Design of Seller Implant Operations in an e-Commerce Marketplace

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Abstract

In the current e-Commerce ecosystem, an ideal supply chain involves the delivery of an accurate product to a precise location, on the right time at a suitable price. To echo this thought further - Speed, Reliability & Cost are earmarked as the important pillars to judge the design of a good supply chain. An e-Commerce marketplace model involves picking up of shipments from sellers & merchants with a daily load ranging as low as one shipment per seller to as high as 25,000 daily orders from these sellers.

This paper introduces an alternate supply chain design to enable first mile pick-up of shipments from high load sellers. Going further, the paper dives deep into this asset-less first mile design and henceforth illustrates its impact on Speed, Cost and Reliability of the supply chain of a particular logistic service provider.

Keywords

Supply chain, Implant, e-Commerce, Logistics, Asset-less.

1. Introduction

1.1 Brief Context

Electronic commerce commonly known as e-Commerce, is the buying and selling of products or services over electronic system such as internet and other computer networks. This can range from ordering online, through online delivery of paid content, to financial transactions such as movement of money between bank accounts. Recent estimates by United Nations Conference of Trade and Development (UNCTAD) pegged the global e-Commerce market as a $22.1 trillion industry in 2015.

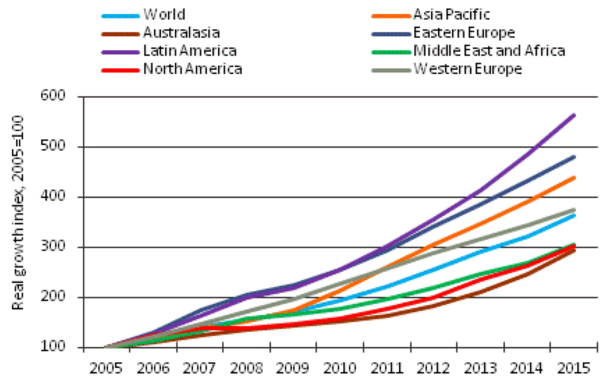

Figure 1. Internet Retail Sales by Region(Real growth index 2005=100)
Source: Euromonitor, from trade sources/national statistics

For the purpose of this paper we will keep our discussion restricted to the physical goods being sold online and how they are transported to the end consumer. For an e-Commerce company the end customer of the product can be:

- Wholesaler or retailer; ie the transaction is Business to Business (B2B)
- Individual consumers; ie the transaction is Business to Consumer (B2C).

E-business has been a powerful and compelling enabler of supply chain integration across a wide range of industries. As a result of e-business, many of the core supply chain concepts and principles have been put in practice in a much more effective way. These concepts include: information sharing, multi-party collaboration, design for supply chain management, postponement for mass customization, outsourcing and partnerships, and extended or joint performance measures. Internet has allowed companies to come up with highly innovative solutions that accelerated the widespread adoption of these core supply chain principles (Lee and Wang, 2001).

1.2 Supply chain in current e-Commerce context

Logistics is the process of strategically managing the procurement, movement and storage of materials, parts and finished inventory (and the related information flows) through the company and its marketing channels in such a way that current and future profitability are maximized(Christopher, 2011).

Companies conducting e-Business perform some or all of the following activities over the Internet across the supply chain (Chopra 2000):

- Providing product and other information
- Negotiating prices and contracts
- Placing and receiving orders
- Tracking orders
- Filling and delivering orders
- Paying and receiving payment.

A supply chain includes the parties involved, directly or indirectly in completing a customer request. The supply chain includes the manufacturer and suppliers and transporters, warehouses, retailers, and customers themselves. Within each organization the supply chain includes all functions involved in receiving and filling a customer request. This includes new product development, marketing, operations, distribution, finance and customer service (Chopra 2004).

