

# **MayaWest Pizza Shop**

## Project Brief *MayaWest Enterprises*

You have just been hired as a consultant by *MayaWest Enterprises*. Although this company has been in the food business for many years, it has a large chain of small restaurants and supermarkets. Over several years, *MayaWest Enterprises* has refined its pizza business design to a standard concept in all of its stores—currently numbering over 200. But currently, they are about to undertake a major expansion program to focus on *to-go orders*, to be called **MayaWest Pizza Shop**. Although the store design concept is firmly established, the staffing and operational aspects are still a problem.

These pizza stores will be of the Delivery and Carry-Out modes only. They are designed to be small and cover only a limited delivery area to provide a high-quality product in a reasonable time. It also helps to limit the store hours, which is a distinct advantage to manage and run each store ideally to confine our sales to the dinnertime crowd. An informal survey found that customers are happy if we can have carry-out orders ready in 35 minutes or less and have our delivered orders in the customers' hands in 45 minutes or less. Exceeding these times resulted in customer complaints and a decrease in sales.

Our store operation is quite simple. It consists of five operations: *order taking*, *pizza making*, *oven*, *cut & box*, and *delivery or carry-out*. It starts with a high-tech phone system that allows us to take the customers' orders automatically and display the order at the pizza-making operation. The pizza-making process is performed in a line at a standard make table with positions for up to three people. Our pizza-making process is divided into three operational tasks. The first task is the selection of the correct size pizza dough (pre-made) and the saucing of that dough. The second task adds the primary ingredients, and the third task adds the final ingredients. Although there are three logical positions, we do not always allocate three individuals to the pizza-making process due to the staffing cost.

The assembled pizza is then sent to the oven through a slide that buffers the area between the make table and the oven. A deluxe line of ovens is used in all stores, as these are fairly standard for the industry. They are a simple conveyor with an enclosure of the central part of the unit, which contains the oven. The pizzas are placed on the load area of the conveyor at the left, then proceed to the oven if there is capacity available, and lastly to the unload area. Pizzas travel through the oven tunnel and emerge at the right completely cooked. There are currently three different load-area sizes of ovens available (Series I, II, or III), and the number of square inches required inside each oven is dependent on the type of pizza.

At the unload area, the pizza is removed by a single worker, cut, and placed in a box. This worker also accumulates the pizzas into the original customer order. The worker is also required to assemble additional pizza boxes if the supply is low and time permits. If the supply gets extremely low, drivers will often assemble boxes during their idle time. When an order is complete, it is sent to the delivery area or the carry-out area. The orders sent to the carry-out area are immediately available for customer pickup. The delivery orders wait for an available driver; our drivers take only one order at a time, as it lessens the probability of a late delivery.

Your consulting firm has been asked to recommend an economical staffing plan for the make table and delivery operations, including a recommended oven size, that will meet *MayaWest Enterprises'* requirements.

Before requesting your services, *MayaWest Enterprises* hired a group of IE students from a local university to collect data, which can be available upon request, as well as other information that is within the scope of the project.

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# MayaWest Pizza Shop

## Project Details MayaWest Enterprises

The process at our *MayaWest Pizza Shop* is described in detail across the different sections of this report.

### Order Demand

A high-tech phone system is installed in all stores, and we have used it to collect information on the customer's order, assuming only one order per customer can be placed. There is a dedicated server to take customers' orders and place them into the computer system of the store, which is displayed and processed in order of arrival at the pizza-making station.

Although there is some minor variation from store to store, a typical order contains from one to three pizzas. Also, there are different pizza sizes (large, medium, small), and previous studies have shown that the pizza size is not dependent on the order size. The store only sells seven different types of pizza: Veggie, Mushroom, Meat Lovers, Cauliflower, Cheesy, Hot & Spicy, and The Works. A large sample of transactions is available upon request (See **Appendix A**).

Since the store is only open for a short period of time, orders are only received for a period of four hours from 4 PM to 7 PM; nonetheless, the store will close operations when all orders are fulfilled. The peak demand is 25 orders per hour on average, while the normal demand is 10 orders per hour on average. Both peak and normal demand for orders' arrival have high variability within each. Also, the time when normal demand changes to peak demand is also stochastic. Actually, the peak demand usually randomly starts 10 to 15 minutes after 5 PM, and it randomly lasts for 30 to 45 minutes. After peak time lapses, orders continue to arrive with normal demand.

