TECHNOLOGY INNOVATIONS AND PROCESS IMPROVEMENTS FOR "THE LAST MILE DELIVERY" SUPPLY CHAIN

by

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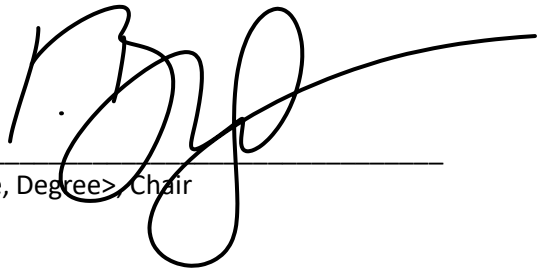

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Dedication

With the start of my thesis document, I would like to step back and ponder over the exciting journey of my Global Doctor of Business Administration (GDBA) program, which I started in Jun'22 to till now while I am writing this document. The journey has been very exciting – learning – self-actualizing and I want to explicitly dedicate my final thesis to my father and my wife who played a very important role in motivating me to undertake this GDBA program alongside my stringent and highly demanding professional life.

It was always a desire of my father to see me succeed in life and he is a firm believer that a good education always provide us a platform to grow. Since he himself could not pursue his post-graduation in Economics (that being his favorite subject in 1960's), he always is wanting me to get educated as much as I can and provides all the psychological support he can give.

The support from my wife had been immense, she is a Masters in Computers and Masters in Chemistry have been very participative in this DBA journey. She has always lent ears to hear my theory and also provide inputs as she too remains one of the consumers of my theory which is getting proved in this thesis. My wife also ensured that I get the space needed for me to critically think – analyze – document the research stages which has finally gotten converged to my final thesis document of GDBA program.

I thank both my father and my wife as they had to postpone many of their plans just because of my tight schedule on this DBA journey and it is their motivations that gave me enough will-power to bring my DBA journey to this level.

Acknowledgements

During my DBA journey I came across many people who provided their guidance with the sole intent of assisting me to successfully complete my DBA program. The most important person is my mentor, Dr. Sasa Petar (PhD), who not only made me comfortable but also ensured that I enjoyed this journey along with my other personal & professional commitments. His clarity on the subject ensured that I am doing the research in the right direction with the right cause and with the intention to get the right results which could benefit industries anytime in future. His commitment to validate my research topic, research contents and direction of research is what I am proud of, and this document is an output of his efforts taken for me to accomplish my DBA journey.

I also would like to acknowledge my fellow DBA program colleagues who shared their experiences of their journey and the approaches they adhered to overcome their challenges or obstacles. Such interactions over the group helped me to keep aligning my thoughts and contents to achieve my goals.

Lastly, I would also like to acknowledge my colleagues in Volkswagen Group IT as they took interest in my research topics and provided their valuable suggestions and input.

ABSTRACT
TECHNOLOGY INNOVATIONS AND PROCESS IMPROVEMENTS
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Praveen Kumar Mishra
2024

Dissertation Chair: <Chair’s Name>

E-commerce retail sales have been growing year on year (YOY), marking a cultural mindset change in purchaser and making them sway to online purchases as compared to traditional window shopping. This mindset took a great faith of leap, with Covid-19, directly impacting lives and businesses across the globe. Change in mindset gave way to unique demands, like expecting delivery in same day or in next 45 minutes as a new normal expectation. These demands led researchers, supply chain domain experts, logistics & delivery partners as well as e-commerce vendors to ponder over ways by which business processes could be made more agile – simpler – faster with additional advantages of shelving out business process inefficiencies as well as reducing the cost of operations by bringing business very near to consumer. This research was an attempt to study how co-ownership/ co-sharing of infra resources and technology embracing can help e-commerce vendors become more agile and can meet the expectations of end consumers for a delivery model to optimize from 1 week to 1 day to 45 minutes. The research used Mixed Method research approach where-by quantitative and qualitative data was collected from different targeted audiences. Theoretical framework of e-business competitiveness was used to derive a web-based online survey targeted to e-consumers, e-commerce vendors, logistics and delivery partners including detailed interviews of selected respondents.