Indian e-Commerce industry as mentioned in the Discussion Paper on e-Commerce(Department Of Industrial Policy & Promotion, 2013-14), is characterized by the Market Place model, which allows large number of merchants/traders especially MSMEs(Micro, Small & Medium Enterprises) to advertise their products on a Market Place and benefit from increased turnover. E-Commerce companies today are dealing with multiple products moving across states and simultaneously are also managing a large number of merchants, delivery personnel and customers. Large volume of transactions, multiple moving parts coupled with nation-wide footprint makes e-Commerce supply chain complex keeping the infrastructure and regulatory constraints in perspective. Logistics is a necessary evil to move the material from the seller to the buyer and there is generally no value addition to the product. Hence efficiency and cost effectiveness provide competitive advantage (Viswanadham and Gaonkar 2003).

Currently, the over-all supply chain design for pickups from small, medium and large sellers is almost similar to each other. This prevents the logistic partner to garner advantage from the characteristics of the respective seller types. We broach this subject by citing the current supply chain assets involved in supply chain of an online Marketplace. Through the thoughts proposed in this paper, we have attempted to improve the process of handing over of shipments to the logistics partner, by merchants/sellers fulfilling orders placed on an online e-Commerce. Later, we will deep dive into the pre-requisites, process design and advantages of leveraging existing infrastructure of such merchants/sellers. For the purpose of this paper we will be focusing on the Supply chain design of the Marketplace model in e-Commerce.

1.3 Facility network for a Marketplace supply chain

For e-Commerce to tap the potential of a large seller base, as is the case in India, it is essential to support it with a cost-efficient yet reliable supply chain model. An online marketplace connects sellers/merchants to customers through a prudent supply chain. Typically, post an order is placed at an online marketplace platform; the following facilities interact during the order fulfillment cycle:

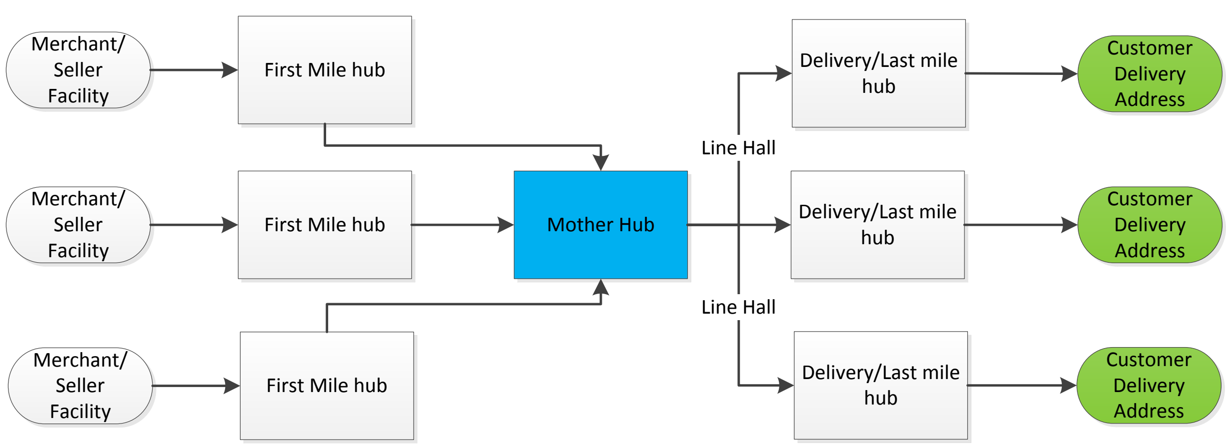

Figure 2. Schematic diagram - Facility network of a Marketplace Supply Chain

- **Merchant/Seller site:** The order placed by the customer is packed and handed over to the logistic partner through this facility. A typical merchant/seller can hand-over a load ranging from one shipment to thousands of shipments daily.

- **Pickup or First mile hubs:** This facility works as a consolidation point of shipments packed and dispatched by nearby sellers within a city or a combination of zip-codes. Number of such hubs can range from 1 to 15 in a city depending on the seller geo-coordinates and their respective loads. The accumulated shipments are then connected to Mother hubs for further processing.

