**Hospitality Review**

Volume 13
Issue 1 *Hospitality Review Volume 13/Issue 1*

Article 5

January 1995

# Menu Engineering: A Model Including Labor

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# Menu Engineering: A Model Including Labor

**Abstract**
Menu engineering is a methodology to classify menu items by their contribution margin and popularity. The process discounts the importance of food cost percentage, recognizing that operators deposit cash, not percentages. The authors raise the issue that strict application of the principles of menu engineering may result in an erroneous evaluation of a menu item, and also may be of little use without considering the variable portion of labor. They describe an enhancement to the process by considering labor.

**Keywords**
Food Science, classify, popularity, finance, labor relations

# Menu Engineering: A Model Including Labor

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*Menu engineering is a methodology to classify menu items by their contribution margin and popularity. The process discounts the importance of food cost percentage, recognizing that operators deposit cash, not percentages. The authors raise the issue that strict application of the principles of menu engineering may result in an erroneous evaluation of a menu item, and also may be of little use without considering the variable portion of labor. They describe an enhancement to the process by considering labor.*

The concept of menu engineering is attributed to work by Michael L. Kasavana and Donald I. Smith.[1] It is a methodology that analyzes the popularity and contribution margin (selling price minus food cost, or gross profit) of individual menu items and assigns a label to each of the individual menu offerings for the purpose of planning future marketing and management activities. Kasavana and Smith proposed classifying each menu item into one of four categories as determined by a two by two matrix of high and low popularity and above or below average contribution margin.[2]

If an item's selection rate exceeded 70 percent of the average popularity (total number of menu selections within a class divided by the total number of menu items within the class), then it would be classified as "popular." If the demand fell short of this 70 percent level, then the menu item was deemed "not popular." For example, in analyzing a menu with eight items in a particular class, an individual menu item is labeled as popular if its sales mix is 8.75 percent or greater of the total sales mix, determined as follows:

$$(100\% / 8) \times 70\% = 8.75\%$$

Sales mix is determined by dividing the number of sales of a particular menu item by the total number of sales within the menu class.



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Exhibit 1 depicts the classification of a sample menu into high and low popularity with the intention to identify to the operator those menu items that are considered popular by customers. It would be improper to delete or severely modify a menu item based solely on its individual popularity. A reaction based on popularity information only, in this example, the bologna sandwich, chicken a la king, fish and chips, and spaghetti would receive management's attention.

Fortunately, menu engineering concepts developed by Kasavana and Smith require that a second dimension be folded into the decision making process, contribution margin.[3] The contribution margin computation is performed by first determining the weighted average contribution margin of all menu items within the class of menu items being analyzed. This is accomplished by computing the individual contribution margin (selling price minus food cost, or gross profit) from each of the individual menu items, and then multiplying the individual item's contribution margin by the number of sales for each particular item in the menu class. This total contribution margin is then divided by the total number of items that were sold within this menu classification, resulting in a weighted average contribution margin. Exhibit 2 depicts the weighted average contribution margin computation.

Those menu items that experienced an individual contribution margin greater than the menu's weighted average contribution margin received a classification of high contribution margin. Those that did not achieve the menu's weighted average contribution margin were labeled low in contribution margin, as shown in Exhibit 3.

Every menu item is fit into a quadrant on the two by two matrix of contribution margin (high or low) and popularity (high or low). Management action using Kasavana and Smith's model is based on each item's defined quadrant.[4]

## Management Action May Be Required

Kasavana and Smith assigned a label and offered suggestions for management action for each of the four quadrants[5]. For example, items that scored high in contribution margin and high in popularity were labeled "stars." These should be tested for price elasticity by raising the selling price. "Plowhorse" was the identification assigned to items nested in the high popularity and low contribution margin quadrant. An appropriate management action for plowhorses could be to raise the price to a point where the item's contribution margin exceeds the menu's weighted average contribution margin. Providing the demand did not drop below the threshold for classification as popular, the menu item would be shifted to a position where it would be high in popularity and high in contribution margin. For those menu items that are low in popularity and high in contribution margin, Kasavana and Smith assigned them the label of "puzzle." Puzzles could be subjected to marketing efforts such as lowering the price or featuring the item on the menu. The fourth label, "dogs," represented



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**Exhibit 1**
**School Cafeteria Menu**
**Analysis of Items Sold**

