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Applications of Operations Research in the food delivery industry

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ABSTRACT

The food delivery industry in India is growing rapidly with the increasing availability of technology. In this research paper, we aimed at finding out the application of operational research in the food delivery industry. It has always been a known fact that humans are known to make mistakes if work is done without the help of any scientific tool. With detailed research in this industry, it came to our knowledge that the processes in various organizations have logistical flaws. This made us want to connect the concept of operations research to the food delivery industry, so as to maximize the results with minimum resources or costs. We have provided an analysis of how operations research can be used in this industry. Our research has been supported by real life implications and it was proven to us that operations research techniques can help food delivery platforms in making decisions about how they should go about with their day to day operations as efficiently as possible at the minimum cost.

Keywords— Operations Research Application, Food delivery industry, E-Business, Food tech, Consumer behaviour

1. INTRODUCTION

“The outcome of a strategy or policy magnifies into a number of times when a scientific tool is applied to it and the results become easy to analyse and interpret.”

The advent of modern technology has led to an increasing demand for efficiency and lower costs. This applies to the food delivery industry in India as well, which has seen massive growth over the past few years. The market for food delivery stands at an estimated 83 billion euros. With the introduction of platforms like Swiggy, Zomato, FoodPanda, UberEats, and many more, customers have become used to fast delivery times and a variety of options delivered right to their doorstep without any hassle. The drawback of this is that it has led to wavering customer loyalty. This means that customers would prefer to order from whichever platform provides them the cheapest rates, rather than be loyal to one particular platform. Thus, the food delivery industry has seen immense competition over the last five to six years. Companies need to operate efficiently and in the most cost-effective manner, while providing the best services, so as to stay competitive and gain market share. Food delivery has become more and more of a logistics play in recent years and operations research has become essential for companies to achieve this goal.

Operations Research is an analytical method of solving problems and decision-making that is useful in various organizations from the management perspective. In operations research, problems are broken down into basic components and then solved in defined steps by a proper mathematical analysis. This research paper will look to address the following questions:

- How can operations research be used in the food delivery industry?
- What are the limitations and scope of this research?
- Which companies in the industry could benefit by increasing their investment into operations research today?

2. OVERVIEW OF THE INDUSTRY

As of today, names like Swiggy, Zomato, UberEats, Scootsy and FoodPanda are the market leaders in the Indian food delivery industry. In India, the food delivery industry generates average revenues of approximately US\$ 7.120b and has a year on year growth rate of around 20%. This industry was nonexistent or negligible in size less than ten years ago, but it is now expected to hit close to US\$ 17.02b by 2023. (Kashyap,2017)

Bengaluru gets the highest number of online orders as compared to other cities with 20% of the market share occupied by the city. It is followed by Mumbai, Pune, Delhi and Hyderabad with a share of 18%, 17%, 15% and 12% respectively. Other cities in the country account for 18% of the market share.

The rising number of logistics providers has also enabled food delivery companies to optimize their fleet, thereby reducing delivery time. Online food delivery platforms are focused towards acquisitions and are collaborating with logistics companies to manage delivery operations in the dedicated region. (BusinessToday,2019)

3. RESEARCH OBJECTIVES

- To understand the need for operations research in the food delivery industry
- To find the primary areas in the industry that could benefit from applications of operations research
- To elaborate on the changes in the food delivery industry over the years
- To outline the importance of logistics in the food delivery industry
- To describe the gain in market share and profit potential by the major players through efficient use of operations research techniques.

4. RESEARCH METHODOLOGY

The research paper has been constructed using data from secondary sources, which include:

- (a) Past research papers (28)
- (b) Articles (1)
- (c) Books (1)

A detailed analysis has been carried out. This analysis aims to understand the need for operations research as a result of the large scale that they operate at, and the variety of services offered by them.

Assignment problems have been applied to understand how companies in this industry can tackle different situations in the most efficient and cost-effective manner.

5. LITERATURE REVIEW

Prospects of Operations Research in E-Business Era Research paper talks about the increased opportunities of OR practitioners in recent times. The activities are either consumer driven or business oriented. The paper provides information about the application of operations research in different combinations and why it is required in e-business.

Research Paper on Operation Research in Food Delivery aims to understand the use of different techniques of OR in food delivery industry. An example of assignment type problem is used to analyse the effective application of OR in this industry.

Research Paper on Consumer Behaviour Towards Food Delivery App gives details on the latest trends and business environment and how technology has reshaped the industrial scenario. The impact of technology in industries have led some players to capture market share and profit potential like Zomato, Swiggy, Food Panda, and Uber Eats.