- **Mother hub & Line hall**: These are big sortation facilities that consolidate shipments from respective first mile hubs in the city and sorts them basis connections (air or ground) to the final destinations of shipments. These facilities due to their enormous size are located outside the city, generally near an airport that aids faster connection speeds. The mother hub dispatches these shipments to the delivery/last mile hubs using its transportation system; commonly referred to as a line-hall.

- **Delivery or Last mile hubs**: These facilities are responsible for receiving and delivering shipments to the end-customers. Number of such hubs in a city is a function of order density within the city zip-codes.

Customarily, merchants/sellers with larger mean daily loads (>1000 orders) operate out of sizeable establishments. The following implant design focuses on reducing the infrastructure dependency of first mile hubs, while aiding faster connections to respective mother hubs by utilizing this seller facility. This supply chain design in-turn creates a positive impact for the merchant, the logistic partner and the end consumer.

2. Implant model

2.1 Overview of design

Implant operation leverages the seller/merchant infrastructure along with an 'on-the-go' sorting capability of the logistics partner through the use of handhelds or other computing devices. First mile executives(in these case-Implants) operate out of the merchant facility to perform their diurnal processes. During this design the high load seller hands over shipments in regular small intervals (30-90 minutes) to the logistics partner. This 'Continuous handover' of shipments in smaller pre-defined intervals has shown to prevent batching of shipments during first mile processes, in-turn preventing creation of any bottlenecks in the value chain.

Following rudimentary requirements/checks ensure compliance to the supply chain design of implant operations.

- Merchant/Seller provides a sustained load in definite intervals during first mile working hours.
- Minimum average daily load handed over by seller should be more than one Full truck load(FTL) for the vehicle used to connect shipments to the next facility ie in this case the Mother hub.
- Required space available at shipments pickup location for first mile team to process shipments.

Terms used:

- *Daily Load: Shipments handed over by the merchant daily*
- *Continuous Handover: Merchant to handover shipments in pre-defined intervals*
- *Number of handovers: Number of times the merchant hands over the shipments to logistic partner daily*
- *Full truck load(FTL): Shipment load carrying capacity of the transport vehicle used for connections*
- *Hours of operation: Time for which First Mile team performs operations at Merchant facility*

2.2 Steps to deploy Implant Operations at merchant site:

1. Check for implementing Continuous handover**:** Logistics partner to verify if the merchant handing over shipments has an average daily load of more than the FTL of forward connecting vehicle. For an ideal implant operation average daily load to be more than two times the FTL. Post confirmation, merchant to arrange for handover of shipments to the logistics partner in batches of continuous load.

2. Logistics partner to calculate space requirements for a streamlined flow of material during operational hours. The same to be compared with the space available at merchant site. For these calculations we assume, first mile processes at merchant site occurs in processing stations. Following is the indicative space requirement calculation methodology for implant operations:

Base Inputs:

- The merchant fulfils 'L' orders daily through the logistics partner.
- Shipments are stored inside Gunny bags of base area 'Ba' square feet.
- Gunny bag can accommodate 'Bs' shipments per bag.
- Logistics partner is operational for 'H' hours during an operational day at the merchant site.
- Every processing station requires 'S_a' square feet area and has a productivity of processing 'Sp' shipments per hour.

Calculations for Space requirements at Merchant site

- Space for Staging shipments handed over by merchant to the logistic partner**:**
  - Cases where continuous handover interval is less than 60 minutes

    Incoming Staging Space required = $L/H/ B_s / B_a$

  - Cases where continuous handover interval is more than 60 minutes

    *Incoming Staging Space required = 1.5*Average load handed in every interval/* B_s / B_a

  Note: If double stacking of bags is allowed, the space required can be halved in this formula

- Space for Stations and shipment processing:
  - *Load per hour* = L/H
  - *Stations required*= Roundup[$L/H/ S_p$]
  - *Area required by all stations= Stations required** S_a

- Space for staging outgoing bags:
  - To ensure faster dispatches and prevent staging of shipments, space required for staging of processed shipments that are pending dispatch to mother hub should be equivalent to the FTL of the vehicle used for transportation.