The findings of the research indicate that consumers at large are now inclined to have daily need products from online shopping, and they are willing to pay extra if the delivery time is quick and is adhering to quality standards. At the same time, the e-commerce vendors and logistics partners are willing to adopt or fund technology adoption and innovation for supporting quick delivery to

customers. It has also been discovered from the data that there are small players in the business too who cannot afford to keep pace with technology changes, but they are willing to piggy ride some big players and contribute to the success of quick e-commerce. This research study will be helpful for e-commerce vendors as well as partners in e-commerce delivery value chain.

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CHAPTER I:

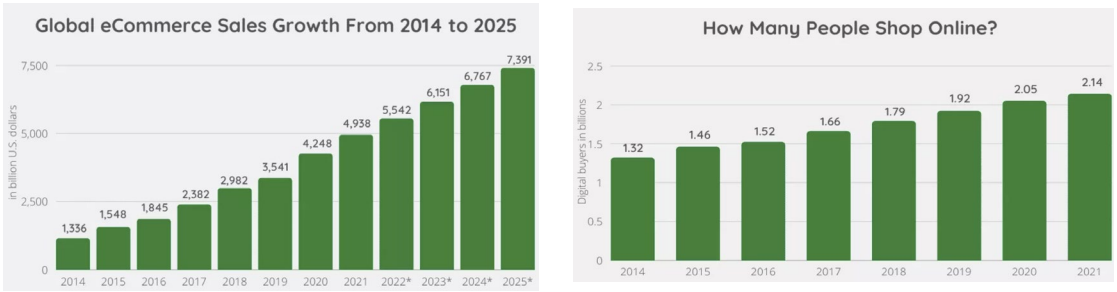
INTRODUCTION

1.1 Introduction

Kiniulis M. (2022) in its study of "e-commerce conversion rates-2022" has provided statistical figures which depict that retail e-commerce sales have clocked 4.9 trillion USD worldwide in 2021 and is forecasted to grow reaching about 7.4 trillion USD by 2025. At the same time, it compares the number of users growing from 2.05 billion in 2020 to increase by 2.14 billion in 2021 which makes 27.6% of 7.74 billion people living in the world.

Figure-1

Year on Year (YOY) e-commerce conversion rates



Source: MarkinBlog Site 'World wide e-commerce statistics' - 2022

The statistical figures mentioned above comes with its own set of challenges for e-commerce vendors like "Dynamic shift in customer loyalty", "Dynamism in product pricing", "Adherence to quality standards", "Managing customer expectations" and "Supply chain dilemma in warehousing and last mile delivery".

Come Covid-19 and the coined word "quick commerce" actually took a flight and there was a rush among the e-commerce vendors to deliver products within 30 to 45 minutes, however this was restricted only to food deliveries and the other product deliveries including medicines are still in the wake of 2 to 5 days or more. The radical change in business thought process actually provisioned to optimize the existing supply chain process for meeting customer expectations in terms of faster and quality delivery. This led to

opportunity for increase in demand of more manpower, integrated network of stores, change in digital applications to name a few. However, the q-commerce came with its set of worms in the can, says (BusinessToday.In 2022) “Indian grocery startups are luring tech-savvy customers with the promise of deliveries within 10 to 20 minutes, sparking a boom in quick commerce, but heating up concerns about road safety as bike riders scramble to meet deadlines.”

With the rise of retail sales in e-commerce, there were multiple research held across globe for:

- Research provisioning Artificial Intelligence (AI) and Machine Learning (ML) to solve routing problems, optimizing pick-up and delivery schedule challenges, capacity optimization etc. Researchers like Auad R. et. al. have developed framework for ‘Dynamic courier capacity acquisition using deep q-learning AI approach’.
- Research on use of robots/ cobots at warehouse to manage logistics, un-manned road and arial vehicles for safe and faster delivery.
- Intelligent Analytics out of historical data accumulated to provide rich insights for better business decisions.

