

Patty's Exotic Plant Food

Patty has a life long passion for growing various exotic flowers and plants. Over the years she found generic plant food products such as Miracle Grow failed to garner the best results and began creating her own recipes that per plant. Being a bio-chemist by trade Patty created specific combinations Phosphates (P), Nitrous(N) and Potassium(K)² that met each plant needs See figure 1.

She began selling them online through community forms for other plant enthusiasts. Soon her business was blossoming, and she was beginning to become concerned about the capabilities of her operations. Soon her product line had 6 different formulas which she would see in 1Litre bottles. She was able to produce these bottles for \$2 and sell them online for \$12. The clients were very particular about their specific type of plants needs and sought out Patty because they want the most optimized formulas. They tended to be older and with significant income to support their hobby. Many lived far from Patty and could take up to 2 weeks to reach via shipping.

Patty would allow online orders to pile up over the week and then would spend up to 12 hours on the weekends producing the orders. She was not willing to spend more time on the side business given her family commitments no matter how she decided to run her business. Her demand was rising though and what was once 2-3 bottles per weekend had bloomed into 20 orders a week.

Patty would start production by printing an order and walking over to her chemical dispensers while holding the requested formula. Patty would walk over and measure out a cup of water add it to a Erlenmeyer flask at a rate of 30 bottles per hour. Then she would go over to the specific chemicals. Careful not to spill on her hands the process allowed her to fill the flask in 180 seconds. She then waited 25 minutes for the flask to boil. During that time she would rinse out a bottle and placing a funnel in the bottle. She called this prepping and believes she could prep up to 45 bottles during the cook time. She would also make a hand made label for the products in batches of 3 during each cook when necessary. The flask would take an additional 10 minutes to cool during which time Patty would stir the mixture constantly. Finally, she would fill the bottles and apply the labels taking 130 and 170 seconds respectively.

Patty's friend Ragesh visited Patty only to find her working non-stop all weekend long. He proposed to her a new process in hopes to help her. He suggested she do a similar process as outlined above, but suggested she not wait for the order and instead produce 6 of a product type at the same time. Ragesh assumes that if she fills 6 bottles of water at the same time she could double the speed in which she was originally filling a bottle by reducing the number of trips to and from the counter. Again, by filling each flask with the identical chemical formula he believes she could fill a flask triple as fast. She would buy a large container that could fit 6 bottles worth cooking simultaneously for \$1500 allowing her to cook 6x

Figure 1. Plant food receipts ¹	<i>P grams</i>	<i>N grams</i>	<i>K grams</i>
<i>Eucalyptus</i>	1	2	4
<i>Dancing Plant</i>	2	2	3
<i>Parachute Flower</i>	4	3	2
<i>Pelican Plant</i>	2	2	1
<i>Hydronea Africana</i>	1	3	1
<i>Fly Paper Plant</i>	3	4	1

¹ <https://www.momtastic.com/webecoist/2009/12/21/15-rare-exotic-amazing-plant-species/>

² <https://www.miraclegro.com/en-us/library/gardening-basics/plant-food-basics>

the volume at the same speed. She would also use a chiller to maintain the previous cooling time of 10 minutes. The chiller was already in her home lab for work during her career as a biochemist. She had permission to use it and it cost \$3000 originally. She could easily prep bottles at new rate of 60 per hour and make 10 labels while the cooking occurred, as necessary. She would not gain any speed in labeling and bottling. Patty believed for safety she should buy a rack to transport the 6 flasks which costs \$200.

Patty was worried about pre-producing the plant food as it had a shelf life of 3 weeks. It would cost \$10 a week to cold store the pre-produced bottles if she used any new method of production.

Patty's had also been considering hiring her son Trevor's neighbourhood friends Sunghoon and Jeff to help with production. Trevor would fill the flask with a cup of water and print of a label for the appropriate formula, taping it to the flask. It would take him 10 worker minutes to complete one. He would then pass it to Sunghoon who would follow the formula and collect / funnel in the chemicals to the flask, he was capable of 7 bottles per hour. Patty would tend to the cooking and cooling. The process would still take the same amount of time as the original process, however she would buy extra flasks and equipment for \$500 so that she could be stirring during cooling, while a new one is cooking. Jeff could make labels and handle filling and labeling at the same rate as Patty during Ragesh's system. However, he would not know which label to make so he would rotate through the 6 stockpiling as needed.