**Menu Popularity Worksheet**

| Menu Item Name | No. Sold (NM) | Menu Mix % | Popularity |
|---|---|---|---|
| Turkey Sandwich | 130 | 10.66 | High |
| Bologna Sandwich | 100 | 8.20 | Low |
| Spaghetti | 60 | 5.92 | Low |
| Pizza | 300 | 24.59 | High |
| Chicken a la King | 40 | 3.28 | Low |
| Grilled Cheese | 180 | 14.75 | High |
| Hamburger | 320 | 26.23 | High |
| Fish and Chips | 90 | 7.38 | Low |
| Totals | 1,220 | 100.00 | |

Note: (100% / items) x (70%) = Average Popularity
(100% / 8) x 70% = 8.75% (Average Popularity)

**Exhibit 2**
**School Cafeteria Menu**
**Analysis of Items Sold**

**Contribution Margin Worksheet**

| Menu Item Name | No. Sold (NM) | Item Sales Price | Item Variable Cost | Item Contrib. Margin | Total Contrib. Margin |
|---|---|---|---|---|---|
| Turkey Sandwich | 130 | 2.20 | 1.10 | 1.10 | 143.00 |
| Bologna Sandwich | 100 | 1.60 | .76 | .84 | 84.00 |
| Spaghetti | 60 | 1.20 | .33 | .87 | 52.20 |
| Pizza | 300 | 1.25 | .19 | 1.06 | 318.00 |
| Chicken a la King | 40 | 1.75 | 1.25 | .50 | 20.00 |
| Grilled Cheese | 180 | 1.10 | .66 | .44 | 79.20 |
| Hamburger | 320 | 1.75 | .90 | .85 | 272.00 |
| Fish and Chips | 90 | 2.10 | 1.20 | .90 | 81.00 |
| Totals | 1,220 | | | | 1,049.40 |

Note: Weighted Average Contribution Margin; $1,049.40 / 1,220 = $0.86



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**Exhibit 3**
**School Cafeteria Menu**
**Analysis of Items Sold**

**Contribution Margin Worksheet**

| Menu Item Name | No. Sold (NM) | Item Sales Price | Item Variable Cost | Item Contrib. Margin | Contrib. Margin Class |
|---|---|---|---|---|---|
| Turkey Sandwich | 130 | 2.20 | 1.10 | 1.10 | High |
| Bologna Sandwich | 100 | 1.60 | .76 | .84 | Low |
| Spaghetti | 60 | 1.20 | .33 | .87 | High |
| Pizza | 300 | 1.25 | .19 | 1.06 | High |
| Chicken a la King | 40 | 1.75 | 1.25 | .50 | Low |
| Grilled Cheese | 180 | 1.10 | .66 | .44 | Low |
| Hamburger | 320 | 1.75 | .90 | .85 | Low |
| Fish and Chips | 90 | 2.10 | 1.20 | .90 | High |
| Totals | 1,220 | | | | |

Note: Weighted Average Contribution Margin = $0.86

**Exhibit 4**
**School Cafeteria Menu**
**Profit Factor Computation**

| (a) Menu Item Name | (b) No. Sold (NM) | (c) Menu Mix % | (d) Item Food Cost | (e) Item Sale Price | (f) Item CM (e-d) | (g) Profit Factor (f/.86) |
|---|---|---|---|---|---|---|
| Turkey Sandwich | 130 | 10.66% | 1.10 | 2.20 | 1.10 | 127.9% |
| Bologna Sandwich | 100 | 8.20% | .76 | 1.60 | .84 | 97.7% |
| Spaghetti | 60 | 4.92% | .33 | 1.20 | .87 | 101.2% |
| Pizza | 300 | 24.59% | .19 | 1.25 | 1.06 | 123.3% |
| Chicken a la King | 40 | 3.28% | 1.25 | 1.75 | .50 | 58.1% |
| Grilled Cheese | 180 | 14.75% | .66 | 1.10 | .44 | 51.2% |
| Hamburger | 320 | 26.23% | .90 | 1.75 | .85 | 98.8% |
| Fish and Chips | 90 | 7.38% | 1.20 | 2.10 | .90 | 104.7% |

Note: Weighted Average Contribution Margin = $0.86



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those items that were low in popularity and low in contribution margin. Kasavana and Smith suggested that they be alternated on the menu with similar items, or eliminated.

