Modelling and Analytics for Supply Chain Management
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Lecture 34
Periodic Review System (Contd.)

Hello, welcome to our session on Periodic Review System related to inventory modelling.

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Let us take one numerical example. Selecting the target inventory level when demand is variable and lead time is constant. This problem has been taken from this book, Operations management by Krajewski. Problem is, the demand for a bird feeder is normally distributed with a mean 18 units per week and the standard deviation of 5 units per week.

The lead time is constant and is given as 2 weeks. The business operates over 52 weeks per year. If you try to design a Q-system for this similar problem for this particular problem, you will find that the EOQ works out to be 75 units and the safety stock of 9 units for a cycle service level of 90 percent, you can easily calculate this and verify.

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Now, what is the equivalent P-system that is the problem?

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So, if we have to work out that first we have to find out what is the annual demand. So, D is given as 18 units per week multiplied by 52 weeks per year gives us 936 units that is the annual demand D. Now, here the review period is not given because we are trying to design an equivalent P system.

So, the review period P is equal to EOQ by D, D is given as 18 units per week, so 75 by 936 into 52 weeks per year. If we work out, this becomes 4.2 that is equal to 4 weeks, we have rounded it. We now find out the standard deviation of demand over the protection interval.

So, the protection interval is nothing but the review period plus the lead time which is equal to 4 plus 2, which is 6 weeks. Therefore, standard deviation of demand over the period P plus L that is standard deviation of demand over the protection interval is nothing but sigma D multiplied by root over P plus L which is nothing but 5 into root over of 6, which is 12.25 units.

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NUMERICAL EXAMPLE ON PERIODIC REVIEW (P) SYSTEM

❑Case: Selecting the target inventory level when demand is variable and lead time is constant

✓Demand for a bird feeder is normally distributed with a mean of 18 units per week and a standard deviation of 5 units per week
✓The lead time is 2 weeks, and
✓The business operates 52 weeks per year
✓The Q-system developed called for an EOQ of 75 units and a safety stock of 9 units for a cycle-service level of 90 percent

(Source: Operations Management: Processes and Supply Chains by Krajewski et al., 2019)

NUMERICAL EXAMPLE ON PERIODIC REVIEW (P) SYSTEM

❑Solution:
➤For a 90 percent cycle-service level, Z = 1.28

➤Safety Stock (SS) = $Z * \sigma_{P+L}$ = 1.28 * 12.25 = 15.68, say 16 Units

(Source: Operations Management: Processes and Supply Chains by Krajewski et al., 2019)

The business operates 52 weeks per year and the lead time is given. For a 90 percent cycle service level, Z which is a standardized normal random variant can be found out to be 1.28. Hence, the safety stock works out to be 1.28 multiplied by 12.25 which is 15.68 say 16 units, the target inventory level will work out to be D bar into P plus L plus safety stock which is 18 units per week into 6 weeks plus 16 units, which is 124 units, the safety stock was worked out to be 16 units.

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Now, let us discuss the advantages of using periodic review system. The main benefit of a periodic review system is that it is simple to operate and convenient to administer. There is a routine where stock is checked at regular intervals, orders are placed, delivery is arranged,

goods arriving are checked and so on, very simple to administer, and this inventory system is particularly beneficial for cheap items with a high demand.

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This routine also means that the stock level is only checked at specific intervals and does not have to be monitored continuously unlike fixed order quantity methods in the Q-system where the stock has to be checked continuously to mark the point when the inventory position falls to the reorder level. Another advantage of periodic review system is the ease at which we can combine orders for several items into a single order, and this will result into larger orders that will encourage suppliers to offer price discounts.

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On the other hand, a major advantage of fixed order quantity method that is a Q-system is that orders of constant size are easier to administer in comparison to the variable ones. Suppliers know how much to send and the administration and transport can be tailored according to the specific needs, perhaps supplying a truckload at a time.

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They also mean that orders can be tailored according to the needs of each item and unlike periodic review method that commonly uses the same period for many diverse items, and items with no demands are ordered as frequently as those with high demand that is the advantage of Q-system.

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So, the major advantage of fixed order quantity method that is the Q-system is that it operates with lower stocks. The safety stock has to cover uncertainty in the lead time L for a continuous review system, while the safety stock in a periodic review system has to cover uncertainty in the cycle length plus the lead time.

So, the protection interval P plus L is greater than L. So, naturally you need to carry more safety stock in a periodic review system in comparison to a Q system. So, basically this allows smaller safety stock in a Q-system and thereby lower overall stocks in the continuous review system.