Each neighbourhood friend was willing to work for \$15 per hour. If they are sent home early they are still paid for the full 12 hours. The need to print off a label at Trevor's step added a cost of \$0.50 per bottle.

1. *Perform a task analysis for the customers.*
2. *What is the current process? Is it appropriate?*
3. *What is Patty's capacity under her current system? Will she meet demand?*
4. *What process is Ragesh's proposing?*
5. *What is the capacity of Ragesh's system?*
6. *Perform a qualitative and quantitatively analysis of Ragesh's alternative.*
7. *What is type of process is the "neighbourhood friends" proposing?*
8. *Perform a qualitative and quantitatively analysis of the neighbourhood friend system.*
9. *Make a decision.*

1. Perform a task analysis for the customers.

Quality	Specific formula varied for plant	The customer desires variation, a batch or job shop process would help meet this need better than the standardization of line flow.	core
Quantity	small but growing demand	The smaller order sizes allow for job shop or batch solutions as more time can be spent per product.	
Price	insensitive	They would prefer that Patty focus on the core needs of delivery and variation than save costs.	
Service	delivered before expires	The customer needs the food in time to still be fresh enough to use effectively. Job shop would prevent the aging caused by storing things. However faster production like line flow would help get the product out the customer quickly to meet the growing season.	
Function	N/A		

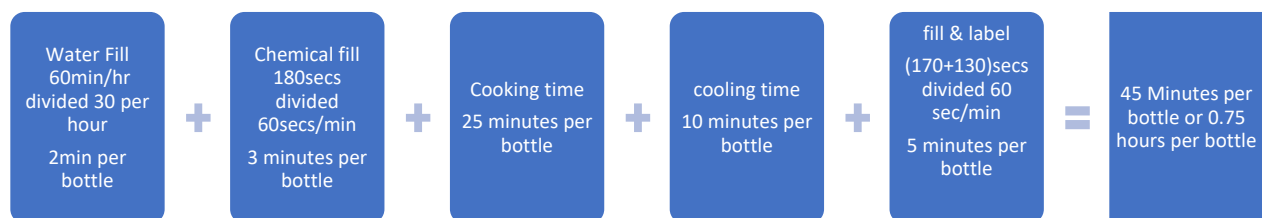
2. What is the current process? Is it appropriate?

The current process is a Job Shop. Patty waits until the customer orders before starting production which is a key sign this is a job shop. Additionally, the variation and low volumes while using her expertise and low automation process all indicate job shop.

Is this appropriate?

From the customers perspective they would prefer at least some element of job shop because the product has a shelf life of 3 weeks. They would prefer it to be as fresh as possible. However, there are only 6 product variations and a batch system might allow variation while still getting some efficiency so that Patty can meet demand and have time to herself.

3. What is Patty's capacity under her current system? Will she meet demand?



*** The work that she does while the cooking is happening does not factor into the process because it happens simultaneous to the cooking

Since she is only capable of doing one step at a time this would be calculated like a batch. A run for her to produce is 45 minutes or 0.75 hours per bottle (the sum the blue squares)

Given that she has 12 hours and it takes 0.75 hour per bottle she can produce 16 bottles per week.³

This is lower than the weekly demand of 20 bottles per week.

4. What process is Ragesh's proposing?

He is proposing a batch process because several products would go through a cycle and then begin again with a new variation in formula. The anticipated demand while still staying low volume is also a strong indicator of batch.

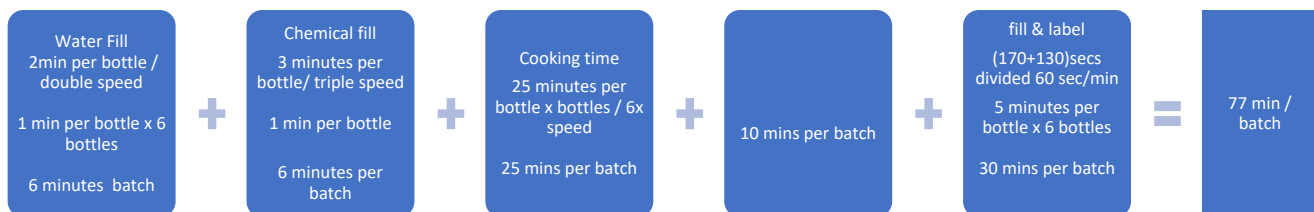
5. What is the capacity of Ragesh's system?

