithm in the replicable manual
- ✓ Monitors theoretical vs actual cost variance as a franchise KPI
- ✓ Shields unit economics before committing expansion CapEx

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EBITDA impact per unit (12 months)	✗ Baseline	✓ +7.4 pts

### THE NUMBERS THAT MATTER

## The numbers a CFO takes to the board

**70%**

Minimum menu index to classify a dish as popular

**7.4pts**

Average EBITDA gain per unit after restructuring the menu

**1.8%**

Target theoretical vs actual cost variance in a mature kitchen

**29%**

Weighted food cost after optimization (vs 34% inherited)

### REAL CASE

*“We had 42 dishes and 31% were Dogs no one dared to kill. We restructured with the matrix: cut 9, redesigned 6 and lifted average contribution margin from \$4.10 to \$6.80 per guest. Only then did we open the third unit. The manual shipped with the algorithm, not the frozen menu.”*

— Head of Expansion, 3-unit casual dining group

## HOW TO APPLY IT IN YOUR RESTAURANT

### How to restructure your menu with the model before you scale

#### 1. Compute absolute contribution margin per dish

For each item: selling price minus theoretical portion cost (standardized recipe). Don't use the percentage: use the dollars. A dish at 25% food cost leaving \$3 loses against one at 32% leaving \$9. That's the number that sustains payroll and rent at scale.

#### 2. Measure real popularity index

Menu index =  $(\text{dish units sold} / \text{total units}) \div (1 / \text{number of dishes}) \times 100$ . Threshold: >70% of expected average = popular. Use 90 days of real POS sales, not perceptions. Demand is data, not the chef's opinion.

#### 3. Classify in the four-quadrant matrix

Star (popular + high margin): protect it. Plow-horse (popular + low margin): raise price or cut cost without touching perceived portion. Puzzle (unpopular + high margin): reposition on the menu or remove it. Dog (unpopular + low margin): cut it unless it serves a clear strategic function.

#### 4. Document the algorithm in the replicable manual

Don't copy the menu: copy the criterion. The franchise manual must include the formula, the popularity threshold and the per-quadrant decision rule, plus the theoretical vs actual cost variance KPI. That way each franchisee restructures with your rigor, not their intuition.

## FAQ

### Frequently asked questions

#### Why optimize by dollar margin and not percentage?

Because payroll, rent and utilities are paid in dollars, not percentages. A dish at 25% food cost leaving \$3 contributes less to your EBITDA than one at 32% leaving \$9. At scale, that difference decides whether the network makes or loses money.

### How often should I restructure the menu with the model?

A light quarterly review with 90 days of POS data and a deep restructuring every 6-12 months, or whenever theoretical vs actual cost variance exceeds 3%. In expansion, do it before committing each new unit's CapEx, never after.

### What do I do with a high-margin, low-selling Puzzle dish?

Reposition it before removing it: move it to a high-visual-contact zone of the menu, improve its description or train it as a server suggestion. If in 90 days its popularity index doesn't clear the threshold, remove it: it consumes attention without paying rent.

### Is this model for franchising or just for one unit?

It's mostly for franchising. In one unit you can fix things with presence; in a network you can't. The model is documented as an algorithm in the replicable operations manual, with popularity threshold, margin formula and variance KPI, so every franchisee restructures with the same criterion.

## DATA & SOURCES

### Sector data 2026 (official sources)

Verifiable industry benchmarks from official, non-commercial sources (government, industry associations, market research) - not competitors.

Metric	Benchmark 2026	Source
Top 500 de cadenas	<b>las 500 mayores cadenas concentran la apertura neta de unidades en EE.UU.</b>	Nation's Restaurant News — Top 500
Expansión internacional QSR	<b>la expansión fuera de EE.UU. la lideran marcas de servicio limitado (QSR 50)</b>	QSR Magazine
Prime cost a escala (multi-unidad)	<b>55–65% de las ventas</b>	National Restaurant Association
Margen neto del sector	<b>3–9%</b>	Statista
Operación fuera del local	<b>~75% del tráfico</b>	Nation's Restaurant News
Hostelería en Europa	<b>estadística oficial de restauración</b>	Eurostat

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