Simulating the Impact of Mobile Ordering at Chick-Fil-A

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In 2015, Chick-fil-A launched a mobile ordering app allowing customers to order and pay for their food on the app rather than in person. With correct implementation, ordering via the app offers better service. Successful implementation includes both educating consumers on the benefits and functionality of the app as well as understanding the impact of increased demand on system performance. A discrete-event simulation model for a specific high-volume Chick-fil-A restaurant was developed. The model included demand from drive-thru, dine-in, carryout, and mobile ordering. Outputs, in the form of graphs, include queuing statistics, customer revenue, and lost sales.

INTRODUCTION

During the summer of 2015, a university marketing student, Blake, worked as an intern at Chick-fil-A. Chick-fil-A is a privately-owned, fast-food restaurant serving primarily chicken entrees in more than 1,700 stores in over 40 of the United States. The fried chicken sandwich is their signature item. In December 8, 2014, Chick-fil-A announced the launch of mobile pay and mobile ordering to be phased in their stores. (Chick-fil-A, 2014) Upon Blake's arrival at his assigned store in Murfreesboro, Tennessee, mobile ordering had been introduced but was not been utilized to its full potential. His challenge was to increase the number of adopters of the mobile app. Although his task was clear, the benefit to the store was not, nor were the trade-offs that mobile ordering would present.

In addition to having a challenge with mobile adoption, this location had infrastructure issues that resulted in lost sales for the location. The parking lot appeared to be full during peak times. In addition, the road that serviced the restaurant was often stacked many cars deep. Numerous customers declined to patronize the restaurant when they saw the cars stacked in line or on the roadway.

According the Chick-fil-A's press release, the goal of the mobile app was "to help guests save time and ensure a convenient and personalized experience". When American consumers started using debit and credit cards, the lines at fast food restaurants could operate quicker with this more efficient payment method. Instead of waiting for a customer to find their cash and make change, employees could simply swipe a card. Mobile ordering will decrease wait times in the same way that credit and debit cards reduced wait time in the 20th century, and mobile ordering will actually cut wait time even more than credit and debit cards did. According to the GSMA's *The Mobile Economy 2015* report, at the end of 2014 there were a total of 3.6 billion unique mobile subscribers worldwide. Of those subscribers, roughly 60% are smartphones in developed markets. An additional 2.9 billion smartphone connections are anticipated by 2020. Due to the rapid adoption of smartphones around the word, the potential for mobile ordering will continue to expand.

Mobile ordering is a revolutionary system that cuts out the wait time that consumers face when placing an order at a fast food restaurant. Rather than waiting in line to order with a cashier, customers can now order through a mobile app linked directly to the restaurant's system. In the past, restaurants have been limited by the number of cashiers, but mobile ordering allows restaurants to now take an unlimited amount of orders and allow their customers the convenience of skipping the line to order their food.

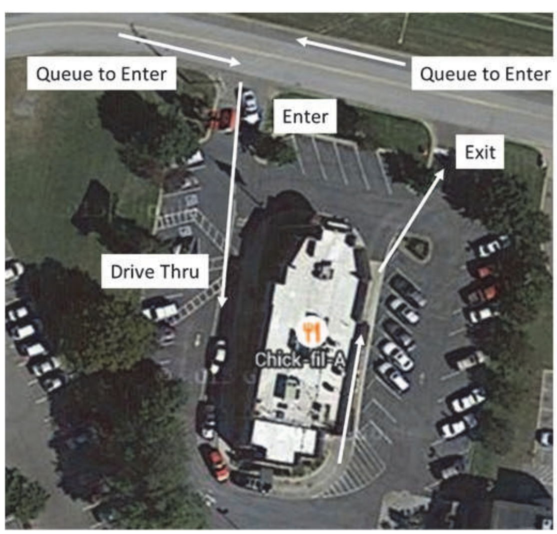
Many companies are starting to see the benefits of mobile ordering and are adopting the system for their restaurants: Starbucks, Taco Bell, and Dunkin Donuts are a few to do so. (Peterson, 2016) Although these name brands are adopting mobile ordering, very little research exist on proving just how valuable mobile ordering can be to businesses. While businesses know mobile ordering makes the ordering time more efficient and that they are able to take more orders, there are a lot of assumptions that are unproven about mobile ordering and its impact on businesses.

To help in understanding the impact of mobile ordering on Chick-fil-A, as well as on fast food restaurants in general, a discrete-event simulation model was developed that models customer demand and service performance. Simulation allows businesses to understand the impact of increased throughput on system performance including longer lines and lost sales.