** The prep and label making work happens during cooking and is not factored in.

12 hours x 60 mins = 720 minutes / week

720 minutes per week / 77 minutes per batch = 9.35, so 9 batches of 6 bottles = 54 bottles per week

6. Perform a qualitative and quantitatively analysis of Ragesh's alternative.



Incremental benefit

Sales: Demand of 20 bottles – 16 bottles of old capacity = 4 extra bottles per week

4 per week x (\$12 price - \$2 cost) x 50

weeks per year = \$2000 per year

Incremental cost

Weekly storage fee : \$10 x 50 weeks = \$500

Net Benefit = \$2000 - \$500 = \$1500 per year

Investment

New container = \$1500 and \$200 new rack.

The chiller is not extra as she has this already.

\$1700 investment / \$1500 annual benefit = 1.1 years to payback.

Pro:

- Meets demand, with spare time
- Increase profitability with reasonable payback
- Batch is a good way to handle the 6 types of variation

Con:

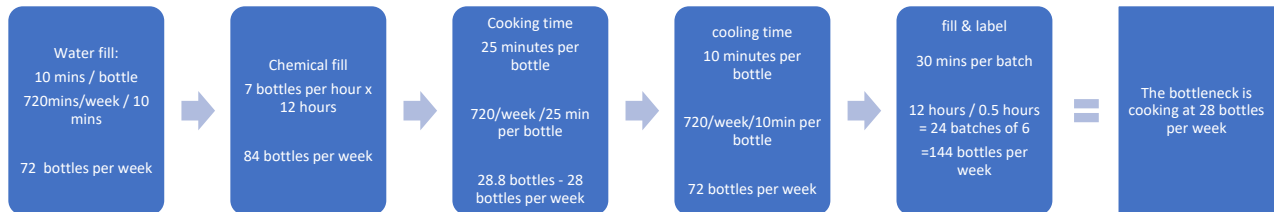
- Need to have cash up front for new equip.
- Stockpiling could result in spoilage with low shelf life.
- Customers might not like shorter shelf life once delivered to them

³ 12 hours divided by 0.75 per hour

7. What is type of process is the “neighbourhood friends” proposing?

This proposal is Line Flow with slight elements of batch. Each person has a distinct role and passes the work to another while beginning their work again which is a line flow. They have more simplified roles and aim for low variation in their task. However they do produce different formulas in this system making it slightly more batch but it is primarily line flow.

8. Perform a qualitative and quantitatively analysis of the neighbourhood friend system.



Incremental benefit

Sales: Demand of 20 bottles – 16 bottles of old capacity = 4 extra bottles per week
4 per week x (\$12 price – (\$2 cost + 0.50 print)) x 50 weeks per year = \$1900 per year

Incremental cost

Weekly storage fee : \$10 x 50 weeks = \$500

Wages: 12 hrs x \$15 x 3 people x 50 weeks = \$2700

Net Benefit = \$1900 - \$3200 = -\$1300 per year

Investment

New equipment = \$500.

Payback: \$500 investment / \$-1300 benefit annually
= never

9. Make a decision

I would recommend applying Ragesh’s system of a batch to produce more efficiently.

This is because batches are suited to variations such as carrying 6 product lines. The added efficiency allows Patty to complete her work alone and insure quality. Batch is what the analysis of task analysis supports as being the customers preferred production process.

Pro:

- Meets demand, with spare time
- Increase profitability with reasonable payback

Con:

- Need to have cash up front for new equip.
- Stockpiling could result in spoilage with low shelf life.
- Customers might not like shorter shelf life once delivered to them
- Way over produced
- Lineflow doesn’t go with variations
- Friends may not be reliable

Having batches allows you to determine when to add more of which product line. Giving better adaption to demand than a lineflow. Given the customers core need of an optimized shelf life this will be key.

The payback on the batch process is reasonable at about 1 year. The increased profit attached to the faster production will make Patty's hobby business more rewarding.

The risk of this choice is a reduced shelf life from stock piles ends up displeasing consumers. Patty should adjust batch sizes to find the right level of inventory to carry but not abandon a batch process.

In conclusion given that consumer desire batch and the added financial and time benefits this is the appropriate decision.