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OPTIMIZING LOGISTICS AND DELIVERY COSTS IN E-COMMERCE: EVIDENCE FROM SMALL BUSINESSES IN UZBEKISTAN

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Abstract. For small online sellers, delivery is often the largest cost they can actually control. This paper builds a per-order cost model of last-mile delivery for a typical small e-commerce business in Tashkent and compares five arrangements: an in-house courier, an in-house courier with route planning and delivery time windows, a third-party courier service, marketplace pick-up points, and a hybrid of pick-up points and third-party delivery. The analysis covers monthly volumes from 200 to 750 orders. The results show that the choice of delivery model depends mainly on order volume. Below roughly 280–306 orders per month, outsourcing to a courier service is cheaper; above this threshold, an in-house courier becomes competitive, and with simple route planning its cost per order at 600 orders falls to about 12,400 UZS, less than half of the third-party tariff. Pick-up points give the lowest cost up to about 600 orders per month and a cost that does not depend on volume, but their use is limited by customer acceptance. Fewer failed deliveries accounted for about one-third of the savings from optimization. The paper concludes with practical recommendations for small sellers and for policy measures that could lower logistics costs across the sector.

Keywords: e-commerce, small business, last-mile delivery, logistics costs, pick-up points, route optimization, Uzbekistan.

1. Introduction

Over the past few years, online trade in Uzbekistan has moved from a niche activity to an everyday channel for thousands of small businesses. The adoption of a new edition of the Law "On Electronic Commerce" in 2022, the rapid growth of domestic marketplaces, and the spread of mobile payment services have lowered the barrier to selling online. A small clothing shop, a home bakery or a spare-parts dealer can now reach customers across the city through Telegram, Instagram or a marketplace storefront within days.

What these sellers quickly discover, however, is that getting the product to the customer can cost far more than getting the customer to the product. Delivery is one of the largest controllable expenses of a small online business, and many sellers set delivery prices by copying competitors rather than by calculating their own costs. Failed deliveries, customers who are not at home, refused parcels and half-empty courier routes all add hidden costs that rarely appear in a simple per-parcel price.

The international literature on last-mile logistics is extensive, but most of it describes large retailers, dense European or Chinese cities, and well-developed parcel networks. Much less is known about how a small seller in an emerging market should organize delivery when volumes are modest, budgets are tight and the infrastructure of lockers and pick-up points is still forming. This gap matters for policy as well: if logistics costs absorb a large share of the margin, the growth of small business through e-commerce will be slower than expected.

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The aim of this paper is to identify which delivery arrangement minimizes the cost per order for a small e-commerce business at different order volumes, and which levers of optimization have the greatest effect. Three research questions guide the study:

1. How does the cost per order differ between in-house, outsourced, pick-up point and hybrid delivery models?
2. At what monthly order volume does an in-house courier become cheaper than a third-party service?
3. How much do route planning and the reduction of failed deliveries contribute to cost savings?

2. Literature Review

The last mile, the final leg from a dispatch point to the customer, is widely recognized as the least efficient and most expensive part of the e-commerce supply chain. Gevaers, Van de Voorde and Vanelslander (2011) showed that it can account for a large share of total logistics costs, largely because parcels are small, destinations are scattered and customers expect fast, flexible service. Boyer, Prud'homme and Chung (2009) demonstrated with simulation that customer density and the width of delivery time windows are key drivers of last-mile efficiency. Their finding that narrow windows raise the distance driven per order is directly relevant to small sellers who promise delivery "at a convenient time".

A second line of research deals with failed deliveries. Punakivi, Yrjölä and Holmström (2001) compared attended home delivery with unattended reception boxes and found that removing the need for the customer to be at home could cut delivery costs substantially. Later work on alternative delivery points, such as Morganti et al. (2014) for France and Germany, showed that pick-up points and parcel lockers allow carriers to reduce failed attempts and consolidate flows. Lim, Jin and Srai (2018) and Mangiaracina et al. (2019) reviewed the growing set of last-mile innovations and noted that their cost effect depends strongly on volume and context.