However, all this research still does not solve the problem of how last mile delivery timeline can be reduced from 5 days to 30 minutes, and here, I intend to propose a framework which will allow different e-commerce vendors to provision a maturity of last mile delivery from 5 days to 30 minutes. The framework can be horizontally deployed to any geographical location within different e-commerce vendors and will be backed with:

- Infra resource sharing like warehousing and storage partners, delivery partners etc.
- Adaptation to latest technologies involving AI, ML, robotics and digital apps.
- Optimizing supply chain process in effort to reduce the stress on traffic and human live conditions thereby having saving in terms of insurance, repairs etc.

This study will cover different stakeholders, the first stakeholder would be public at large who are using e-commerce for their online purchases. The second stakeholder

would be the e-commerce vendors while other stakeholders would be those who act as logistics and end mile delivery partners. The contribution of this study would be to the e-commerce vendors, warehouse partners and delivery partners in embracing technology and co-ownership for managing last mile delivery 20 to 30 minutes.

1.2 Research Problem

The world is gradually shifting from windows shopping culture to online retail sales and e-commerce industries along with customer mindset was getting attuned to it, however, with advent of Covid-19 the online e-commerce sales gotten a booster kick start shattering all previous culture adoption and statistics. The food delivery model became the torch bearer where they were able to deliver the product within 45 minutes to 90 minutes depending on the traffic and weather conditions while other products, including medicines, are still lagging from next day delivery to 5 day delivery model. In this research proposal we intend to propose a framework which will mature from 5 days last mile delivery model to 1 day to 90 minutes to finally 30 minutes last mile delivery model. Having said so, the framework will have some challenges as below:

a. How to improve traffic conditions in the heat of fact that the delivery is supposed to be done in next 30 minutes from packaging at warehouse to last mile delivery?
b. How to ensure that the delivery boys do not run a risk/ threat of accidents in heat of delivering fast and saving on insurance, accidents & repair costs?
c. Are the e-commerce vendors ready to invest in technology innovations and share the same with other supply chain partners working with them?
d. Are the lawmakers of the countries and governments ready to make amendments in the law for adoption of technology, security of customer data, provisions of tax rebates for using technology which promotes reducing carbon footprints?

In this research, we will try to address the following problems which will cater to the above-mentioned challenges:

a. Co-sharing and co-owning of warehouses, dark stores, last mile delivery partners to speed up end delivery time.
b. Adoption of technology using robots and un-manned vehicles in entire supply chain process for better management of logistics and faster with safer delivery.
c. Solving the delivery scheduling problem by using digital apps and AI-ML to optimize the number of deliveries to be done vs delivery operators available. We will look into the research done by Frank M et. al (2020), Ostermeier M. et. al. (2021), Liu Z. et. al. (2024) and Beneich et. al (2023) to solve multi-compartment vehicle routing problem using AI.
d. Solving the delivery routing problem and wide area search problem by using AI-ML to optimize the best route to deliver in case of multiple and dynamic delivery.

   Provision of real-time analysis (weather, traffic, dynamic delivery etc.) via real time data and historical data available

1.3 Purpose of Research

The long term goal/ objective of the research is to develop a formalised framework for developing maturity in e-commerce supply chain journey from 5 days last miles delivery to 30 minute last mile delivery model and it will be backed by:

a. Proposed technology advancements using Artificial Intelligence (AI) and Machine Learning (ML) to resolve/ optimize supply chain issues in logistics, scheduling and last mile delivery.

b. Proposed integrated and connected environment of robots in warehouse for managing logistics operations leading up-to manned delivery boys and un-manned road/ aerial vehicles for last mile delivery.
c. Strong real time updates of every stage in supply chain process, weather conditions, traffic conditions etc. and strategic insights from historical data to take business strategic decisions on the fly.
d. Paradigm shift in e-commerce vendors operations working model from end-to-end ownership to co-sourcing/ co-ownership business model for logistics – warehousing and last mile delivery.