METHODOLOGY

The model focused on the flow of customer vehicle traffic that arrive at a Chick-fil-A in Murfreesboro, Tennessee between 11:00 a.m. to 2:00 p.m. This three-hour block is a critical time for a Chick-fil-A as the store attempts to capture the maximum amount of lunch sales possible. Occasionally, waiting lines are long during peak demand such as lunch. The line length will become so long that customers will turn away; thus, creating a lost sale. FIGURE 1 shows a satellite photo showing traffic flow.

FIGURE 1
CHICK-FIL-A TRAFFIC FLOW



Customers enter the property and proceed to either the drive-thru lane or find a parking space on the lot. After eating in the store or going through the drive-thru, customers exit. Drive-thru customers enter a lane that wraps around the store to place an order, then pay for and pick up their food at a window before exiting the lot. Drive-thru customers take an average of fifty-seven seconds to order their food and forty-nine seconds to pay for and receive their food at the window for a total of one minute forty-six seconds. With forty-six percent of customers coming through the drive thru line during the lunch rush, every second saved is money made.

Carry-out customers park, enter the restaurant to order, and collect their food. Once their order is filled, customers leave the system. Carry-out customers take eleven minutes on average to navigate the line in the store, get their food and leave the lot. Carry-out customers compose twenty-three percent of lunch rush customers. Dine-in customers park, enter the restaurant to order their food, and eat in the restaurant, taking an average of twenty-six minutes. TABLE 1 summarizes the types of customers.

TABLE 1
CUSTOMER TYPE PRIOR TO MOBILE ORDERING

Customer Type	Description	Time	Demand
Drive-thru	Single line service, order, pay, and receive food without leaving car	106 seconds (does not include waiting)	46%
Carry-out	Park, enter restaurant, order, pay, receive food, and leave system	11 minutes	23%
Dine-in	Park, enter, order, pay, receive food, eat, and leave system	26 minutes	31%

A fourth type of customer has now emerged, the new mobile ordering customer. This type of customer can order their food on their phone and either pick it up in the store or have the food brought out to their vehicle. Mobile ordering currently takes less than five minutes for customers to get their food because the customer orders and pays prior to arriving without engaging restaurant personnel. Traditional ordering requires the majority of customers to wait in line to get their order in the system. Mobile ordering's distinct advantage is that it allows every customer to enter his or her order simultaneously.

The system was modeled using the discrete simulation software, SIMUL8. In addition to modeling the current system, increase demand and increased mobile ordering percentage were also modeled. Since proposed improvements can be modeled, information can be gathered to improve a business without having to make the changes in the real world and thus this software eliminates the tremendous cost of implementing a system just to see if it works.

ANALYSIS

Although the model could be modified to analyze different scenarios, this analysis included the following different trials:

1. Increasing demand with no other changes to the system. FIGURES 2 and 3 show the results.
2. Increasing demand and increasing the mobile ordering percentage up to 10%. Increasing mobile ordering reduces the drive through percentage. FIGURE 4 shows the results.

