Here is what I consider to be an "A+" answer to the Deli Flow Problem:

1) "How many sandwiches can be made in the 10 hours worked? (Assume breaks are not included in the time provided. You will not need to factor in any break times in your responses.)" [*]

This sandwich shop can fulfill a total of 139 sandwich orders with the current process. Here is the reasoning for that answer:

(1) It takes 10 minutes to make the first sandwich. 10 minutes is obtained by adding up the times for all the store associates to assemble their parts of the order.
(2) Nine hours and fifty minutes remain to make the rest of the sandwich orders. This is obtained by subtracting the 10 minutes that it took to make the first order from 10 hours.
(3) The remaining sandwich orders will only take 255 seconds each to make because the slowest step in the process (the last associate in the process who has to toast, wrap, and deliver the order) takes this long to do so. Dividing this number into nine hours and fifty minutes (which is 35,400 seconds) yields 138.82 sandwiches produced in this time which truncates to 138 sandwiches made in this time because a fractional sandwich is unacceptable.
(4) 139 sandwiches become the total because you add the one sandwich made in the first ten minutes to the 138 sandwiches made in the last nine hours and fifty minutes of the shop's daily store hours.

This capacity can be improved with process adjustments, however. We should be careful in going up to the capacity because it could lead to excessive wait times for the customer.

2) "How does this compare to the average demand?" [*]

It is about 2.32 times (over double) the average demand.

3) "With the increase in customer demand expected to increase 25% as a result of the business expanding, what impact does this have on the current process?" [*]

An increase in customer demand of 25% translates to a fulfillment requirement increase of 15 sandwiches.

If these sandwiches need to be made during this shop's busy hours that may result in longer lines and some customer dissatisfaction. Therefore, we should plan to make the catering sandwiches outside of our lunch and dinner rush customers to avoid alienating any of our peak time customers.

Making the catering sandwiches during off-peak times is the best way forward. In doing this we must be careful in estimating the lead time and delivery estimates to our new catering customers. We should also track how making the sandwiches during our least busy times affects the customers who may come to our store during those times. We should be sure to track store traffic during various times, to make sure that all our customers stay satisfied while we expand.

It takes 69.5 minutes (600 + 255 * 14 = 4,170 seconds = 69.5 minutes) to make 15 sandwiches all at once, so if this work is done during our least busy time after lunch we should also be able to accommodate walk-in customers as well if we expedite their orders to the front of the line. The catering

orders would be delayed, but then we were careful in anticipating the delays that the walk-in customers would impose on the catering orders – so that the stated delivery times for these orders would be met.

4) "What does this tell you about the business decision to expand?" [*]

It is a good one. However, the process can be changed to make it an even better one, and some new investment would be advisable to make it a truly excellent decision.

New Process v. 1.0:

The book, "The Effective Manager", by Mark Horstman (Copyright 2016 by Manager Tools Publishing, LLC), which is on Amazon's recommended reading list for its managers (from the inside Amazon website), states that one of the four critical behaviors for managers is to "ask for more". With this answer, I will seek to therefore "give more" in outlining the best productivity solution while maintaining the process which ensures the fantastic quality that our customers have come to expect.

The first person to be tasked to do more is the associate adding meat to the sandwich. She will also be asked to execute the customer's bread selection. This will mean that the time it takes for her to do her job will increase to 105 seconds – which doesn't negatively affect the entire process because this time is less than the time needed to do the longest step – that of toasting. The bread selector position will then be eliminated – giving the business the option to either liquidate this position to save money or to create another position in its place that is not directly involved with the normal sandwich creation line here. A person could be hired or promoted into such a role as to increase sales, assemble catering orders, do extra cleaning, safety compliance, human resources, or be otherwise involved with customer or employee retention.

The second person to be asked to do more is the person assigned to toast, wrap, and deliver the sandwich order to the customer. His job takes the most time to do and we'll ask him to do it differently from his normal flow of: take the staged sandwich, toast it, wrap it, then deliver the final order to the customer. With nothing else said about his role, we must assume that he does the same thing to each new sandwich that the associate before him made for his step. The thing that we'll ask him to change or add to his role is that if a sandwich is staged for him when the sandwich in the toaster oven is finished toasting, to put that sandwich in the oven instead of waiting to complete the entire order before cycling through his duties. His new flow becomes: take the staged sandwich, toast it, after that is toasted check if a new sandwich is staged for toasting – if so begin toasting it, wrap the already toasted sandwich, and then deliver the order to the customer.