1.4 Significance of the Study

The above objectives of the research metioned in section 1.3 will attack many constraints of e-commerce supply chain and they will be the sub-objectives/ benefits of this research, which are as below:

a. Co-sourcing and co-ownership partnership model with warehouses and delivery partners will provision deep penetration in remote geographical areas which will directly increase the market share and brand value of e-commerce vendors.
b. 30-minute last mile delivery model will cement the leadership position of e-commerce vendor in the market and will also tackle one of the most important challenges of dynamic shifting of customer loyalty.
c. Allocation of right mix of delivey people w.r.t. geographical location and time to manage dynamic scheduling and delivey thereby improving cost of operations. The reduced cost of operations can be given back to the customers in terms of competitive pricing model or discounts or coupons.

d. Better traffic condition can be achieved based on real time traffic and weather conditions reducing traffic snarls and accidents. This indirectly will lead to redcution in carbon footprint as well as a reduction in accidental as well as insurance claims.
e. Due to deep geographical penetration of e-commerce vendors in rural areas (based on co-ownership and co-sourcing model), there will be rise in small scale local businesses which certainly will give rise to more local jobs and higher standards of living.

The results of this study will be valuable to e-commerce vendors, logistics and delivery partners in supply chain process, software development companies who will develop digital apps for support of e-commerce vendors and their partners as they will all play crucial role in optimizing the process, reducing the inefficiencies and participate in making life and world more better.

1.5 Research Questions

The research poses questions to multiple stakeholders like e-commerce users (who are involved in online purchases), e-commerce vendors (who provide end to end platform for online sales), e-commerce partners (who are involved in logistics, warehouse management, supply chain management, delivery partners etc.) at all scale.

Base questions for this research are as follows:

a. Online Buyers: Are the consumers willing to pay extra for 30 minutes delivery? If yes, how much extra would the online buyers pay? What type of products would end-users prefer within 30 min delivery?
b. E-commerce Vendors: Are e-commerce vendors matured enough to co-share and co-own the logistics and delivery process and partners? Are e-commerce vendors geared up to develop dark stores near to consumers to facilitate quick delivery? Are e-commerce vendors willing to invest in AI and technology innovations?

c. Logistics and Delivery Partners: Are the logistics and end mile delivery partners ready to invest in the technology innovations? Are they matured enough with data and process to fully use the intelligent analytics to keep themselves updated with near real-time updates.

CHAPTER II:

REVIEW OF LITERATURE

2.1 Introduction

In the era of Covid-19, e-commerce vendors found itself wanting for a radical upgrade and vertical shift in the process and technology so that they could keep pace with customer's demand. With customer's attention shifting from outlet shopping to online shopping the trend towards home delivery and technological growth paced up in the e-commerce sector. However, this lateral shift also brought in certain challenges, and it became importance of utmost nature for all e-commerce vendors to address the challenges posed:

a. Dynamic shift in customer loyalty: As per Aslam et. al. (2019) "Customer loyalty and trust are the key factors for long-term profitability and growth for organizations". Aim of the e-commerce vendors is to grow its market share by offering best possible value to customer at least possible cost. The e-commerce players have taken the online shopping to next level that the customers are spoils for choice leading to shifting of the loyalty of a customer. Verona G. et. al. (2002), in her research speaks about the dynamic model of customer loyalty and the approach for maintaining the market edge in this competitive environment.

b. Dynamism in market prices: As per Vijay Victor (2019) "Today, online pricing has evolved into a very efficient and sophisticated pricing strategy where product prices are personalised and tailored to the last conceivable individual buying unit possessing similar characteristics". With increase in competition, inflation and rise in deficit of profits the delivery services must focus upon adopting offensive or defensive pricing models to deal with the competitors. Specifically, the perishable product vendors and food delivery vendors struggle to find the right pricing model.

c. Adherence to quality standards: The quality standards have different measurable parameters depending on type of products being shipped and hence this brings another level of challenges for the e-commerce vendors. Measurable factors for quality standards will differ based on fragile items, perishable items and non-perishable items. Hence, the process of warehousing, transportation has to be modified to manage optimum quality.

d. Managing customer expectations: As per Hadleigh Reid (2022) in his blog for DCL Logistics, states, capturing higher market share will always be a failed attempt if the customer expectations are not met by e-commerce vendors and partners involved in delivery. It is a challenge to fill the gap that exists between delivery partners and product owners to work together and meet customer expectations proactively.

e. Supply Chain Dilemma: Logistics challenges faced by perishable product vendors are immense as they cater to wider geography, area specific orders, allocation of right number of vehicles at right time vs right place, ensuring optimum quality etc. are some of the critical supply-chain related issues. Drexl M. (2021) in his research paper touches the challenges of one-to-one pickup and delivery problem with time windows with capacitated vehicles using single delivery vehicle – delivery boy – delivery route combination problems.

