

Midterm

QUESTION 1

Before providing an example of concurrent engineering and mass customization, they must first be defined. Concurrent engineering is the idea of bringing together the design engineering staff into direct work with others. Moreover, the design for mass customization attempts to reach a compromise between the benefits of standardization for the producer and the desire of consumers for variety and customization. An example that uses both of these concepts is custom-made shoes. This is particularly popular in streetwear shoes and brands such as Nike and Adidas. These companies provide users with the opportunity to design a particular model of shoes, with various colors, patterns, and looks via some user interface over the internet. They even go as far as to modifying the laces, the fitting, and even add engravings. Once this is done, users would specify their shoe size, address, and payment method. Then, the order would be sent to the companies to begin the production. The shoes are manufactured, designed, and sent out to the customer, typically at a higher price due to the customizations.

This is a good example of concurrent engineering because the designers of the user interface and people in charge of providing the different customization options have to get together with production and manufacturing to determine which options are available to do. They cannot just provide every possible option, as they are limited by what is available in production. They also have to collaborate with finance to determine at what higher cost these customizable shoes should be at compared to regular models. In addition, they must work with operations to decide how customer support will work with these products. If the user specified a certain option on their design, but production ran out of that option, or an incorrect color or pattern was added instead, they must have the appropriate measures to deal with them in order to sustain customer trust. For example, a measure could be to send another pair with the corrected design.

This is also a good example of mass customization because the shoes can be easily mass produced in central areas, with only minimal resources needed for the customization. This allows producers to output a large volume of these shoes in a short amount of time. Since only specific shoe models are used for this product, companies do not have to account for modifying the actual structure of the shoes themselves, but rather only change the colors and patterns of them. Thus, there is both standardization for the producer, as well as variety and customization for the consumers.

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An example of a product that succeeds in one region but could not survive in another are electric vehicles, more specifically Tesla cars. This product requires electric car charging stations to be able to function as a day-to-day vehicle. Thus, they would thrive in areas such as North America, where charging stations are abundant, and the resources needed to sustain electric vehicles are there. However, they would struggle in areas like rural Africa and Asia, where electric vehicles, and thus car charging stations, are much less common. Moreover, production of these vehicles would be more difficult in these areas, as there are much less resources and a less ideal environment to operate.

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QUESTION 2

Stakeholder theory and stakeholder management is nicely quoted by Freeman in 1984: “Any group or individual who can affect or is affected by the achievement of an organization’s objective.” In other words, not only are the employees, managers, and owners of a company responsible for their success, but also external parties such as the customers, suppliers, and the government. This concept is important for effective service and production operations management because these external parties are the main sources of revenue and continued success for a company. Without its suppliers, they would not be able to produce their specific product or provide their specific service, as they would not have the means to do so. Moreover, if companies continue to develop products or provide services without the customer experience and satisfaction in mind, then they will lose profits over time. It is important that companies seek consumer feedback and improve upon their products and services with a customer-first mindset. The main function of a company is to produce their product or provide their service, and this can only be done if they have the means to do so, and in this case, that means is money. They require a constant stream of revenue to be able to continue to improve upon their products and services. External stakeholders also include shareholders and outside investors, who provide the company with funding through stocks. These people should also be considered, as companies need to maintain their trust in order to keep them invested.

Not only are external stakeholders important, but also stakeholders within the company are just as important. Companies need to keep employees happy so that they continue to develop their products and services for their customers. Without the employees, they do not have the resources to make profits, which will lead to the downfall of the company. Overall, stakeholder theory is important because both internal stakeholders (employees, managers, owners) and external stakeholders (customers, suppliers) are equally important, and must be accounted for to attain success in a company. Without employees there is no product or service, and without customers there is no revenue and no business.

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QUESTION 3

For this question, advice will be given to the online retailer industry, for instance Amazon. Demand forecasting is the concept of strategic planning when it comes to plant or service design, and in this case, that would be Amazon's planning with respect to their online retailer website, all the way through to delivery of the products. This concept is essential for budgeting and determining capital requirements, as is for Amazon, with this being their main stream of revenue alongside their other products and services such as Amazon Web Services and their various consumer electronics.

Amidst this COVID-19 pandemic, this is a very rare occurrence that resulted in worldwide and unprecedented changes to the economy and society. Any demand forecasting that was done before the pandemic began would be vastly impacted by what has been brought upon us. In this case, Amazon has seen soaring profits due to the pandemic, as there has been a huge uprise in the use of online shopping as a result of the lockdowns. When demand forecasting began after arrival of the pandemic, they must have forecasted demand to skyrocket, since physical retailers and shopping malls were forced to close down, leaving online shopping the only other option.

A weakness of a demand forecasting system amidst this pandemic is that it relies, to some extent, upon past demand and criteria identified as affecting that demand. This is a problem because demand pre-pandemic would be wildly different than during the pandemic. With this system, it is virtually impossible to predict events like this would happen. Thus, demand forecasting becomes inaccurate when abnormal events like this occur, and re-evaluation is required to determine new forecasting. In terms of forecasting accuracy, an event like this pandemic is a presence of a random variable, making it impossible to create perfect predictions of future demand.

