



# Michelin-McDonald's Mode: Applying Mass Customization in Chinese Catering Industry

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**Abstract.** With the progress of the times, both people's requirements for food diversity and catering companies' needs for cost control are increasing. Therefore, the catering industry in China faces challenges and needs improvements in its management and business model. With the help of mathematical simulation, it is concluded that mass customization, as is between pure customization and pure manufacture, is the better choice under today's circumstances. The paper provides references for catering companies on how to decide among mass customization, mass manufacture, and pure customization.

**Keywords:** Mass customization · catering · math modeling

## 1 Introduction

As “food is the first necessity of the people,” the catering industry is an indispensable part of people's lives. In such a fast-paced society, the importance of fast food rises as traditional Chinese cuisine does not suit the fast-paced environment. First, traditional Chinese cuisine pursues good quality and tastes of the dishes and therefore takes lots of time to make. Second, cooking traditional Chinese cuisine often involves different types of ingredients, condiments, and cooking processes, making it very complicated. Third, the complexity of cooking traditional Chinese cuisine places a high threshold on the cooks. The inconvenience, the complexity, and the high threshold for cooks make traditional Chinese cuisine incompatible with the current fast-paced society. Comparatively, fast food, with its convenience, simplicity, and low requirements for the cooks, is welcomed by busy workers in the current society.

Speaking of fast food, we always think of KFC and McDonald's, two of the most famous chain brands of western fast food in China. However, western fast food, mainly consisting of hamburgers and fried chicken, will not prevail in China because of the discrepancy between western and Chinese tastes and the low nutrient content of western fast food. If Chinese food companies want to adapt to the current fast-paced society, they have to make some explorations and changes. Then, Chinese fast food emerges as the answer to this challenge. Modern Chinese fast food companies like Laoxiangji, Country Style Cooking, and Real Kungfu [1] serve set meals with rice, meat dishes, and vegetable dishes, which suit Chinese tastes more and are healthier than western fast food. These

Chinese food companies made a great success. In 2021, the market size of the whole Chinese catering industry is 4698.4 billion yuan, and that of Chinese fast food is 767.7 billion yuan, 70.7% of the whole fast food industry in China. It is also predicted that the market size of Chinese fast food will have a year-over-year increase of 6.9%, expanding to about 840.7 billion yuan in 2022 [2]. Therefore, the Chinese fast food industry has a broad prospect.

## 2 Literature Review

With respect to the catering industry, many researchers have thought of introducing standardizations and large scales. Burong Xu [3] researched the standardization practicability of Chinese food production. He first researched the difficulties the Chinese food standardization faces. He found that for many Chinese dishes, a common standard for every cook to follow is absent. The standards for the dishes are only “stored” in the head cooks’ memory. Also, many cooks do not pursue standardized kitchen productions but traditional hand-made productions based on their cooking experiences, wanting to make the dishes more “authentic”. What’s more, the complexity of making Chinese food leads to the emergence of many external factors which cannot be easily quantified. These factors result in arbitrariness during the cooking process of Chinese food, making Chinese food standardization difficult.

Then, he researched the practicability under such challenges. First, to standardize food production, companies have to control the production process: the raw material purchases and acceptance checks, the raw material storages, and the cooking process. Open market purchasing, bidding, and one-stop purchasing are applicable for the raw material purchases; dry storage, refrigeration, and frozen storage can be applied to the raw material storage; cultivating the cooks’ standardization awareness, strengthening human resources management, and developing strict operation specifications can guarantee the cooking process.

Ruinan Sun and Xinping Ren [4] researched the development of the industrialization of staple food and the industrialization of Chinese fast food. They found out that the industrialization of staple food and Chinese fast food shows a good momentum of development for the following three reasons: the acceptance rate of young consumers is high; increasing operation costs caused by the increasingly strict environmental protection policies and the increasing human costs will result in great market development potentials; enterprises accelerate the establishment of central kitchens, a significant and essential part of the process of staple food industrialization and Chinese food industrialization. The two researchers also studied the advantages of industrialization, like promoting consumption upgrades, improving people’s diet, ensuring food safety, and improving the ability of food supply and emergency guarantee.

Qinfang Hu, Haowei Yu, Dingxiang Fan, and Lu Tan [5] researched mass customization, which he found to incorporate three significant elements: satisfying the customers’ requirements, forming scale effects for the products, and adding values to the enterprises. In their paper, mass customization has three major characteristics: flexible manufacturing postponed manufacturing, and modularization. These three characteristics

influence each other: process postponement as a fundamental principle of modularization maximizes flexibility; modularization, differentiating mass customization from common customization, is a key part of flexible manufacturing.