FIGURE 2
AVERAGE QUEUE LENGTH VS. HOURLY DEMAND

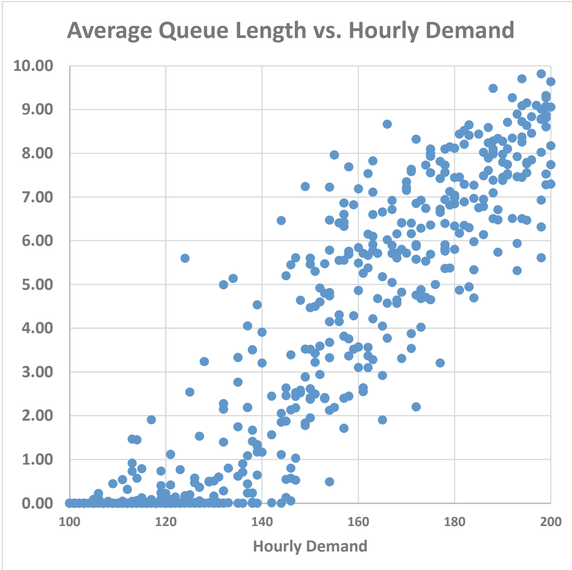


FIGURE 3
DAILY LUNCH REVENUE AND LOST SALES VS. HOURLY DEMAND

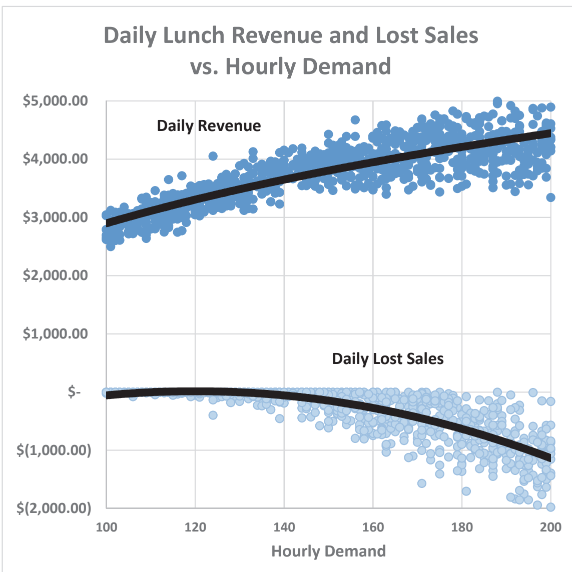
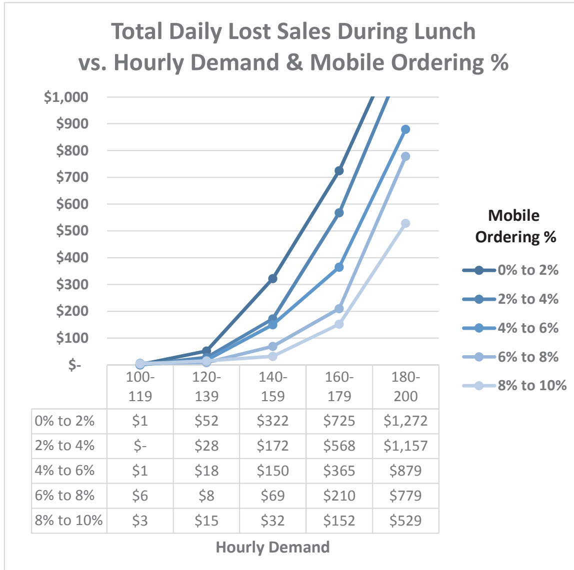


FIGURE 4
DAILY LOST SALES VS. HOURLY DEMAND & MOBILE ORDERING %



	100-119	120-139	140-159	160-179	180-200
0% to 2%	$1	$52	$322	$725	$1,272
2% to 4%	$-	$28	$172	$568	$1,157
4% to 6%	$1	$18	$150	$365	$879
6% to 8%	$6	$8	$69	$210	$779
8% to 10%	$3	$15	$32	$152	$529

SIMULATION-BASED QUESTIONS

1. Given that the current daily lunch demand is between 120 and 140 customers per hour, based on FIGURES 2 and 3, what are the implications of increasing demand?
2. FIGURE 4 shows lost sales based on both (1) increasing hourly demand and (2) for different percentages of customers who use mobile ordering.
    a. How does the different mobile ordering percentages affect lost sales?
    b. What are the results of increasing demand to 200 customers per hour?
3. With regard to this Chick-fil-A restaurant, what other types of scenarios should be modeled with simulation?
4. What are the benefits of using simulation to model a service system?

GLOBAL MARKETING QUESTIONS

5. This case demonstrates benefits that could be applied to restaurants in any country. What are the benefits?
6. What are some key adoption rates and other metrics one should review to help predict future acceptance of mobile ordering in a particular country?
7. How could mobile ordering improve sales and service in restaurants where drive-thru service is not available?

REFERENCES

Chick-fil-A Launches Mobile Payment Nationwide, Pilots Mobile Ordering. (2014, December 8). Retrieved from http://inside.chick-fil-a.com/mobile-payment-pilots-mobile-ordering/

GSM Association. (2015). The Mobile Economy 2015. Retrieved May 20, 2016, from www.gsmamobileeconomy.com/GSMA_Global_Mobile_Economy_Report_2015.pdf

Peterson, A. (2016, February 13). Ordering Fast Food by Mobile App Is the New Drive-through. *Washington Post.* Retrieved from www.washingtonpost.com/news/the-switch/wp/2014/02/13/ordering-fast-food-by-mobile-app-is-the-new-drive-through/
SIMUL8 Simulation Software [Computer software]. (2016). Retrieved from www.simul8.com.

APPENDIX - CASE NOTES

Intended Audience

The target audience for this case is for undergraduate or general MBA students either in an operations management or international marketing course. The case is primarily a queuing analysis; however, the system is complex enough that closed-form queuing formulae would either be too basic (if assuming too much) or too complex for the intended audience. Students are comfortable with the concept of simulation due to the popularity of video games, and the reasons for using simulation are readily drawn from simulation video game examples. In simulation video games, players can learn in a safe and economic environment, and this extends to the use of simulation to model service systems.

Additionally, the extension to developing and emerging markets is clear. Mobile ordering capability will exist in developing markets due to the prevalent use of mobile phones. Understanding its impact on demand and service is critical, and without a clear understanding, lost sales and/or poor service quality will be the result.