Research paper on Growth of Food Tech provides the data related to causing a surge in demand for services that free them of such inconveniences. It also talks about the restaurants in India who provide home delivery services and are able to see marginal profits from their take-away sectors. This indicates a high potential in a relatively untapped market. Different operations research techniques are used in food delivery.

According to Erera(2017), the techniques of operations research that can be used in food delivery systems. This includes an order-to-driver AP, and unassigned driver movement AP. Through this, meal delivery times and costs can be fully optimized and cost cutting can be done to maximum efficiency to increase profits to its maximum possibility.

6. FINDINGS

6.1 Prospects of OR in E-Business Era

With the rapid growth in technology, the OR practitioners have a lot of opportunities. They need to become better informed about application opportunities in the digital economy, develop the skills called for by e-business projects, including those relating to information and communication technology.

To understand these opportunities, one has to understand the e-business landscape. The e-business landscape contains two major divisions, (1) consumer-oriented activity and (2) business-oriented activity, both supported by (3) the e-business infrastructure.

OR is used in the following four areas:

- (a) within business-to-consumer commerce in information goods and services, applications in online financial services and travel-related services;

- (b) within business-to-consumer commerce in physical goods and services, applications in supply-chain management and electronic markets;
- (c) within network infrastructure and applications, applications in network design and quality-of-service improvement;
- (d) within decision technology software tools, the packaged software component.

OR is needed in the e-business because:-

- (a) OR helps in reducing the data, which the digital economy is creating in excess.
- (b) OR can cope with complexity in design, planning, and operations because it is very analytical.
- (c) OR can manage risk and deal with uncertainty using statistics, decision analysis, and probabilistic modeling.
- (d) OR's model-building approach is very reliable to achieve a deep understanding of business processes and issues.
- (e) OR can perform virtual experiments (analyses, simulations) without risking damage to a company's assets or financial performance.
- (f) OR can provide decision technology for operational software to handle entire classes of decisions quickly, repeatedly, and automatically.

6.2 Operations Research in Food Delivery

The research papers that have been studied make it clear that food delivery has become more and more of a logistics play, restaurant discovery is not a deep competitive advantage in this industry anymore. There are clear trends on customer and seller satisfaction supported by the better delivery speed and compliance that vouch for the superiority of the captive delivery model in the Indian market. This research paper aims to understand the uses of different techniques of operations research in the food delivery industry in India. It makes use of the model followed in transportation problems to understand how food delivery services can operate more efficiently so as to minimize costs and maximize profit. The primary objective of the paper is to provide an overview of how operations research is so important in the food delivery industry today due to the advent of the digital age and the competitive nature of the industry due to big players like Swiggy, Zomato, Uber Eats and many more. It has been noted that delivery platforms that don't act as a convenient, quick and cost-effective intermediary between the restaurants and final customers are more liable to lose market share due to the lack of efficiency in their operations. The findings of this paper conclude that operations research is essential to manage food delivery logistics.

6.3 Consumer Behaviour Towards Food Delivery Apps

The primary motive of this research paper is to understand the unique selling proposition of online food ordering companies in India and to understand the latest issues that are faced by these companies (Swiggy, Zomato, Uber Eats, Food Panda). It has been observed that the main problems faced by these companies are wavering customer loyalty, logistic dilemmas, unreliable delivery and logistic staff and an inability to cope with volume. On the other hand, the advantages are convenience of online ordering, different methods of payment and large variety. The limitations faced by these large companies show us that it is important to have efficient logistics to help the company retain customers and improve delivery times. The unique selling propositions that have been offered by these companies also need to be maintained and improved constantly, so as to maintain a competitive advantage and gain customer patronage. Therefore, this paper affirms the need for operations research in the online food delivery industry.

The last 15 years has seen a rise of digital technology is reshaping the industry. With the increasing use of technology, the number of people with access to technology has rapidly increased. The online food ordering firms have grown in large numbers in terms of quality, profits and also service, this has led to more trust from consumers who appreciate the quality conscious and convenient service. Many new players are joining the segment with innovative business models such as delivering food for health conscious and environmentally conscious people. Swiggy has debuted its service Swiggy Daily in Gurugram to provide homecooked meals as well.

The online food ordering companies operating in India have huge profit potential and have grown over the years considering scientific method of operations, their profiles and their USP. Most of the recent trends are set by the dominating online food chains due to their growth potential and market share. Although there are a lot of local players in this industry, but it is dominated by four major players, Swiggy, Zomato, Food Panda and Uber Eats. These players are dominating the food delivery industry due to their scope of restaurant listings, user friendliness of the app, marketing strategies and websites and they have also gained customer's trust through their policies. This has been done by applying operations research techniques to better their service and satisfy customers.