Hu, Yu, Fan, and Tan also researched the prerequisites and results of mass customization. There are mainly four prerequisites for mass customization: 1. The ability to recognize the customers' demands; 2. The ability of mass production; 3. Flexible production process; 4. Coordinated supply chain. For the results, the influences of mass customization are generally positive. For customers, they can purchase high-quality products at fewer costs. For enterprises, they can improve customer satisfaction and occupy more market share.

To better apply mass customization, one has to know its boundary conditions. Hu, Yu, Fan, and Tan mentioned three conditions: the demand uncertainty, the complexity level of the supply chain, and the intensity of competition. First, if customers have specific and consistent demands, mass customization will lose its advantages over common customization; if customers cannot recognize and express their preferences well, the final products will not truly suit the customers, and mass customization will lose its advantages over mass manufacturing. Second, if the supply chain is complex, mass customization can make it more systematic and simple, but if the supply chain is simple enough, mass customization might bring unnecessary complexity and reduce the efficiency of the supply chain. Third, if the competition is fierce, adopting mass customization gives companies a competitive edge, but if the competition is mild, without comparison, customers cannot fully understand the value of mass customization.

Paul Zipkin [6] also summarized four limits of mass customization. First, a production technology with high flexibility is required for mass customization. The high costs of developing such technology sometimes make mass production a better alternative to mass customization. Second, systems like questionnaires or ingeniously designed menus to elicit the customers' preferences and needs are necessary. It is in fact really difficult to well design such systems. Third, it requires a logistics system that directs to the customers. Last, mass customization can only be applied in a market with a large number of needs for products with custom features. Otherwise, mass customization might not add value to the enterprise.

Nengmin Wang, Mengdan Wang, Hesong Ren, Qidong He, and Xili Pang [7] researched the Haier model, RenDanHeYi (RDHY). RDHY is an idea of a win-win between employees and customers. In RDHY, employees, like small companies, control their own customers and bills and earn money based on the bills they receive. Many factors propel the emergence of RDHY. First, as the age of surplus economy comes, customers have more choices in purchasing products, and customers with different purchasing powers can give different requirements for the products. This change in market supply and demand motivates the emergence of RDHY. Second, the development of the Internet and technologies of big data ensures that the data-driven RDHY works more efficiently. Third, as employees' needs for self-realization are increasing nowadays, RDHY provides a platform for employees to be independent and responsible for themselves. Therefore, RDHY is the result of business competitive environment changes during the information era. The RDHY mode suits the modern business situations, making Haier better adapt to the modern market developments.

### 3 Mathematical Modelling

Suppose there is a Chinese fast food restaurant. This paper gives the following assumptions about the restaurant.

Assumption 1: Usually a Chinese fast food restaurant provides 4 kinds of meat dishes and 8 to 10 kinds of vegetable dishes. To simplify the calculations, we assume that the restaurant provides 2 kinds of meat dishes, B1 and B2, and 4 kinds of vegetable or half vegetable dishes, C1 to C4, with their names, costs, and prices shown in Chart 1.

Assumption 2: To make the calculation easier, we assume that the restaurant averagely sells 1000 set meals a day.

Assumption 3: the restaurant plans to provide set meals consisting of 1 meat dish and 2 vegetable dishes. Therefore, there are  $\binom{1}{2} \times \binom{2}{4} = 12$  possible set meals to choose from. However, the combinations of B1, C2, C3 and of B2, C1, C4 are not planned to provide because, for these two combinations, the meat dish and the vegetable dishes are not a good match. Therefore, there are 10 possible set meals, A1 to A10, as shown in Chart 2. Through investigations, the restaurant estimates the approximate number of likers of each set meal. However, the number of likers of each set meal who come every day fluctuates by 10%.

Assumption 4: the fixed costs are store rent, warehouse rent, energy costs, and risk costs (approximately 2000 yuan/day). In order to sell 1000 set meals each day, a total area of 200 m<sup>2</sup> is needed, with 8 yuan/day/m<sup>2</sup>. Adding the warehouse rent, energy costs, and risk costs, the total fixed costs will approximately be 2000 yuan/day.

Assumption 5: The quasi-fixed costs are the waiters, with costs 300 yuan/set meal, and the cooks, with the original work efficiency of 20 set meals/hour and costs of 40 yuan/hour. The number comes from the wages of 9000 yuan/month.

Assumption 6: variable costs are the sum of all raw materials costs of the served dishes which is shown in Chart 1.