Route planning itself has a long methodological history. The savings algorithm of Clarke and Wright (1964) remains a practical tool for building delivery routes from a single depot and underlies many routing applications available to small businesses today. Ranieri et al. (2018) added an environmental dimension, showing that last-mile innovations can reduce not only private costs but also external costs such as congestion and emissions.

Despite this rich body of work, three limitations stand out. First, most studies are based on large carriers or retailers whose volumes allow full use of economies of scale. Second, the empirical settings are mostly high-income cities with mature locker networks. Third, there is little guidance on the threshold at which a small seller should switch from one delivery model to another. The economics of delivery for small online businesses in Uzbekistan has received little attention so far. This paper addresses that gap.

3. Methods

The study uses a scenario-based cost model of a representative small e-commerce business in Tashkent. The business sells non-perishable consumer goods (clothing and accessories) through a marketplace storefront and social media, with an average order value of 250,000 UZS. Packaging and product costs are the same under every scenario and are therefore excluded; only delivery-related costs are compared.

The cost per order in each scenario is calculated as:

$$C = F / Q + v + f \times r \qquad (1)$$

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where C is the delivery cost per order (UZS), F the fixed monthly delivery cost, Q the number of orders per month, v the variable cost per order, f the share of failed first attempts, and r the extra cost of each failed attempt (re-delivery or return). Five scenarios are compared (Table 1).

Table 1. Delivery scenarios and model parameters

Scenario	Description	F, UZS/month	v, UZS	f	r, UZS
A. In-house courier	One courier with own vehicle, unplanned routes, delivery "any time today"	7,800,000	0	12%	6,000
B. In-house, optimized	As A, with savings-based route planning and two-hour time windows confirmed by SMS	7,260,000	0	5%	6,000
C. Third-party courier	City courier service, flat tariff per parcel	0	25,000	10%	12,500
D. Pick-up points	Delivery to marketplace pick-up points	0	12,000	5%	8,000
E. Hybrid	60% of orders to pick-up points, 40% by third-party courier with confirmed windows	0	—	—	—

The fixed cost in scenario A consists of the courier's wage (4.5 million UZS), fuel and vehicle costs (3.0 million UZS) and communication (0.3 million UZS). In scenario B, route planning is assumed to reduce distance driven, and therefore fuel and vehicle costs, by 18%. Confirmed time windows are assumed to cut failed first attempts from 12% to 5%. One courier is assumed to handle up to about 750 orders per month (around 29 per working day).

In scenario E, the courier share is assumed to reach a 4% failure rate thanks to confirmed windows, giving 25,500 UZS per courier order; the pick-up share keeps the scenario D cost. Each scenario is evaluated at monthly volumes of 200, 300, 450, 600 and 750 orders. The break-even volume between in-house and outsourced delivery is found by setting the two cost functions equal and solving for Q.

The parameters are representative values set by the author for a Tashkent-based seller and should be read as an illustrative calibration rather than as survey estimates. The model is meant to show the structure of the decision, and any seller can replace the inputs with their own figures.

4. Results

4.1. Cost per order by scenario and volume

Table 2 shows that the ranking of delivery models changes with volume. The outsourced and pick-up options have a flat cost per order, while the in-house options fall steeply as the fixed cost is spread over more orders.

Table 2. Delivery cost per order, UZS (share of the 250,000 UZS average order value in brackets)

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Orders per month	A. In-house	B. In-house, optimized	C. Third-party	D. Pick-up points	E. Hybrid
200	39,720 (15.9%)	36,600 (14.6%)	26,250 (10.5%)	12,400 (5.0%)	17,640 (7.1%)
300	26,720 (10.7%)	24,500 (9.8%)	26,250 (10.5%)	12,400 (5.0%)	17,640 (7.1%)
450	18,053 (7.2%)	16,433 (6.6%)	26,250 (10.5%)	12,400 (5.0%)	17,640 (7.1%)
600	13,720 (5.5%)	12,400 (5.0%)	26,250 (10.5%)	12,400 (5.0%)	17,640 (7.1%)
750	11,120 (4.4%)	9,980 (4.0%)	26,250 (10.5%)	12,400 (5.0%)	17,640 (7.1%)

Source: author's calculations.

At 200 orders a month, an own courier is clearly uneconomical: each delivery costs almost 40,000 UZS, or about 16% of the order value. At 750 orders the same courier delivers for about 11,000 UZS, less than half of the third-party tariff.