    Outgoing Staging Space required = $FTL/ B_s / B_a$

  Note: We can further take into account a factor of safety while calculating space in the above formula to accommodate for load variations and vehicle availability.

Overall space required for Implant Operations	=	**1.25*∑(Incoming staging area, Station area, Outgoing staging area)**

Note: Through the study of existing implant operations, we identified that 25% of the space required for processing and staging handed over shipments, is required for man-power movement. Hence, the total space required is increased by a factor of 25% to accommodate space for manpower movement. This factor can be modified basis process design of the logistic partner.

3. Logistic partner's field executive to take handover of shipments in continuous intervals from the merchant at a pre-defined area on the pickup site. These static intervals can range from 30 minutes to 90 minutes. For higher daily load it is advisable to have smaller handover intervals to prevent batching of shipments.

4. Logistic partner to maintain a daily log of shipments handed over during every handover slot. This log to be attested by the merchant for material integrity and shipment reconciliation purposes.

Date			
Time slot	**Shipment Count**	**Merchant Acknowledgement**	**Logistic Partner Acknowledgment**

Figure 3. Sample of Continuous hand-over manifest

5. **Vehicle Dispatch Design:** Mother Hubs typically function on a wave based processing design, ie certain category of shipments is processed during a particular time interval(a wave). Shipments not belonging to this processing wave are staged at the mother hub till the allocated wave commences. The waves are configured basis the forward connection timings & the final destination of these shipments. To ensure maximum numbers of shipments are connected to the end destination on the same day, the dispatch of shipments from the merchant site should be aligned to the waves running in the mother hub.

   Following is the criterion for designing the dispatch cut-offs for vehicles at the merchant site:

   - Wave based dispatch: Dispatch cut-offs to be defined basis the timings of the waves of the connecting Mother Hub. This exercise is done to maximise the number of shipments processed by the mother hub on the same day during the appropriate wave to ensure faster forward connections.
   - Logistic partner to factor in the time taken by the transport vehicle to reach the Mother Hub from Merchant site.(Assumption: After the transport vehicle has reached 'Full truck load'(FTL) it will directly travel to Mother hub)
   - Vehicle is dispatched post FTL of vehicle is reached or at the pre-defined cut-off(whichever first)

   To summarize –

Dispatch cut-offs => ***f(****MH forward connections, Seller to MH Transit time, FTL of vehicle used****)***

2.3 Control points & Feedback metrics:

To scrutinize the performance of any Supply chain design, it is critical to keep analyzing the relevant feedback metric indicators. Corporations that can achieve seamless, real-time supply chain integration will gain a competitive advantage over their competitors. To achieve real-time efficiency, e-Commerce applications have to be multi-layered and full of rapid decision-making capabilities (Tam, 2003). The report –'E-Commerce in India-2016' by Confederation of Indian Industry defines the following key features of the metrics that help in tracking the functions of any effective supply chain. These metrics should:

1. Support live visibility of day-to-day operations through exception management and triggers actions to respond to supply chain events
2. Enable performance tracking through KPIs (Key Performance Indicators) and help in understanding performance trend
3. Support root cause analysis and facilitate a deep dive into the key drivers of a problem
4. Enable scenario planning to understand the impact of any improvement across supply chain.

Keeping the above mentioned thumb rules in mind; we have defined the following metrics to measure the health of an implant operation. These metrics can then be used further to derive the relevant Key Performance Indicators (KPIs).