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At times, it is possible to get the benefits of both the approaches, Continuous review system and Periodic review system by using a hybrid method. And two common methods of hybrid approaches are the periodic review with reorder level that means at any point in time when you are reviewing the stock.

You will try to compare the inventory position with the reorder point and if your inventory position is above the reorder point we will not issue any fresh order. Another is the hybrid approach combining reorder level and target stock, both these things are widely used in practice.

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COMPARISON BETWEEN P-SYSTEM AND Q-SYSTEM

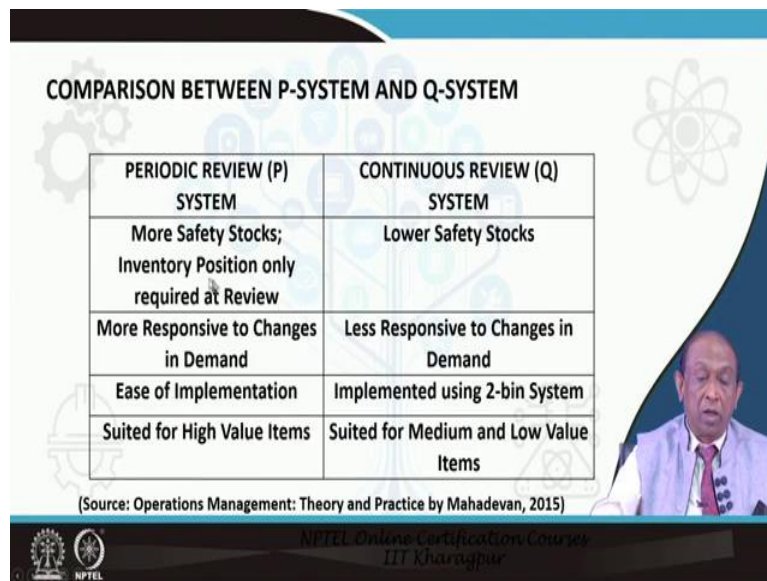| PERIODIC REVIEW (P) SYSTEM	CONTINUOUS REVIEW (Q) SYSTEM
Fixed Order Interval	Varying Order Intervals
Variable Order Sizes	Fixed Order Size (Q)
Convenient to Administer	Allows individual review frequencies
Orders may be combined	Possible Quantity Discounts

(Source: Operations Management: Theory and Practice by Mahadevan, 2015)

So, here is the table which gives you the comparison between P system and Q system. In a periodic review system the order interval is fixed. But in a continuous review system, order interval is varying, because basically it depends when the stock or inventory position will reach the reorder point, variable order sizes in a periodic review system.

Whereas, a continuous review system is a fixed order size, periodic review system convenient to administer whereas, a continuous review system it allows individual review frequencies. In a periodic review system orders may be combined, continuous review system is possible to provide quantity discounts.
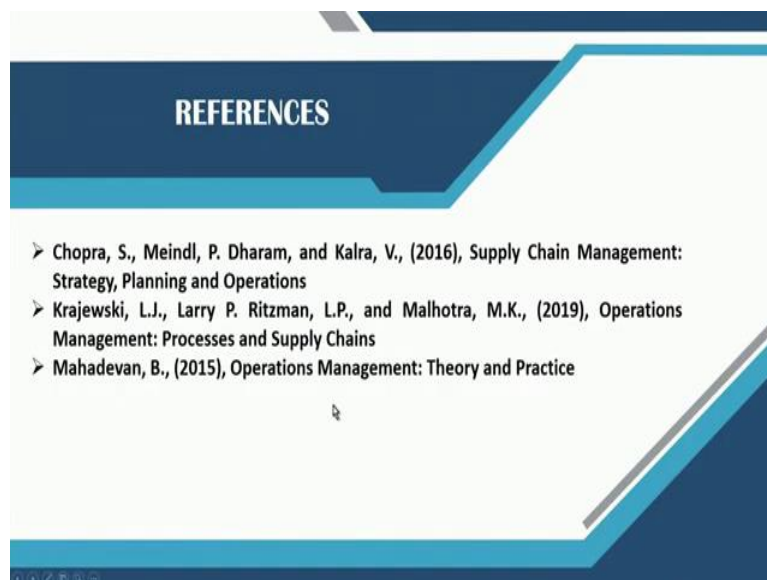
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Periodic Review system more safety stock, in a continuous review system Lower safety stock. Periodic Review systems are more responsive to changes in demand, in a Q system, it is less responsive to changes in demand. Ease of implementation in case of periodic review system, in a continuous review system in practice, it is implemented using 2-bin system. Periodic review systems are suited for high value items, whereas continuous review system is suited for medium and low value items. Thank you.

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These are the references for this particular session. Thank you