### Pizza Making

The first task is the selection of the correct size pizza dough, which is pre-made, and the saucing of that dough. The second task adds the primary ingredients, and the third task adds the final ingredients. Although each different pizza type requires different ingredients, standard times have been developed based on the pizza size and task. Most of these task times are independent of the pizza type, except for The Works, which takes 5% more time for each task in the pizza-making process. To study the variation of the time standards, another IE intern conducted a preliminary study sampling a fixed number of pizzas of each size, and the analysis showed dependence on the pizza size for all tasks, with probability behaviour following a triangular distribution. **Table P1** shows the parameter values of these triangular distributions in seconds.

**Table P1.** Pizza Making Tasks Times by Pizza Size

Task Times (sec)	Pizza Size								
	Small			Medium			Large		
Dough & Sauce	18	24	36	24	42	48	30	42	54
Primary Ingredients	24	30	36	30	42	54	36	48	60
Final Ingredients	12	24	30	24	30	36	30	36	42

Although there are three logical positions at the make table, we do not always allocate three cooks to the pizza-making process due to the staffing cost. There are no differences in expertise required among cooks at any of the three stations; therefore, any could perform any of the tasks required. Currently, if there are three cooks assigned to this process, the first performs the first task and passes the product to

the second. If the second is busy, the product is placed between them to wait for the second cook. Once the second cook is done, it passes the product to the third one. If three people are assigned to the make table, each cook is assigned to a station, and there is only room for one product between task stations. Thus, the line will sometimes back up because a cook has nowhere to place a finished pizza. However, if two cooks are assigned to the line, they share the work so that either of the two can perform any of the tasks. Still, it is desired that a cook be assigned preferably to a task most often to reduce possible delays. If there is only one cook assigned to this process, all three tasks are performed by that person before work starts on the next pizza. Also, all travel activities by these cooks are negligible.

## **Oven**

The assembled pizzas are placed on the load area, then proceed to the oven and lastly to the unload area. The pizzas travel through the oven tunnel and emerge at the other side completely cooked. When a pizza is ready to be baked and arrives at the load area, it waits until there is a known number of square inches of the load area available. It then enters the load area and is conveyed into the oven. If there is no space available in the oven, up to 2 pizzas can wait in a buffer region before the load area. If this buffer is full, then the pizza-making station will be blocked because no more assembled pizzas can be placed there. Once it enters the load area, it takes exactly 1.9 minutes to enter the oven, and it takes exactly 7.5 minutes for a pizza to emerge from the oven and enter the unload area. Of course, different pizza sizes require a different number of square inches of oven capacity: 115 in<sup>2</sup>, 175 in<sup>2</sup>, and 250 in<sup>2</sup> for small, medium, and large pizzas, respectively. Also, there are currently three different sizes of ovens available with load-area sizes of 435 in<sup>2</sup>, 520 in<sup>2</sup>, and 605 in<sup>2</sup> for Series I, II, and III, respectively.

## **Cut and Box**

At the unload area, the pizza is removed, cut, and placed in a box by a single Cut & Box worker. There is no current limitation of buffer space at the unload area. The pizzas are always removed one at a time by the single worker and placed in the Cut & Box station, which is 3 feet away from the unload area. The single worker then proceeds to cut and box the pizza. A time study was performed to study the variability of times to complete the cutting and boxing of a pizza, and can be provided upon request (See **Appendix A**). Once the pizza is cut and boxed, it is placed in an order fulfillment rack by a single worker. This rack is 6 feet away from the Cut & Box station.

## **Box Assembly**

The Cut & Box worker is also required to assemble additional empty boxes if the supply is low (*fewer than 2 boxes available*) and time permits, taking about 12 seconds for each box. If drivers are idle, they can assemble boxes as well. At the start of the day, 10 boxes must be assembled and placed at the Cut & Box station by the Cut & Box worker. There are 3 feet between the Cut & Box station and the table to assemble boxes.

