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APPLICATION OF OPERATION RESEARCH IN E-COMMERCE HOME DELIVERY SERVICES

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Abstract-*The basic purpose of our research is to study the application of operations research in e-commerce home delivery. It has been observed that most of the transportation costs occur on the supplier's side and so there is a need for a model different than the traditional manufacturer- wholesaler- retailer. To tackle the problem of failed deliveries, we have figured out alternatives like – change in time, change in location and change in routes. We have also discussed the need for pick-up service points which can be helpful in providing flexibility and would also help companies to reduce failed deliveries as packages can be picked up as per the convenience of the buyer. In this paper, we have tried to provide alternatives to the service providers so that their cost can be optimized efficiently.*

Introduction

The E-Commerce industry in India has grown multifold in the past years and is worth 19.5$ Billion. It is not just seen as a discounted means of shopping but now the convenience is valued more than the cost to a consumer. There is still huge potential and upside in the Indian market as many Tier 2 and below have yet to come in due to poor logistics and delivery infrastructure.

Drivers for the E-Commerce Industry - Internet penetration is on the rise hence there will be even more user coming to the online platform for shopping. There are approximately 500 million internet users in India, with cheaper smartphones and data plans, penetration in the rural areas will likely increase. There's more awareness and trust in the e commerce industry and more people have accepted it. There are various efforts by the Government for a "Digital India" and is offering various benefits. Disposable Income will rise by 55% by 2020 and Credit and Debit Transactions by over 60%.

There is nothing you can't get delivered in today's e-commerce industry. The consumer is the king in the market and hence the convenience of the customer is kept at the top priority. Companies strive to optimize their operations for their own as well as the customers benefit. There is heavy investment in R&D and Operations Management to improve the efficiency and thus increase the bottom line of a company.

With the advent of technology, a receiver can constantly track the location of his product/food. The companies also use the Vehicle Tracking System to analyze the points in the Delivery procedure which eats up most of the time and where is time wasted and this information is used to alter the operations later on. The traffic can also be tracked before a delivery vehicle leaves the depot to optimize the route. All these points have been discussed in the Paper extensively.

The Research Paper highlights various issues which a company faces while delivering the products and some methods through which the costs can be minimized and the convenience can be increased.

Literature Review-

The E-commerce industry is ever expanding in the products and services it is providing, the industry has reached a point where we can not only order durable goods like mobiles and televisions but also things as small and perishable as daily groceries.

The process of delivering starts from retailer's warehouses to customer's place. In giving the convenience to customers, home delivery has become a dominant of distribution channel of Business to Customers. This has led to introduce strict policies by the retailers regarding the delivery by making the customers to choose their preferred time slot so that the probability of attended deliveries get increased significantly. But, the presence of customer is very hard to predict.

One of the main problems all the companies face is the problem of customer absence during delivery, this leads to increased cost, decreased efficiency, and loss of time.

This is being tackled through various methods which are being tested:

- There is a study which correlates the presence of the receiver with the consumption of electricity. Lower electricity consumption will indicate the absence and a probabilistic model can be formulated. These probabilities can be the input for an optimizing problem for managing the delivery.(Yufei Han, Etta Grover-Silva, Bin Qiao, (2017))
- An alternative way which E-commerce retailers are now adopting is making a local pickup point in every area, in case of a failed delivery the package can be left at a local pickup point and the customer can go and collect it from there, this strategy is being tested by amazon.

Objective of the Research-

The distribution of goods varies and depends on the type of business. A relatively large share of the distribution of goods has occurred through distribution centres, owned by producers, wholesalers or logistics service providers. Retail shops function as the end points of the distribution chain that a delivery carrier involves. The customers mostly have to take care of the 'last-mile' transportation of goods. However, this is not the case with e-commerce. As companies and consumers can easily contact more potential purchasers and suppliers, e-commerce has changed the traditional supply chain. Products purchased online are transported from a distribution centre directly to customer's home timely and reliably regardless of shipment size. This implies that e-commerce generates a different need for the transportation of goods from traditional delivery practices. As we know, the logistical requirement of e-commerce goods that extend the end of the supply chain to the customer's address may generate many problems in local areas and potentially causes higher costs in carriers' fleet operations than it used to be. This is due to the small size and low density of e-commerce shipments. The *economies of scale are not being achieved* so average costs go up. The increasing demands for quicker and more reliable delivery are raising the weight of local delivery operations in the supply chain of e-commerce goods. The local movements are a very important segment in the whole delivery process because they take up a large segment of the overall delivery time. Some demands driven by e-commerce are extremely sensitive to the time in transit and time of delivery and these are determined mostly by the traffic conditions in areas.
Successful solutions will focus on how to derive the most utility out of available capacity. Examples of desirable distribution strategies may include: eliminating redundant delivery attempts, promoting personal deliveries to residential or office sites where package delivery services are already calling, and efficiently locating warehouse sites. There will be a need of further researches to examine the feasibility of various alternative operation schemes and to assess their effectiveness in the system which will benefit the customers as well as the companies both.