A strength of this system is that there are some ways to mitigate the inaccuracies caused by this pandemic. Namely, methods such as averaging the data and ignoring outliers come to mind. When performing demand forecasting, one can set this event as an outlier and use this to predict more reasonably. Moreover, they can do their forecasting with the mindset that this will only be temporary, and make predictions after this is all over, to get more accurate long-term demand forecasts.

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QUESTION 4

a) $\alpha_1 = 0.05, \alpha_2 = 0.3, TAF_{last\ year} = 21, TAF_{2\ years\ ago} = 19, T_{last\ year} = 15$

$$S_{2\ years\ ago} = TAF_{2\ years\ ago} + \alpha_1(A_{2\ years\ ago} - TAF_{2\ years\ ago})$$

$$S_{2\ years\ ago} = 19 + 0.05(20 - 19) = 19.05$$

$$T_{2\ years\ ago} = TAF_{last\ year} - S_{2\ years\ ago}$$

$$T_{2\ years\ ago} = 21 - 19.05 = 1.95$$

$$S_{last\ year} = TAF_{last\ year} + \alpha_1(A_{last\ year} - TAF_{last\ year})$$

$$S_{last\ year} = 21 + 0.05(21 - 21) = 21$$

$$T_{last\ year} = T_{2\ years\ ago} + \alpha_2(S_{last\ year} - S_{2\ years\ ago} - T_{2\ years\ ago})$$

$$T_{last\ year} = 1.95 + 0.3(21 - 19.05 - 1.95) = 1.95$$

$$TAF_{this\ year} = S_{last\ year} + T_{last\ year}$$

$$TAF_{this\ year} = 21 + 1.95 = 22.95$$

The forecast for this year using trend adjusted (double) smoothing is 22.95.

- b) Given the ongoing pandemic situation, I would recommend accepting slightly less than the forecasted amount. The reason is because due to the pandemic, many students in Canada will stray away from applying to schools internationally such as in the United States and Europe, and rather lean towards accepting enrolment here. This would prevent over enrolment, where classes would have too many students and not enough professors and resources, and therefore, a lower quality of education. This can be seen with the Computer Science Class of 2025 at Waterloo, as they had a staggering 225% enrolment this year. This will unfortunately result in classes being constantly capped and the co-op program being too competitive for software jobs. Hence, by enrolling less than the forecasted 22.95 thousand, this will prevent such problems.

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QUESTION 5

a) $\alpha = 0.3, F_1 = 56$

$$F_t = F_{t-1} + \alpha(A_{t-1} - F_{t-1})$$

$$F_1 = 56$$

$$F_2 = 56 + 0.3(56 - 56) = 56$$

$$F_3 = 56 + 0.3(61 - 56) = 57.5$$

$$F_4 = 57.5 + 0.3(55 - 57.5) = 56.75$$

b) $\alpha = 0.5, \beta = 0.1$

Use the first week to estimate S_1 and T_1 :

$$S_1 = \frac{56}{1} = 56, T_1 = 0, TAF_2 = 56$$

Now, get S_2 and T_2 :

$$S_2 = 56 + 0.5(61 - 56) = 58.5$$

$$T_2 = 0 + 0.1(58.5 - 56 - 0) = 0.25$$

Finally, calculate TAF_3 :

$$TAF_3 = 58.5 + 0.25 = 58.75$$

The trend adjusted forecast of Period 3 is 58.75.

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QUESTION 6

	Vendor ABC	Vendor XYZ
Variable Cost	\$150/unit	\$180/unit
Fixed Cost	\$900,000	\$750,000
Revenue	\$210/unit	\$210/unit
Output	50,000 units	50,000 units

$$\text{Total Annual Cost} = \text{Fixed Cost} + \text{Variable Cost Per Unit} \times \text{Annual Quantity}$$

$$\text{Vendor ABC: } \$900,000 + \$150 \times 50,000 = \$8,400,000$$

$$\text{Vendor XYZ: } \$750,000 + \$180 \times 50,000 = \$9,750,000$$

The total annual cost for the production company for going with vendor ABC is less than for going with vendor XYZ. Therefore, machine from vendor ABC should be purchased.

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QUESTION 7

- Purchasing a new blood analysis machine for \$60,000
- Charge \$80/*visit* to have a patient's blood analyzed
- Variable cost of a blood analysis is estimated to be \$30

a) *design capacity* = 6,000, *effective capacity* = 5,000

Expects to perform 4,500 blood analyses every year:

$$\text{actual output} = 4,500$$

Calculate utilization of this machine:

$$\text{utilization} = \frac{\text{actual output}}{\text{design capacity}} = \frac{4,500}{6,000} = 0.75 = 75\%$$

The utilization of this machine is 75%.

b) Given:

$$FC = \$60,000$$

$$R = \$80/\text{visit}$$

$$v = \$30/\text{visit}$$

$$P = \$50,000$$

$$Q = ?$$

$$Q = \frac{P + FC}{R - v} = \frac{50,000 + 60,000}{80 - 30} = 2,200 \text{ blood analyses}$$

Therefore, the hospital would have to perform 2,200 blood analyses in order to make a profit of fifty thousand dollars.