

Logistics Optimization for Rural E-Commerce

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ABSTRACT

Companies like Amazon, Alibaba, and Lazada are well known in the Ecommerce industry and primarily focus more on urban markets. But what about the rural markets? For this thesis, MISI partnered with Ecommerce X, an ecommerce company in India that is servicing the rural markets of India. We developed a framework to help locate Last Mile Partners (LMPs) for delivery as the company expands into other regions in India as well as analyzed a variable pay structure and impact on LMP profitability.

About the Authors:



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KEY INSIGHTS

1. We find that Last Mile Partners (LMPs) in the state of Tamil Nadu have gaps in coverage and are traveling more than 50km for deliveries.
2. We highlight that the current LMP pay structure is not profitable for LMPs.
3. We also find that LMPs are not traveling an optimal route for deliveries

INTRODUCTION

Given the opportunities in rural India, our study looks into the operations and supply chain of Ecommerce X (pseudo name). Ecommerce X started 8 years ago and focuses

on ordering, processing, and delivering goods to rural locations through their in-house online platform. Ecommerce X sells a variety of products from smartphones to household appliances. The company has expanded into 16 states in India, our study, however, focused on Tamil Nadu and West Bengal. The distribution process starts with the Sales Agents and ends with the Last Mile Partners (LMPs). The Sales Agent processes the order which is then sent to the company headquarters (HQ). At HQ, the order is then sent to the manufacturer, who sends the products to a central warehouse. From the central warehouse, the products are repackaged and sent to the Last Mile Partners (LMPs). Currently in the state of Tamil Nadu, Ecommerce X has 45 LMPs who deliver orders to customers. LMPs are not Ecommerce X employees but small business owners who live near the villages they deliver

to. Ecommerce X promises product delivery within a 10-day delivery window. Each LMP is also paid a per item delivered flat rate commission of 300INR and is held to a delivery radius of 30km. Ecommerce X is expanding rapidly into other regions of India,

EXTANT KNOWLEDGE

Prahalad (2009) noted that the Base of Pyramid (BoP) is a socio-economic concept that groups the largest yet poorest population at the BoP. Invisible to corporates, the large global population at the BoP is a massive opportunity (Prahalad, 2009). It is not an easy task to enter the rural market, however, Ecommerce X has established an innovative approach. Ecommerce X uses an approach similar to hub-and-spoke to deliver within the last mile. The hub-and-spoke model is where, each network is arranged like a wheel where there is a centralized hub with many spokes attached to it (O'Kelly, 1998). Ecommerce X has established Last Mile Partners (LMPs) as hubs who deliver to the rural villages. Through our research, we found that although several studies have focused on locating DCs most have not looked at last mile delivery, in particular, last-mile deliveries in rural markets.

RESEARCH METHODOLOGY

We used two forms of data in our research, first was data provided by the company and second was data that we collected through Census of India (2011)¹ website. We first mapped the current LMPs and the customer deliveries to assess the LMP coverage. We then used ArcGIS to map current LMPs and potential LMP locations to analyze and determine the number of LMPs needed in Tamil Nadu and West Bengal as well as where they should be located. In our study we

with this rapid growth our study focused on analyzing LMP locations in the current market (Tamil Nadu) as well as an expanding market (West Bengal, and analyzing the LMP pay structure in Tamil Nadu.

also analyzed the current pay structure based on the LMP distance traveled. Through Google Maps we first determined the total distance an LMP (in this case LMP 1) travels in a month. From that analysis we then further applied a traveling salesman problem and optimized the route traveled by an LMP through Microsoft Excel Solver.

RESULTS

LMP Location Analysis

Using ArcGIS, a mapping software, we mapped customer orders vs LMP locations to see what the coverage looked like if LMP were held to a 30 km radial. Figure 1 shows the locations of LMPs as a yellow box, the red dots are all the customers that were missed. To analyze the number of LMPs needed in Tamil Nadu we first created 30km circles to cover the whole state, in which case 58 LMPs are needed as shown in Figure 1. We then overlaid the current LMPs of Tamil Nadu to assess the areas that lacked LMP presence (the red dots in Figure 1). After mapping the current LMPs, we inferred that there were LMPs that overlapped in regions. We then mapped the rural pin codes in Tamil Nadu to analyze where the new LMPs need to be located. The triangles in Figure 1 show the potential locations, the triangle closest to the center of the circles were considered the optimal location. From our analysis, we recommend that Ecommerce X can add 26 more LMPs to the current 45 to cover the gap in Tamil Nadu or they can consolidate the current LMPs and add the 26 bringing the

¹ <http://censusindia.gov.in/> (accessed 24 April 2019)

total to 58. A similar analytical approach was taken for potential LMPs in the state of West Bengal. A total of 40 LMPs are needed to

cover the state of West Bengal within the 30km radial.