T_{SO} - *Timestamp (Shipment order assigned to merchant)*
T_{SP} - *Timestamp (Shipment packed and marked ready to ship by merchant)*
T_{SH} - *Timestamp (Shipment physically handed over to Logistic partner)*
T_{IS} - *Timestamp (Shipment in-scanned by first mile operative in ERP)*
T_{BOS} - *Timestamp (Shipment out-scanned in ERP and sent to Mother hubs in bags)*
T_{VA} - *Timestamp (Vehicle containing shipments reaches Mother Hub)*
T_{BR} - *Timestamp (Bag containing shipments received in Mother Hub)*
T_{SIC} - *Timestamp (Shipment in-scanned at MH)*
S_L - *Count of shipments lost post hand-over*
S_R - *Count of unfit shipments returned immediately to seller*

Sno.	Health Metrics	Inferences
1.	T_{SO-} T_{SP}	Indicates time taken by merchant to dispatch shipment post allocation of the order on the online marketplace. This metric can be used to track merchant performance.
2.	T_{SP-} T_{SH}	Signals the time elapsed between shipment being marked 'ready to dispatch' by the merchant and the time when shipment is handed over physically to the logistics partner. Large time intervals between continuous handovers, non-compliance of First-In-First-Out (FIFO) or staging of shipments during this process might lead to distension of this metric.
3.	T_{SH-} T_{IS}	Time taken for the shipment to get in-scanned in the first mile ERP post physical handover by merchant. Post in-scanning of shipments, typically the logistic partner acquires the legal ownership of shipment and is responsible for any damages.
4.	T_{IS-} T_{BOS}	Implies the time spent to connect the shipments forward basis process design in first mile. First mile processing generally involves sortation on the basis mother hub waves and the time spent for the same can be reduced by designing lean processes and reducing Non-Value Adding (NVA) activities.
5.	T_{BOS}- T_{VA}	Time taken by the transport vehicle to reach mother hub post-dispatch from merchant site. This metric would be a function of the geographical location of facilities, transport infrastructure & conditions across the route taken by the vehicle.
6.	T_{VA-} T_{BI}	This metric represents the time taken by Mother hub operatives to acknowledge the bag received from merchant site, post vehicle arrival at the mother hub. In an ideal scenario, this interval should be minimal.
7.	T_{BI-} T_{SIC}	Mother hub opens the received bags basis the waves running at a particular time. In-case of improper alignment of dispatch cut-offs defined for implant operations and mother hub waves, this metric may inflate and may result in poor delivery speeds.
8.	S_L	Indicates the number of shipments lost by the logistic partner during transit.
9.	S_R	Indicates the shipments rejected by the first mile operative and returned immediately to the merchant. Rejection may be a result of improper packaging, un-readable barcodes etc and can be used to track merchant performance.

Figure 4. Health metrics for Implant operations

2.4 Advantages of Implant model:

Professor Michael Porter in his revered book – Competitive Advantage, elucidated two major strategies to winning business: differentiation and cost advantage. Providing customers with an offering that they perceive as having higher value helps a company create differentiation, while cost advantage is gained by doing things more economically than competition. Continuous dispatch of shipments to Mother hub through implant operations aids faster forward connections and in-turn reduces transit time of a shipment. Shipment dispatch from the merchant facility can be orchestrated basis Mother hub wave design. Through the deployment of implant model, we have seen improvements in end to end shipment delivery speed (Day 3 Speed) *of up to 35%.* Note: Day3 speed is measured as the percentile of shipments delivered to the end customer by the 3rd day of order allocation to the logistic partner.

Facility location decisions are critical to the efficient operation of a supply chain. Poorly placed plants and warehouses can result in excessive costs and degraded service no matter how well inventory policies, transportation plans, and information sharing policies are revised, updated, and optimized. At the heart of many supply chain facility location models is the fixed charge location problem. As more facilities are located, the facilities tend to be closer to customers resulting in lower transport costs, but higher facility costs (Daskin and Berger 2003).

For a typical first mile asset, infrastructure amounts to *roughly 15-25% of the overall* first mile cost. This attribution is a function of factors like seller geo-distribution, average load distribution in the seller ecosystem, overall facility network design and infrastructure cost. Implant model utilizes the existing merchant & seller infrastructure for connecting shipments to the Mother hub & hence rendering no requirement of first mile hubs for forward/reverse connections. Since, almost all first-mile hubs are required to be located near areas with high seller density, ie zones within the city with higher rental tariffs. Hence, minimizing dependence on self-owned/leased facilities and reducing the first-mile infrastructure footprint in the city leads to significant reduction in the over-all cost of a logistic partner's supply chain. The service provider can then pass on these savings to the merchant or the end customer. This design also offsets the risk of sudden load variations at multifarious nodal points.