Early avoidance of menu engineering can be attributed to the necessity of management being required to know each menu item's selling price, food cost, and quantity sold. This data collection process was tedious until technological contributions to the industry allowed for the adoption of mechanized point of sale devices as the standard. Now, virtually every operation has this information, and more, at its fingertips. In fact, Dougan contributed a spreadsheet example to help facilitate operators in the use of menu engineering.[6] There are three reasons why menu engineering has not become a standard management tool: managers are often compensated based on food cost percentage rather than contribution margin; the model fails to discriminate between items in the same quadrant; and the model does not consider other variable costs and labor costs.

Disciples of menu engineering are often forced to retreat from their position of support of this system because they are working within a personal measurement system and performance reward system that is based solely on attaining a specific food cost percentage, which ignores contribution margin. Therefore, it is not hard to understand why menu engineering would not be embraced by these individuals. In order to succeed in applying this concept, commitment to the process is required by upper management. Without this commitment, measured in terms of managerial salary and bonus, managers cannot be expected to promote the sale of a menu item for $10 with a food cost of $5 (50 percent food cost percentage and a $5 contribution margin) over a menu item selling for $6 with a food cost of $2 (33 percent food cost percentage and a $4 contribution margin).

An expansion of the menu engineering worksheet developed by Pavesic computed the individual menu item's contribution margin as a percentage of the weighted average contribution margin.[7] This computation is also called the "profit factor."

Profit factor looks at the profitability of a particular menu item relative to the weighted average contribution margin of the sample menu items. Therefore, an item with a profit factor of 100 percent or higher would represent the menu items that the operator would probably want to sell, and, correspondingly, these menu items carry a contribution margin label of "high." The benefit of computing the profit factor is that it allows for another dimension of analysis, rather than relying on only "high" or "low" profitability labels.

### Profit Factors Are Important

Analysis of menu engineering data can be incorrect when the profit factor is ignored, and management relies solely on the position that the menu item occupies in the two by two matrix to develop a plan to modify the menu. In the example of a school cafeteria, the grilled cheese sandwich and the hamburger were both considered



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plowhorses; these items were popular, but were not making much money on their individual sales. If the profit factor were ignored, then the inclination might be to raise the price because they are high in popularity in an attempt to get them to "star" status. Even though this might be the correct action for the hamburger, since it is almost at 100 percent profit factor and therefore requires only a small price increase to become a "star," such an action on the grilled cheese sandwich could force the menu item to lose its high status of popularity and become a puzzle, since the price would have to be raised considerably to achieve status as a high profit item. A second problem with the grilled cheese sandwich is that the price might not be able to be increased enough to reach the level of a puzzle (high contribution margin). This action to increase the profit factor could result in the creation of a dog, or the maintenance of its position as a plowhorse with different coordinants in the quadrant, because the popularity may significantly suffer.

All costs can be identified as either fixed, variable or semi-variable. A fixed cost is a one that remains stable over a relevant range of activity. A relevant range of activity is that range of activity within which cost data are valid. A variable cost is a one that is constant per unit, but changes in total in proportion to activity. A semi-variable cost is a cost that has both a fixed component and a variable component.

In the menu engineering discussion so far, contribution margin has been identified as selling price minus food cost. Analysis has incorrectly assumed that the variable costs of the particular menu item equal only the food cost of the item, and therefore all other costs associated with selling the item are fixed. Although food cost certainly is a variable cost, this computation does not account for all of the variable costs that are incurred in the sale of each menu item. Any other true variable costs of a particular menu item should be included in the contribution margin computation, such as paper goods. An accurate computation of contribution margin is the selling price minus all variable costs.

The problem with including all variable costs in the contribution margin computation is the effort required to separate semi-fixed (or mixed or semi-variable) costs into their fixed and variable components.

There are several ways to separate semi-fixed (or mixed or semi-variable) costs into their fixed and variable components, which are the high/low or minimum/maximum method; construction of a scattergram graphical presentation; or the use of regression analysis. Regression analysis (method of least squares) is, however, the most accurate procedure, and the recommended process.