4.2. Break-even volumes

Solving the cost functions for equal cost gives three thresholds:

- An unoptimized in-house courier (A) becomes cheaper than a third-party service (C) at about 306 orders per month.
- With route planning and confirmed windows (B), this threshold falls to about 280 orders per month.
- The optimized in-house courier (B) matches the cost of pick-up points (D) at about 600 orders per month and becomes cheaper above it.

In other words, optimization lowers the volume at which insourcing pays off by roughly 26 orders per month.

4.3. Sources of savings

At 600 orders per month, moving from scenario A to scenario B saves 792,000 UZS a month. About 540,000 UZS (68%) comes from shorter routes and 252,000 UZS (32%) from fewer failed first attempts. For a business that relies on a third-party courier, the effect of confirmed time windows alone is smaller in absolute terms but still noticeable: lowering failures from 10% to 4% saves 750 UZS per courier order.

The largest single saving comes from choosing the right model for the current volume. A seller with 600 orders who still uses a third-party courier pays about 8.3 million UZS a month, or nearly 100 million UZS a year, more than with an optimized own courier. That is roughly 5.5 percentage points of the order value.

5. Discussion

The main finding is that there is no single "best" delivery model for a small online business. The right choice depends on where the business stands on its growth path. This agrees with the conclusion of Lim, Jin and Srai (2018) and Mangiaracina et al. (2019) that the value of last-mile solutions is

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context-dependent, and it gives that conclusion a concrete form for a small seller: a threshold of roughly 280–300 orders per month.

The strong performance of pick-up points is consistent with Punakivi, Yrjölä and Holmström (2001) and Morganti et al. (2014). By removing the need for the customer to be present, they eliminate most failed attempts and turn many separate trips into one consolidated flow. In Uzbekistan, marketplace pick-up networks make this option available to small sellers without fixed costs. Its limitation is behavioural rather than economic: some customers still prefer home delivery and may abandon the purchase if it is not offered. For this reason, the hybrid model (E) is likely to be a realistic option for many sellers: it costs about a third less than relying solely on a courier service while keeping home delivery for those who want it.

The results on failed deliveries support the argument of Boyer, Prud'homme and Chung (2009) that service design matters alongside routing. A confirmation message with a two-hour window costs almost nothing, yet in the model it produced a third of the savings in scenario B. For small sellers, who rarely have access to advanced routing software, such organizational measures may be the quickest win.

The study has several limitations. The parameters are illustrative rather than observed, and real costs vary with district, season and product size. The model assumes one courier and does not consider the step in costs when a second courier is needed above about 750 orders. It also leaves out the revenue side: faster or more convenient delivery may increase sales, which a pure cost comparison cannot capture. Future research should test the model on survey data from small sellers in several regions of Uzbekistan and include customer preferences for delivery options.

6. Conclusion

This paper compared five delivery arrangements for a small e-commerce business in Tashkent and found that order volume is the decisive factor in choosing between them. Below about 280–300 orders a month, outsourcing delivery is cheaper; above that level, an own courier with basic route planning can cut the cost per order to less than half of a third-party tariff. Pick-up points offer the lowest cost for most small sellers, and a hybrid of pick-up points and courier delivery is a practical compromise between cost and customer convenience.

For small business owners, the results suggest four practical steps:

1. Calculate the real cost per order, including failed deliveries, and review the delivery model each time monthly volume passes the 300-order mark.
2. Encourage customers to choose pick-up points, for example through a lower delivery fee or a small discount.
3. Confirm delivery windows with customers in advance; it is the cheapest way to reduce failed attempts.
4. Use free or low-cost route planning tools as soon as an own courier is hired.

For policymakers and support institutions, the analysis points to measures that would lower logistics costs for the whole sector: supporting the expansion of shared pick-up points and parcel lockers, especially outside Tashkent; offering small businesses training and subsidised access to logistics software; and encouraging joint delivery services through business associations, so that small sellers can achieve the volumes that make efficient delivery possible. Improving these economic mechanisms would help e-commerce become a real driver of small business growth in Uzbekistan rather than a channel whose benefits are eaten up by delivery costs.

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