## **Order Fulfillment**

The Cut & Box worker also accumulates the pizzas into the original customer order, taking randomly between 0.5 and 2 minutes at the Order Fulfillment rack. The order server can also help assemble pizzas into orders if idle. Finally, when an order is complete, it is sent to the delivery area (40%) or the carry-out area (60%).

## **Delivery & Carry Out**

The orders sent to the carry-out area are immediately available for customer pickup. Customers waiting or dining at the restaurant are out of the scope of this project. The delivery orders wait for an available driver. Currently, the drivers take only one order at a time, as it lessens the probability of a late delivery. Obviously, the delivery time is highly dependent upon the store's location. But our delivery area is

limited to up to 10 miles. Historical data shows that variation in the drive-time from our store to the customer's door follows a triangular distribution with parameters 5, 10, 15 minutes; this time includes any time the driver takes to walk to his/her car to start driving. Assume that the time the driver takes to return to the store is the same time it took to take the order to the customer.

## **Staffing**

All the staff are devoted to producing and delivering pizzas. The time before and after this peak is devoted to preparing for the peak and cleaning up after the peak, and it is out of the scope of this project. Since this type of store is only open for a short period of time, the staffing schedule of cooks, workers, and drivers is part-time, requiring a minimum of 2 hours per shift. Though the store receives orders for four hours, the store will remain working on orders until they are all fulfilled. Therefore, staff remain working but are paid overtime (time and a half). The usual walking speed for servers, workers, and drivers varies randomly, typically, between 1 and 3 mph, unless specified otherwise.

## **Financial Information**

Estimated salary wages per hour for order takers, cooks, workers, and drivers are \$10.50 per hour, \$10.50 per hour, \$11.50 per hour, and \$20.50 per hour, respectively. Moreover, oven investment is a major capital expense, and its pricing is as follows: Series 1 costs \$25,000, Series II costs \$60,000, and Series III costs \$95,000. Changing our current oven, Series I, to a new oven, Series II or Series III, has a fixed cost of \$2,000 to install it in the shop. The oven company has offered a deal to provide a 15% discount on each oven if we buy more than 2 ovens, but there is a fixed installation cost of \$5,000 to connect the load and unload conveyors to multiple ovens.

## **Requirements**

As stated in the brief, an informal survey found that customers are happy if carry-out orders are ready in 35 minutes or less and delivered orders are in the customers' hands in 45 minutes or less. Exceeding these times resulted in customer complaints and a decrease in sales.

Provide the most economical staffing and oven investment to achieve 90% to 95% customer satisfaction.

- Number of people at the make table
- Oven size—Series I, II, or III
- Number of oven sizes, *if needed*.
- Number of delivery people

Though more expensive, more than one oven could be recommended, and the way it could work is that the ovens will work in parallel, with all ovens having a separate load and unload area. When the pizza is ready to be placed in the oven, it chooses one of the ovens with available capacity. If both have space, they could be assigned to the one with the most capacity and placed in their load conveyor area. Once the pizzas are cooked and leave the oven, each proceeds to their unload areas that merge into one. Any other recommendations are welcome.

## **Current Scenario**

Currently, there are three cooks at the pizza-making table, 1 order taker, 1 cut & box worker, and 2 drivers available in a fixed form throughout the entire time the store is open. There is only one Series I oven in use. Historical data shows that with this current scenario, the average KPI values are:

- Time to fulfill carry-out orders: 68 minutes
- Time to fulfill delivery orders: 80 minutes
- Number of fulfilled carry-out orders: 30 orders
- Number of fulfilled delivery orders: 19

- Customer satisfaction in terms of time completion: 55.5%
- Closing Time: 6.5 hours

These metrics were estimated by members of the analytics department, and there could be discrepancies that can be discussed by request through our contact person.

Moreover, there are no specific metrics, but our managers have mentioned that the cut & box worker is quite busy all the time, while the order taker and cooks are idle most of the time. For cooks, they are idle most of the time due to blockages of the pizza-making station, due to the limited capacity of the oven, most likely. You can validate these with our contact person once your team has some results.

## **Appendix A.**

A large sample of customer transactions by order is available upon request. These transactions are ordered by the time they occurred, and it is identified by the order ID. Besides the order ID, the data file contains information on the number of pizzas, the time it took for the order to be completed, the size of the pizza, plus the type of pizza by order.

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