### Labor Costs Must Be Calculated

The largest expense in most restaurant operations is labor cost, which is a semi-fixed cost. Part of the labor cost is fixed, representing the necessary staff expenses that will be incurred to serve a minimum number of guests, and depending on volume and standards



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established by management, the total labor effort will increase. If regression analysis were to be done on labor costs for each menu item, the variable labor component could be added to the food cost and other variable costs for the item, affecting the contribution margin for each item, and the weighted contribution margin for the menu grouping. If a two by two matrix were used, this new information could affect whether a product has a high or low contribution margin, which would affect its designation into a specific category and the profit factor computation.

Looft recognized the need to consider labor in menu engineering and suggested that an exercise in determining the actual labor effort that pertains to a specific menu item would be a difficult process.[8] The authors interviewed and collected data from three family restaurants of a national chain of unequal sales volumes. The same menu was used in each of the three restaurants. No relationships between specific menu items and labor could be ascertained.

An alternative to separating each menu item's labor cost into its fixed and variable components is to rank the labor effort required for each menu item relative to the other menu items in the grouping. A label of "high" labor cost would be assigned to the menu items in the top one half of the rankings and a "low" labor cost label would be assigned to each menu item in the lower one half of the group that is being analyzed.

It is suggested that the rankings and labeling of a high and a low labor classification be a judgment call by the professional food manager or through employing the technique of a jury of executive opinion, which is a method commonly utilized in qualitative forecasting models[9]. Since there will be variability of demand for any particular menu item on any particular day, and labor will be planned without knowledge of this variability of demand, any quantitative method to determine the variable labor component of a menu item is suspect.

## Menu Engineering Revised as a Three by Two Matrix

Labor, designated as either high or low in the menu engineering worksheet, can be incorporated into the model. This is an alternative to adjusting the variable cost of the menu item for labor. The result is a three by two matrix. This new matrix will result in eight possibilities, along with appropriate classifications adapted from Kasavana and Smith's original two by two matrix:

- High contribution margin, low labor, and high popularity (Shining Star)
- High contribution margin, high labor, and high popularity (Star)
- High contribution margin, low labor, and low popularity (Puzzle)
- High contribution margin, high labor, and low popularity (Brain Teaser)
- Low contribution margin, low labor, and high popularity (Tractor)
- Low contribution margin, high labor, and high popularity (Plowhorse)
- Low contribution margin, low labor, and low popularity (Dog)
- Low contribution margin, high labor, and low popularity (Ultimate Dog)



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**Exhibit 5**
**School Cafeteria Menu**
**Analysis of Items Sold**

**Menu Engineering Worksheet**

| Menu Item Name | Popular | Contrib. Margin | Labor | Category |
|---|---|---|---|---|
| Turkey Sandwich | High | High | Low | Shining Star |
| Pizza | High | High | High | Star |
| Fish and Chips | Low | High | Low | Puzzle |
| Spaghetti | Low | High | High | Brain Teaser |
| Hamburger | High | Low | Low | Tracctor |
| Grilled Cheese | High | Low | High | Plowhorse |
| Bologna Sandwich | Low | Low | Low | Dog |
| Chicken a la King | Low | Low | Low | Ultimate Dog |

Working with the original menu engineering example, and classifying each menu item as either high or low in labor cost, this expanded worksheet can be summarized as in Exhibit 5.

Menu engineering has been available as a management tool for some period of time. It has not been used to its full capabilities. Critics have correctly pointed out that contribution margin did not include all variable costs. Additionally, managers are not usually paid on the basis of contribution margin. It is a more common industry practice to pay based on the attainment of goals such as a food cost percentage or sales volume. Even users of menu engineering could come to incorrect conclusions by ignoring positions within coordinants and profit factor.

A significant flaw with menu engineering is the failure of early models to factor in all variable costs in the computation of contribution margin. For those variable costs other than food, a correction to the item's contribution margin should be done immediately to include other "true" variable costs. However, it is not so easy to identify the variable component of semi-fixed costs, the most significant being labor. The variable cost component of labor cannot be easily computed, and if it were to be quantified, it is questionable as to the validity of the result.

The solution is to assign a label to labor, either high or low, and expand the menu engineering worksheet to eight possibilities. Management action then can be developed for each of these descriptors. By "ranking" labor, the management process is improved, much the same as through the use of profit factor.

Menu engineering used as a tool can force management action in marketing and merchandising aspects of the business to create a new



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sales mix resulting in a higher level of contribution margin. This new sales mix will provide an opportunity to reach the enterprise's financial objectives by serving fewer customers, since it will be driven by contribution margin.

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