Drone Delivery Case Study

Based on the provided information, here’s a structured plan for designing an efficient drone-enabled delivery system for Taclo, evaluating economies of scale, rollout planning, and conducting a cost-benefit analysis.

**1.** **Efficient Drone-Enabled Delivery System Design**

**Key Drone Capabilities:**

* Range: 7-8 km (suitable for urban area service radius)
* Speed: 40-50 km/h, reducing average delivery time
* Capacity: 5 kg, enough for multiple smaller orders or a single large order
* Flight Time: 30 minutes per charge, supporting timely delivery within range
* Cost: INR 130,000 per drone, with additional monthly maintenance and battery costs

**System Design Components:**

* Hub-and-Spoke Model:
  + Designate high-tech kitchen hubs and strategically position drones for dispatch at key locations in Bangalore.
  + Drones operate within an optimized 5-7 km radius from each hub, allowing prompt service in high-demand areas.
* Order Aggregation Algorithm:
  + For efficiency, group orders within a 2-3 km range if drone capacity allows.
  + Apply algorithms to batch and prioritize orders, ensuring effective use of drones based on proximity and readiness.
* Dynamic Drone Dispatch:
  + Incorporate real-time data on traffic, weather, and delivery patterns, ensuring drones are deployed only when advantageous.
  + Integrate GPS and visual sensing with Taclo’s app, providing real-time tracking and arrival estimates to customers.

**Key Benefits:**

* Reduced Delivery Time: Estimated delivery within 20-25 minutes per order within 7 km radius during peak hours.
* Lower Attrition Impact: Automated delivery reduces reliance on delivery executives, minimizing labour attrition effects.
* Increased Serviceability in Traffic-Dense Zones

**2. Drone System Vs. Current Delivery System**

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| --- | --- | --- |
| **Metric** | **Current Delivery Model** | **Drone Delivery Model** |
| Delivery time | 30-40 minutes in high traffic | 20-25 minutes with drones |
| Maximum Delivery Radius | 3-4 km/ delivery personnel due to traffic | 7-8 km coverage/ drone |
| Capacity Constraints | One order/ delivery person | 2-3 orders/drone/trip (weight constraints should be kept in mind) |
| Scalability Potential | Limited as per available labour | High scalability as drones are tech driven and labour dependency will be minimised. |
| Average Cost per delivery | INR 55 (per delivery labour cost) | INR 65-70 (Drone Costs) May be probably higher and go upto 80. |

**Considering: -**

* **Cost Efficiency:** The per-delivery cost with drones, factoring in maintenance, remains comparable to labour-based delivery. Over time, with increased volume, drone utilization could reduce costs further.
* **Operational Scale:** Drones offer a scalable solution, capable of expanding service radius and alleviating traffic bottlenecks, leading to long-term savings.

**3. Roll-Out Plan**

**Phase 1: Pilot and Infrastructure Setup (Months 1-3)**

* **Pilot Area**: Target high-density zones in Bangalore, such as Koramangala and Indiranagar.
* **Drone Acquisition**: Purchase 20 drones (INR 2.6 million) to serve initial pilot zones.
* **High-Tech Kitchen Setup**: Establish drone launch pads and high-tech kitchen facilities (INR 10 million).
* **Technology Integration**: Develop and test integration of the drone fleet with Taclo’s app for order management and tracking.

**Phase 2: Scale-up and Evaluation (Months 4-9)**

* **Expansion to Additional Zones**: Expand to 3 additional zones, adding 30 more drones (additional INR 3.9 million).
* **Performance Monitoring**: Assess delivery times, cost per order, and user satisfaction through metrics gathered via the app.
* **Refinements and Adjustments**: Based on pilot feedback, adjust drone routes, and add more charging and maintenance hubs.

**Phase 3: Full Implementation (Months 10-18)**

* **City-wide Deployment**: Increase drone fleet size as needed across Bangalore. Add 50 drones (INR 6.5 million) for full city coverage.
* **Ongoing Maintenance and Support**: Allocate monthly maintenance and replacement budget.
* **Data-Driven Optimization**: Use analytics to optimize drone use, route planning, and ensure maximum cost-efficiency.

**4. Should We shift to New Delivery System?**

**Cost Benefit Analysis**

|  |  |  |
| --- | --- | --- |
| **Metric** | **Current Model** | **Drone Model** |
| Fixed Monthly Cost | High due to labour | Low due to less labour dependency |
| Initial Capital Expenditure | N/A | INR 25 million Approx |
| Ongoing Monthly Expenses | High labour Replacement and Salary | INR 325,000 (Drone will require maintenance) |
| Delivery Time Reduction | Moderate-High | 20-25% reduction leading to customer satisfaction |
| Environmental Impact | Carbon emissions with vehicles | Lower carbon emissions with Drones as they are electric |
| ROI timeline | Immediate but limited | Might take 18 months to 2 years |

**Conclusion:** Transitioning to a drone-enabled delivery system offers a strategic advantage in reducing operational delays and costs tied to labor management while expanding service capacity and coverage. The new delivery structure, particularly in metro zones with dense traffic, will likely offer improved economies of scale in the long run due to lower attrition, reduced reliance on labor, and enhanced delivery speeds.