This model refines 'track and trace' for shipments while enabling the logistic partner to perform on-the-spot shipment reconciliation at merchant's location. We have observed these issues to arise during handover of - duplicate shipments, shipments with illegible barcode, shipments not passing packaging guidelines. If required, such shipments can be immediately returned to the merchant. The logistic partner can on the cost of return journey of a shipment rejected at the hub and aids faster intimation to the end-customer in-case of a delayed delivery.

3. Conclusion

A new economic model needs a new logistics model. Development of B2C e-commerce needs logistics for support. Without an efficient and reasonable logistics system, e-commerce will suffer because no one wants to delay their shopping (Yingli 2014). Today we have supply chains as one of the infrastructure basics for implementation of e-Commerce around the world. The final and most sophisticated of the e-Commerce regions is the supply chain collaboration where, both customers and partners are able to seek and leverage the full value of real-time transactions and collaboration solutions. Interchangeably, E-business has been a powerful and compelling enabler of supply chain integration across a wide range of industries. As a result of E-business, many of the core supply chain concepts and principles have been put in practice in a much more effective way.

As consumers and businesses embrace the Internet, strategies of e-Commerce applications and processes need to be constantly reassessed. Implant design enables the merchant to have lower shipping charges along with reduction in overall order fulfillment cycle. To summarize, this model enables the service provider to deliver faster 'Service Level Agreements (SLAs)' – ie faster speeds as a mode of differentiation for their customers while utilizing the low cost supply chain advantage through an asset-less first mile system. The resulting positive impact on Speed, Cost & Reliability of the service provider's supply chain is favorable for the merchant and the end consumer. The need for competitive advantage has further elevated the need for logistic companies to come up with innovative solutions to solve fundamental problems and act as a differentiator in the ecosystem. Constantly evolving a supply chain into cost-effective and reliable design will help these companies gain the competitive edge. Minimizing infrastructure dependency of facilities to reduce end-to-end costs, while improving delivery speeds and customer satisfaction through implant operations is one such step in this direction.

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Biography

Suryansh Shrivastava is currently working as a 'Specialist of Process design' in the Supply chain design function of Flipkart India Pvt. Ltd, an Indian e-Commerce company. He earned his B.Tech. in Civil Engineering from the Indian Institute of Technology – Bombay. Suryansh has spent approximately 2.5 years closely studying and optimizing processes involved in the Supply chain of an e-Commerce company. Currently he is leading the efforts to design supply chain processes in order to open Flipkart's supply chain to serve other e-Commerce players as their Logistics partner. His interest lies in the field of automation & shrinkage reduction in the supply chain processes of Logistics entities.

Sarvartha Kanchan is currently working as a Director of Supply Chain Design for Flipkart India Pvt. Ltd. He earned B.Tech. in Electronics and Communication Engineering from Technical University of Uttar Pradesh, India and Masters in Operations Management from ICFAI University, India. Sarvartha has worked in supply chain environment of highly regulated / process driven manufacturing companies like GE Healthcare, Britannia Industries Limited and complex logistics and warehousing domain with Flipkart. He has worked across different supply chain functions namely, Strategic Sourcing, Vendor Development, Process Engineering & Quality, Materials Management and Order Fulfillment. He was responsible for driving efficiency improvement projects in supply chain at a corporate level and was looking at end to end value chain for driving LEAN Six Sigma improvements. Currently he looking at transforming supply chain design to improve speed, reliability and cost for the logistics function of Flipkart. His interests include vendor development, manufacturing, simulation, optimization, design for six sigma and lean. He is member of ASQ, APICS, WERC.