Assumption 7: the willingness to pay: since some of the ten set meals might not be served, some customers can only have a set meal that is not what they like. Therefore, the willingness to pay shows the percentage of the original price the customers are willing to pay for the dishes they are going to change into. As shown in Chart 3&4, on the left side are the dishes the customers originally like, and on the upper side are the dishes the customers are going to change into. (formula see Formula 4).

Assumption 8: Since the cooks learn, if the number of dishes that a cook finishes doubles, his or her work efficiency will improve, and the working hours will decrease by 10%. The cooks costs, a part of the quasi-fixed costs in this math model, will then decrease by the same ratio as the working hours. (formula see Formula 5) All cooks are supposed to practice 1000 set meals before starting to work. The work efficiency of waiters is supposed to stay the same because the work is simple, and the work efficiency can hardly be affected by proficiency (Chinese fast food waiters only have to put the dishes together on a large plate).

Assumption 9: Buying a set meal with a discount makes the customer happy and increases the customer's degree of satisfaction. To simplify the calculations, we suppose that the satisfaction degree of all the likers of the same set meal increases simultaneously at the same rate, even if, as the number of customers who come every day fluctuates,

**Table 1.** Dishes Names, Costs, and Prices

	Cost (yuan/serve)	Price (yuan/serve)
B1: Braised Grouper	25	39
B2: Braised Pork with Preserved Vegetable	15	26
C1: Fried Chinese Cauliflower	12	18.5
C2: Tomato and egg stir fry	9	14
C3: Chopped Garlic Bok Choy	6	10
C4: Shredded Pork with Green Pepper	15	23

**Table 2.** The Dishes and Number of Likers of Each Set Meal

	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
Meat dish1	B1	B1	B1	B1	B1	B2	B2	B2	B2	B2
Vegetable dish 1	C1	C1	C2	C2	C3	C1	C1	C2	C2	C3
Vegetable dish 2	C2	C3	C3	C4	C4	C2	C3	C3	C4	C4
Number of customers who likes this set meal	120	80	100	60	50	120	90	150	110	120

some of them don't come some days. Every one percent of the final discount on the whole set meal increases the degree of satisfaction by 1 (the degree of satisfaction could be a decimal).

Assumption 10: When customers are satisfied with the fast food restaurant, they will trust the food quality of the fast food restaurant and come to the restaurant frequently. Although the set meal one chooses is one's favorite, having the same set meal every time is never a good choice for the customer. Therefore, the customer will be willing to try a new set meal. Since trying the new set meal is the customer's own decision, he/she will pay the full price. In summary, we can assume that when the degree of satisfaction reaches multiples of 100, the customer will randomly choose one of all available set meals (possibly the one the customer likes) and pay the full price (Tables 1, 2, 3 and 4).

Based on the assumptions above, we gave the following formulas:

Formula 1: *Total Costs = Fixed Costs + Quasi\_Fixed Costs + Variable Costs*

Formula 2: *Total Income = ∑ sales volume of A<sub>i</sub> × the total price of A<sub>i</sub>*

Formula 3: *Profit = Total Income - Total Costs*

Formula 4: *Final price of a dish = original price × willingness\_to\_pay*

Formula 5:  $v(x) = 40 \times 0.9^{\log_2 \frac{x}{200}}$  ( $v(x)$ : the work efficiency of a cook for a day of work, who has cooked x set meals before that day).

**Table 3.** Willingness to Pay (on the left side are the dishes the customers originally like, and on the upper side are the dishes the customers are going to change into)

	B1	B2
B1	1	0.9
B2	0.8	1

**Table 4.** Willingness to Pay

	C1	C2	C3	C4
C1	1	0.9	1	0.85
C2	0.85	1	0.9	0.75
C3	0.7	0.8	1	0.6
C4	0.9	0.95	1	1

Through the simulation of a c++ program (see Attachment 1), we get the following result. According to the final 90-day total profit of all 1024 cases, there are three leading choices:

selling set meals 2, 4, 7, and 9 is the best choice, with a total profit of around 1577700 yuan; selling set meals 2, 4, 7, and 10 is the second, with a total profit of around 1577000 yuan; selling set meals 2, 5, 7, and 9 is the third, with a total profit of around 1575900 yuan. (due to some randomness in this math model, there might be an error not exceeding 200 yuan for the total profit).

## 4 Conclusion

If we choose to cook all set meals, we will have a lower total profit of around 1496100 yuan; if we only choose one of the ten, there will be an even lower total profit. Therefore, fulfilling certain parts of the customer's demands is the best choice, which is also the idea of mass customization. Mass customization fulfills both customizations, increasing the customers' willingness to pay, and mass production, decreasing the production costs. Therefore, mass customization is the better choice in the modern set-meals catering industry.

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