Key Points

- The use of simulation to model service systems
- Analyzing the tradeoff of increased demand and service quality
- Mobile ordering use in service systems both in existing and emerging markets
- Interpreting graphs

Background

The case originated when an undergraduate business student, who did a summer internship at Chick-Fil-A, wanted to know if mobile ordering was a good thing. During his internship, he was tasked to market the newly created mobile ordering app. However, while doing his job, he wanted to know was mobile ordering worth the investment, and how would it affect current demand of drive-thru, dine-in, and carry-out customers. He had taken an operations class in which system simulation is covered, and he wanted to use simulation to model the system.

The current system had no mobile ordering customers; however, it had very long lines during peak times such as lunch. The queue to the drive-thru extended outside of the parking lot into public roads See FIGURE 1. With the help of Chick-Fil-A management, we estimated that the maximum line length, and assumed that once the lines reached a certain limit (about six or seven cars into the public roads), potential customers chose to not consider Chick-Fil-A; thus, creating a ‘lost sales’ within the model. In reality, lost sales are very difficult to quantify; however, based on observation, an assumption of maximum line length, and a decent estimate of peak demand, lost sales are fairly easy to model with simulation.

Classroom Use

Students are comfortable with the concept of simulation due to the popularity of video games, and the reasons for using simulation are readily drawn from simulation video game examples. In simulation video games, players can learn in a safe and economic environment, and this extends to the use of simulation to model service systems. Therefore, the first 15 minutes should include a discussion of simulation. Question 1 covers this topic.

Although simulation is a powerful tool, we wanted to develop the case for students who might not have simulation. Therefore, the simulation model was run over one-thousand trials with different scenarios to generate the graphs in FIGURES 2, 3, and 4. The case presents data in graph form for the students to understand the relationships between demand and service. Generally, high demand systems offer a drop in service quality vs. low demand systems. FIGURES 1 and 2 and questions 2 and 3 cover this topic.

Although not part of the case, the simulation model was used to analyze many other scenarios. For those of you who have SIMUL8, we are more than happy to send you the actual SIMUL8 simulation file. Question 4 addresses other issues that the Chick-Fil-A model could be used to analyze.

Questions 5 through 7 transition to an emerging markets focus. Mobile ordering capability will exist in developing markets due to the prevalent use of mobile phones. Understanding its impact on demand and service is critical, and without a clear understanding, lost sales and/or poor service quality will be the result.

Suggested Case Answers

1. Although increasing demand is increasing sales, the Murfreesboro-based Chick-fil-A is starting to experience longer lines which can result in lost sales once the lines expand beyond Chick-fil-A's property lines. If Chick-fil-A only focuses on increasing demand without modifying operations, lost sales increase faster than revenue as demand approaches 200 customers per hour.

2. a. One way to delay lost sales is converting traditional ordering (drive-through, dine in, and carry out) into mobile ordering. With mobile ordering, longer lines do not occur as quickly. If the percent of mobile ordering increases to 10%, hourly demand could move to almost 180 customers without significantly increasing lost sales.
   b. Unfortunately, at 200 customers per hour, lost sales are rapidly increasing regardless of the mobile ordering percentages. Other operational improvement will be required to reduce lost sales. One option is updating the model to include even higher percentages of mobile ordering beyond 10%.

3. The simulation model could be used to model the impact of increasing the drive-thru rate. Currently, the time to order, pay and collect food for the drive-thru is a little over 1.5 minutes. What is that time could be reduced? Is the effort to reduce more cost effective than adding mobile ordering? This is one of many different uses of simulation. Another is analyzing the utilization of the parking lot. Is it always full? Does mobile ordering percentages affect the parking lot use?

4. Simulation modeling offers a risk-free environment to evaluate different designs or policies. Simulation results are timely and much less expensive than using the actual system to perform what-if scenarios. For this analysis, we were able to increase demand beyond current values and see when the system begins to have service disruptions. Thus, we have a valuable tool for planning for the future. Another benefit of simulation is that it is a proven methodology for out-of-the-box thinking. Simulation modeling allows managers to be creative in their problem-solving efforts.

5. The mobile app requires the customer to record their order and pay for their meal, thus freeing employees to serve customers in the restaurant while not losing sales from absent customers. Sales can be increased without increasing the number of employees or the seating capacity of the restaurant. The adoption rate of smartphones should be determined to verify the cultures' acceptance of this technology to predict the rate of success of mobile ordering.

6. Some of the key factors to look at include smartphone usage, credit card or other mobile payment acceptance, and dining habits (including typical time allotted to meals, social nature of restaurant purchases, the importance of quick service/time-pressures).

7. In restaurants where drive-thru service is not offered, whether from design or culture, mobile ordering expands the ordering capacity of the restaurant. Instead of being limited by the number of orders that can be recorded, the sales limitation shifts to the output capacity of the kitchen. The size of the store does not have to be increased to accommodate the increased number of orders. Pick-up locations for mobile orders can be designated within the restaurant's current footprint.

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