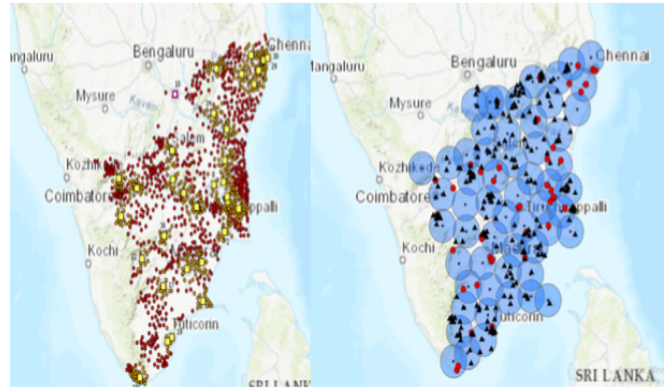


Figure 1 LMP Coverage

LMP Pay Structure Analysis

We further analyzed the per item commission paid to LMPs in Tamil Nadu. Using excel we first analyzed the distance traveled by LMP 1 to understand how much distance was being covered. We were able to infer that each trip was one order, so LMP1 was traveling 1491 km since each trip equaled 1 order. We then applied a route optimization model through Microsoft Excel and consolidated all orders into one trip and LMP 1 was now traveling

203km since all orders were delivered in one trip. We then applied profit analysis to see if the per item flat rate was profitable for the LMP. From our analysis we recommend that Ecommerce X use a variable pay structure as shown in Table 1. We recommend that Ecommerce X can implement a variable structure in which (i) for small items a rate between 150-250INR is paid and (ii) for medium to large items 300INR is paid per item.

Month	Orders in No	Scenario 1(Fixed Pay/Item)	Profit	Scenario 2 (Variable pay/Item)	Profit
Aug 2017	37 small	300 INR	8913.4 INR	268 INR	8939.4 INR
Sep 2017	42 small 4 medium	300 INR	8890 INR	211 INR 300 INR	8900 INR
Oct 2017	20 small	300 INR	3335 INR	200 INR	3332.6 INR
NOV 2017	54 small 8 medium	300 INR	14871.3 INR	258 INR 300 INR	14871.6 INR
Dec 2017	27 small 1 medium	300 INR	5969.2 INR	238 INR 300 INR	5988.3 INR
Jan 2018	94 small 8 medium	300 INR	17881.2 INR	191 INR 300 INR	17909 INR
Feb 2018	88 small 13 medium	300 INR	19551.8 INR	208 INR 300 INR	19673.8 INR
Mar 2018	54 small 52 medium	300 INR	19734.5 INR	120 INR 300 INR	19984.2 INR

Table 1 LMP Variable Pay Structure

CONCLUSION

Four major insights were drawn from the process of analyzing LMP locations and a variable pay structure.

- First, there are gaps in coverage when it comes to LMP locations. And in the case of Tamil Nadu LMPs are traveling up to 50km or more.
- In order to handle demand Ecommerce X needs to add more LMPs to Tamil Nadu.
- With the current pay structure LMPs are not as profitable, so a variable pay structure should be considered.
- LMPs are not delivering via an optimal route.

Ecommerce X is a fast-growing retail company and, in this thesis,, we addressed the following question: “How many LMPs are needed to handle the demand and as the company grows where should the LMPs be located as well as, should Ecommerce X consider a variable pay structure?” By analyzing historical data and mapping the

orders vs LMP locations we were able to analyze and provide Ecommerce X the number of LMPs and potential locations for future expansions. We recommend from our analysis that Ecommerce X keeps a 30km radial coverage for LMPs. In Tamil Nadu there should be 73 LMPs and in West Bengal 40 by doing so they will ensure timely deliveries as well as have LMPs that are located closer to the customers. We also recommend that LMPs deliver using optimal routes and are paid between 150-250 INR for small items delivered and 300 INR for medium/large items.

The findings of the thesis are based on Census Data as well as rural addresses for mapping and distance calculations. As a result, the findings are based on approximations. Future studies could refine the results further using an analytical approach for location analysis and route optimization.

REFERENCES

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