**What Assumptions I made When solving this case study?**

1. **Customer Demand for Drone Delivery**:

* I assumed there is significant customer demand for faster delivery and that customers will positively respond to drone delivery services.
* I also assumed that current traffic congestion and limitations in delivery radius are sufficiently problematic that drones will noticeably improve the customer experience.

1. **Drone Operational Efficiency**:

* I assumed that drones can reliably cover a 7-8 km radius without substantial delays or technical issues. Also, each drone can carry up to 5 kg and make multiple deliveries per trip where orders are close in proximity, improving economies of scale.

1. **Labor Cost Reductions**:

* Assuming that the deployment of drones will lead to lower dependency on delivery executives, thus reducing costs associated with high turnover and attrition. Also, that over time, reduced labour expenses will offset the high initial investment in drone technology.

1. **Regulatory Compliance and Airspace Access**:

* I made an assumption that there are no significant regulatory barriers to the operation of drones for commercial delivery purposes in Bangalore, or that any such barriers can be managed within the rollout timeline.

1. **Customer Satisfaction Gains**:

* I analysed and assumed that reduced delivery times will significantly improve customer satisfaction, retention, and repeat orders, which in turn will support revenue growth.

1. **No Major Maintenance or Tech Disruptions**:

* I at last assumed that maintenance costs and battery replacements are predictable and manageable, without accounting for unexpected breakdowns or tech updates that could impact costs. Considering we have great relations with out providers and we can place orders for batteries in advance.

**Does the Plan follow following factors?**

**1. Time Value of Money:**

* **No**, the current plan does not explicitly consider the time value of money. It does not discount future cash flows or factor in the present value of expected future savings and revenue.
* **Recommendation**: To account for this, the investment schedule and ongoing operational expenses should be evaluated with a discount rate to reflect the time value of money, particularly since the initial capital expenditure is high, and returns are projected over a long period (12-18 months or more).

**2. Calculation of Present and Future Value for Money:**

* **No**, there is no explicit calculation for the present and future value. The plan mentions a high initial investment and suggests a potential ROI timeline but does not include calculations for net present value (NPV) or internal rate of return (IRR).

**3. Supply-Demand Analysis:**

* **Partial**. The plan addresses demand in terms of expected customer satisfaction with faster delivery, high traffic density in metro zones, and operational challenges during peak hours, but it does not provide a detailed supply-demand analysis.
* **Assumptions**:
  + Assumes that the demand during peak hours is high enough to justify drone investment, without specific quantification of demand growth over time.
  + Assumes that the rollout will not oversaturate the supply of drones relative to demand within each 7-8 km hub radius.

**4. Cost-Benefit Analysis:**

* **Yes, partially covered**, but more detail would strengthen the analysis.

**A Rough Cost-Benefit Analysis will look like-**

**Costs:**

1. **Initial Capital Expenditure**:
   * **Drone Costs**: INR 130,000 per drone.
   * **High-Tech Kitchens**: Estimated at INR 10 million for initial setup.
   * **Technology Integration**: Estimated at INR 2 million for software updates to manage drone tracking and integration.
2. **Ongoing Operational Costs**:
   * **Drone Maintenance**: INR 6,500 per drone per month.
   * **Battery Replacement**: INR 13,000 per battery, with an average of three months’ battery life.
3. **Labor Costs**: As drones replace delivery executives, labour costs will decrease over time. Estimate labour savings based on reduced headcount and high attrition replacement.

**Benefits:**

1. **Reduced Delivery Time**:
   * Faster delivery (20-25 minutes) can improve customer satisfaction and potentially increase order frequency.
   * **Customer Retention and Repeat Business**: Estimate a 5% increase in customer retention and order frequency due to faster delivery.
2. **Increased Operational Efficiency**:
   * Reduced attrition costs, as fewer delivery executives will be needed.
   * Improved economies of scale, especially during peak hours, reducing the per-delivery cost.
3. **Environmental Impact**:
   * Drones, being electric, produce fewer emissions compared to delivery vehicles, aligning with sustainability goals and possibly enhancing brand value.
4. **Long-Term Competitive Advantage**:
   * Early adoption of drone technology could position Taclo as a market leader in innovation, attracting tech-savvy customers and enhancing brand loyalty.