This quick step of checking to see if a sandwich is already staged for him after a sandwich has been toasted (instead of immediately going to wrap and deliver the already toasted sandwich) saves time because it gets the slow step of toasting started quicker and ultimately doesn't leave the toaster oven as underutilized as it was before the change (we assume that we have an industrial grade toaster oven that can handle continuous operation). It decouples the toasting from the main part of his job, which is wrapping and delivering the order to the customer. This means that the rate limiting step is now simply the toasting process, which takes 165 seconds, instead of what used to be this associate's entire job, which took 255 seconds. This increases the capacity of the shop to FLOOR ((36,000 – 600)/165) + 1 = 215 sandwiches per 10-hour shift.

This proposed process increases capacity by 54.7% and saves the owner money by eliminating a position. Note that quality is unaffected since it still takes the same time, care, and attention to produce each one (10 minutes worth) but the efficiency is gained by utilizing the toaster as a robot, asking the associates to do more, and lowering the time of the rate-limiting step.

The owner can then reinvest some of the considerable saved or made with the additional capacity and the eliminated (or re-imagined) position to make some capital investments:

(1) A second toaster oven for New Process v. 2.0
(2) A large oven or multiple toaster ovens for the catering business expansion

New Process v. 2.0:

The owner decided to make the capital improvements suggested above and in so doing combined with the process changes given below expanded the capacity of her business to be able to produce 296 per 10-hour shift. Here is how we did it:

We asked the associate who executed the bread and meat of the order to add one or two toppings to the sandwich before handing it off to the toppings specialist. This increased the time it took for her to do her job to 115 seconds, still less than the rate limiting step, and decreased the time it took the toppings specialist to do his job by at most 10 seconds to 110 seconds.

However we then asked the toppings specialist to then do more by putting the sandwich in a vacant toaster oven and starting toasting process – this puts his time to do his job back up to no more than 120 seconds – equal but not more than the new rate limiting step of taking customers and delivering them to the kitchen.

The toasting step used to be the rate limiting step before but because there are two of them now associates can now alternate between the two effectively cutting the toasting time of multiple sandwiches by half. The new rate limiting step is the order taking process, or the time it takes to put most of the toppings on the sandwich, both of which take 120 seconds. Then the new shop capacity becomes FLOOR ((36,000 – 600)/120) + 1 = 296 sandwiches per 10-hour shift.

Note that the quality of each sandwich remains the same as each sandwich still takes 10 minutes to make – they are just produced more efficiently.

Catering Quality

It was recommended for the owner to also purchase a large oven for toasting many sandwiches at once (or multiple toaster ovens would do this as well). This would allow the shop to achieve uniform toasting freshness in its catering orders. Even with the most improved New Process v. 2.0, the first sandwich made of a 10-sandwich order would have been toasted 20 minutes before the last one was prepared. Even with staging all the untoasted sandwiches first with two toaster overs that toast each sandwich in 165 seconds, the first two sandwiches would be toasted 13.75 minutes after the last two sandwiches toasted. The toasting freshness deficit widens even more for larger orders. If the owner had an oven that could toast 15 sandwiches at once, this would fix the toasting freshness deficit problem and ensure quality across all sandwiches delivered.

Conclusion for the Response to Question #4

It indeed is a good decision to expand the business. It would be possible to do with the current process, but it would strain wait times for existing customer to at least a certain extent. It would be better to make efficient process changes now that could be used to pay for capital expenditures that would ensure that catering customers get the same freshly toasted sandwiches that walk-in customers get.

To summarize, the process changes proposed in New Processes v.1 and v.2. will free up a position and simultaneously boost production capacity from 139 sandwiches a shift to 296 sandwiches a shift. The freed-up position can be used to fund the capital expenditures of a new toaster oven and a new high capacity oven that will help drive productivity and ensure high quality freshness.

-Jeremiah Tabb

November 4, 2020

Notes:

[*]: References the original questions.