Analysis of the Research-

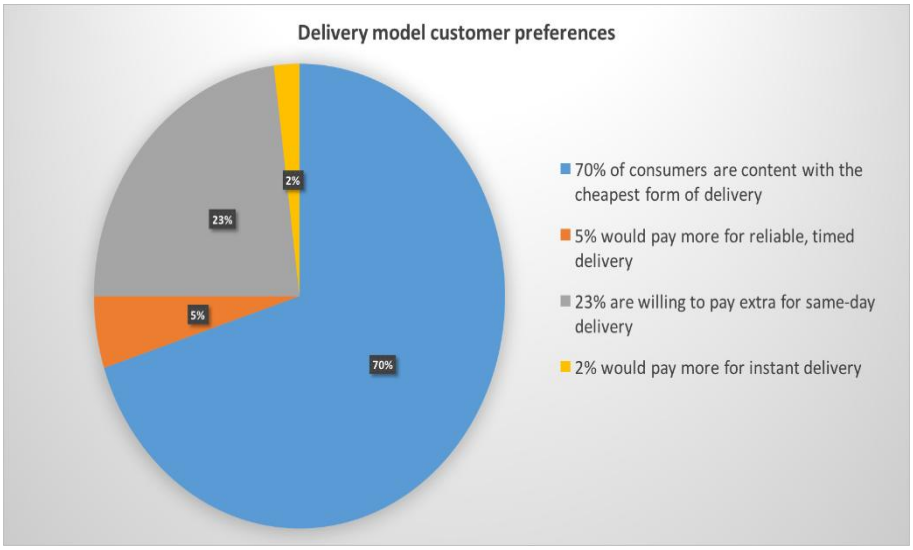
The strong competition in and increase in E-commerce market has led to an increase in business to consumer deliveries. Due to this competition it is very important to deliver the product in a cost-efficient way. For understanding this, the process of parcel delivery has to be known. The regular delivery process is where the order is picked up at the shipper and is transported to a nearby terminal (Departure terminal). Then the goods are transported to another terminal (Arrival terminal). Then the last mile parcel delivery is done where the last mile is the last stretch of a business to consumer delivery. A failed delivery occurs when the customer is not at home to receive the product. So, when the delivery is failed for the first time, the courier returns to the next terminal and is redelivered the next day or the chosen day. This rework of the delivery process results in extra handling costs and transportation costs. To tackle this problem there are certain alternatives which can be adapted to deliver the product in a cost-efficient way.

- **Demand of faster delivery**:

Nowadays, customers expect the retailers to provide their orders as soon as possible because the waiting time in online delivery is more and as the consumers are becoming more tech- friendly they don't like to wait for the order long enough. Companies like Amazon have started catering to such faster delivery services by offering membership of Amazon Prime which gives the customer an advantage of receiving the product early. Due to this process of faster delivery of products, the cost of the companies is increasing day by day but at the same time profits are also increasing due to high demand of products.

The demand of faster delivery increases the cost of delivery of the company as they then have to travel to different locations whose delivery has to be done on an urgent basis**.** If the customer demands the product to be delivered earlier then the company charges extra from those customers, due to this the customers often choose the cheapest delivery option instead of getting the products earlier.

In a study done by us, 70% customers are satisfied with the normal delivery. Even though the premium charged isn't that high but it has a big psychology factor. The question which arises in the mind of the consumer is," Why should I pay extra if I can just go and buy it myself?"
If "Routing" and "Inventory" is optimised maybe the company can drop the premium even lower.



- **Change in location:**

The change in location is basically delivering the product at alternate location on the absence of consumer to receive the product. That the product may be delivered to the neighbour which can be picked up by the consumer. However, it is only possible for the prepaid orders only and also the consent of consumers is required. Another option to change in location is to local collection points where when the delivery is failed for the first time, customer can pick up the product at their convenience from the collection point. This is being tried by Amazon. They are making Amazon Lockers in residential areas. It is a common Locker with storage space of different size and a lock. The package is dropped in the locker and the customer can pick it up from there.
Another option is leaving the parcel at the door but it will have security issues as the delivery is unattended.