6.4 Growth of technology

According to Bhotvawala (2016), grocery shopping, meal planning and cooking is now considered a chore by a good proportion of the growing Indian middle class, causing a surge in demand for services that free them of such inconveniences. Upwards of 50,000 restaurants in India provide home delivery and are often only able to see marginal profits from their take-away sectors. This indicates a high potential in a relatively untapped market. Aggregators such as Swiggy and Zomato provide a platform for customers to discover restaurants, with the ability to navigate through menus of different cuisines. They manage the delivery segment as well, and charge per order commission (10-15%). They are highly scalable and have all experienced remarkable growth in the Indian sector. However, they also take on a significant operational load of hiring and training, maintaining equipment, bringing faster service, etc. These services opt for a full integration of the process: An in-house app is developed where consumers can order a limited range of meals. These meals are reheated in their own fleet of cars as orders come in and delivered in about 15-20 minutes. According to Kedah, (2015), online food ordering satisfies the needs of busy individuals living in the city who place their order online and receive delivery within a few minutes. Prior studies on food ordering have investigated the determinants of trust, satisfaction and loyalty mostly in the offline consumer environment. However, researchers have recently discovered that the online

environment offers great opportunities for interactive and personalized marketing. The internet provides an impulsive shopping channel. Customers can easily search the competitive providers that match their expectations, besides receiving input from peers through interactive media such as blogs, Facebook and Twitter in making purchase decision. Aggregators decide the strategies based on which ones give them maximum operational efficiency.

6.5 Use of Assignment Problem in food delivery industry

Problem: There are three delivery boys in a food delivery company’s database. Three different customers have placed orders. Which delivery boy should be selected to deliver each order, so as to deliver the food in the least possible time?

Time (minutes)			
Delivery boys	Order 1	Order 2	Order 3
1	8	4	14
2	16	10	6
3	8	10	12

STEP 1: The given assignment problem is balanced because no. of rows is equal to no. of columns

STEP 2: Row Minima (subtracting minimum time in each row from all amounts in the row.)

Time (minutes)			
Delivery boys	Order 1	Order 2	Order 3
1	04	0	10
2	10	04	0
3	0	02	04

STEP 3: Column Minima (subtracting minimum time in each column from all amounts in the column.)

Time (minutes)			
Delivery boys	Order 1	Order 2	Order 3
1	04	<u>0</u>	10
2	10	04	<u>0</u>
3	<u>0</u>	02	04

STEP 4: The most efficient solution for the food delivery company to allocate orders in the minimum time frame is given in the schedule below:

Delivery boy	Order no.	Time (minutes)
1	2	4
2	3	6
3	1	8

Total time to deliver all the orders in the most efficient manner is 18 minutes.

STEP 5: Observations

By making use of assignment problem technique, the food delivery company can efficiently allocate order to reduce costs and time. The use of operations research allows for the efficient utilization of available resources with minimum wastage. These techniques can be employed on a much larger scale with thousands of orders on a city-wide level.

7. LIMITATIONS

- (a) Due to lack of accurate primary data, secondary sources of information have been used as a medium to collect information thus findings may be influenced by conclusions of previous research papers.
- (b) Since secondary resources are being used, the authenticity of information on the internet is questionable. Consideration of resources chosen is thus imperative.
- (c) While factual figures or representation of certain documents may be reliable, different sources may present varying information on the same topic.
- (d) The analysis is done using assumptions and the mathematical models prepared are not equipped with actual data thus the scope of the research paper is limited
- (e) There are chances of attribution, exaggeration in prior research studies.
- (f) Biases may have played into the conclusions of previous research papers forming our source for data.
- (g) The use of the different problems is based on certain assumptions like fixed quantities and only a few parties involved which may not hold true in real life thus making the decision making and the problem more complex.

8. CONCLUSIONS

Operations research is gaining more visibility as a competitive advantage, especially in this digital age. Operations research transforms business decision-making and this is being increasingly recognized by companies around the world and in India.

The findings of the conducted research indicate that as the number of people in India with access to technology and higher disposable income increase, the number of people ordering food through online platforms will also increase. With the increase in the market size and the sheer volume of orders, every company in the industry will be looking to capture a larger share of the market. Operations research can provide that much needed competitive advantage that is necessary to attract customers. Companies using operations research techniques in the right manner can make their operations more efficient by reducing delivery times and overall costs.

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