- **Pick up service points:**

The service retailers have an option of opening pick up points. These points are beneficial for the company as it can provide flexibility in the operations of the company and things can be delivered speedily to the customers as per their convenience. The customer will have the freedom to choose any pick-up location as per their convenience near to their address. Each address should be allotted a pick-up point so that they can collect their orders from there and in case of return they can go and return the order there. Such points can help the company to improve their cost efficiency as the person delivering the order then won't have to travel much in the same locality for different customers to deliver the products due to the common pick up point in an area convenient for all customers present there. This pick-up point service will also solve the problem of the company of attended delivery as then, it will be on the will of the customer to come and pick up their orders any time of the day. The service mentioned will help to improve the routing capacity of the company and will free some delivery space of the company and help improve the cost of the company. It can work as an alternate solution to home delivery in case of unattended deliveries as when the product is not successfully delivered once to the customer, the customer then can have an option to go and collect the order from a pick-up point nearest to them. This can reduce the problem of travelling expense as they won't have to travel again to the customer's place to fulfil the delivery obligation resulting in cost minimization for the service provider. In case of order return, these services are a plus point for the company as if the product fails to meet the customer requirements, the customer can at the same day same time return the product there. For return orders, they can provide an option to the customer for dropping the product at the pick-up location or collecting it from their home. Incentives can be given to customers who opt for pick up points like price discounts. This service can help the customers who live in apartment /blocks whose address are difficult to trace by the deliverymen. So, due to the increasing competition in the market the companies can adopt such strategies to connect to customers on a personal level and at the same time optimize their cost expense.

- **Change in time:**

The common problem that the deliverymen face is the problem of failed home deliveries due to this the cost of the company is impacted highly.

We are highlighting the problem of Failed Delivery as there is a chance of 60% that a customer misses it and hence the company has to incur extra cost to deliver it again on a later date.

Lots of parcel service providers do not offer an option for consumers to choose a delivery-time slot. It is also possible to change the order delivery, and have efficient schedules based on the proposed timeslots. The reason for this is that timeslots are not only used as a promise for the consumer, but also for designing an efficient delivery schedule.

For that reason, while making changes in time, timeslot design is based on the following decisions-

1. The service requirements and delivery charges for a zip-code-area.

2. Assign specific time slots to each of the zip-codes.

The time slots for delivering the product can be offered in various ways such as based on the zip code of area. It could be helpful to balance regional differences in demand volumes. The agreed upon-timeslot has strong potential to improve the delivery efficiency because the customer is more likely to be available to receive the parcels.

- **Change in route:**

Changes in route is related to the changes in time. This is because if route is changed but the delivery time was the same then the delivery still would have failed. The main difference is that the change in route can further optimize the delivery. Generally, algorithms are used to decide the most efficient route for delivery. There are two ways of routing which is Static and Dynamic. Dynamic Vehicle Routing (DVR) allows vehicles to update services based on renewed information, the existing vehicle routing algorithms are often used for repeated and planned orders whereas static routing occurs when a router uses a manually-configured routing entry, rather than information from a dynamic routing traffic. Also, time dependent information about traffic jams for example, should be considered by logistics service providers to optimize and select the best delivery routes. So due to all this uncertainty in selecting the most efficient route, smaller timeframes should be used as there can be many last-minute changes.

Conclusion-

The E-commerce industry is an ever-growing one, and as they say this decade is the **".com"** decade, this decade has seen the herculean rise of giants like Amazon, Flipkart, eBay etc. The reason why customers prefer to buy online is because they can order at their convenience without going out, online ordering eliminates the risk of a product not being available at the particular store, also considering the fact that the online retailers have ensured fast delivery in all Tier-1 and a majority of Tier-2 cities, The order reaches the customer the very next day or within two days of placing the order, which has increased consumer satisfaction.

But these retailers pay a logistical cost which only increases if an attempted delivery fails, which is why before the package arrives the customer is constantly notified of its arrival in order to prevent a failed delivery, the biggest nightmare for these retailers is failed delivery as this leads to an increased operational cost.

The retailers have various proposed resolutions for the same,

1.) The customer can change the location of the package before it is shipped from the warehouse.

2.) The customer can change the delivery time according to their convenience and the delivery will be attempted during those hours only.

3.) The route of delivery can be changed according to the convenient time set by the customers and according to that the route the delivery agent can be given live updates and a dynamic route to make all deliveries on time.

4.) The retailer's partner with local stores and make them pick up points and the customers can come and pick up the goods from these stores during the operational hours of the store.

5.) Companies like amazon have started giving the option of leaving the package with neighbor where you can give your neighbors' details and get the package delivered to them.

All these alternate routes are helping minimize the operational cost to the best possible extent they can.

Limitations-

- Data used for research is secondary and obtained from various sources with different facts and figures.
- The analysis of the result is situational and if the situation is not optimal the processes might not yield the desired results.
- Customers paying extra for priority delivery, can disrupt the optimal route.

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