It becomes imperative for all e-commerce vendors to address the above prominent issues to not only sustain themselves in the competitive market but also make a mark for themselves. To sustain and flourish, every e-commerce vendor needs to adopt to the technology innovations and optimize their business processes for adapting to stricter KPIs. Top trends paving way to shape the last mile delivery in 2022 – 2025:

a. Contactless Delivery: According to Salesforce survey, close to 40% of the US customers prefer contactless delivery due to security and safety reasons and e-commerce vendors and last mile delivery partners have adopted the same very well.
b. Autonomous vehicles, drones and delivery bots: Amazon and Alphabet are leading innovations and technology embracements by spending around USD 500 millions in autonomous technology.
c. Increase in urban fulfillment centre's and micro-warehouses: Quick commerce players are setting up the warehouses very near to end consumers so that the delivery promised timelines can be met.
d. Intersourcing last mile deliveries for faster fulfillment: Rather than developing their own delivery team from scratch, ecommerce vendors should depend on partnering with local delivery partners and have hybrid fleet management system for faster fulfillment. Kronmueller M. et. al. (2021) in his research paper touches on the subject of on-demand grocery delivery from multiple local stores in autonomous robots.
e. Decision based on intelligent analytics: Adoption to near-real time monitoring solutions allows delivery patterns and e-commerce vendors to take informed decisions.

The empirical research utilised for the literature review was gathered by:

- Conducting various searches on online databases like Google Scholar, ResearchGate, ERIC, IEEE and Science Journal. Searches were made against the specific keywords like quick commerce, last mile delivery, autonomous vehicles for supply chain and fast fulfillment of e-commerce delivery.
- Online Questionnaires were developed for e-commerce users, e-commerce vendors, warehouse & logistics partners and last mile delivery partners based on which the empirical framework is developed.

2.2 Theory: Adoption of Artificial Intelligence (AI) – Machine Learning (ML) – Intelligent Analytics (IA) – Robotics for succeeding '30-minutes delivery model.'

Artificial Intelligence (AI) has a great use in the ecommerce industry and Tingting Cao (2019) in his review in 'Synced Review' represented through the picture:

Figure-2
AI Implementations in e-commerce value chain

AI Implementations in the E-Commerce Value Chain

Applications	Scenarios	Involved AI Technologies	Related Companies in the Value Chain
Search & Recommendation	Product Search	Computer Vision, Reinforcement Learning, NLP	Pinterest, Alibaba, Clarifai Samsung, Xiaohongshu (Red), Google, eBay, Target
	Product Recommendation	NLP, Reinforcement Learning	Alibaba, Salesforce, Netflix, Stitch Fix, Episerver, BloomReach, Walmart, Niemen Marcus, Adidas
Payment Security	Fraud Risk Management	Reinforcement Learning	Stripe, Square, Ant Financial, JD.com Shopify, Kickstarter, Lyft, Xiaozhu.com, China Guangfa Bank

Source: Synced Review Blog – 2019

There are numerous challenges which surface up during the last mile delivey and these challenges can surmount to traffic conditions, weather conditions, delivery routing

challenges, mix-match of the number of riders location wise or time wise etc. There has been research done on this area, but all research is done based on singularity of the subject.

As a researcher, I certainly believe that we need to look holistically for AI-ML & connected environment to solve the last mile delivery problems through efficient and optimized solutions which can be saved on time – cost – resources, and, obviously be sustainable – scalable – horizontally deployable.

In this paper we will discuss the usage of AI-ML & IIOT for resolving complex challenges, Intelligent Analytics provisioning stakeholders to take quick and right decisions based on the insights and automated delivery vehicles which can provide efficient delivery at last mile delivery of ecommerce vendors.

2.2.1 Reasoned Action: Usage of AI-ML & IIOT technology to enable quick and efficient complex solutions.

As per Peter Judah (2021), "Artificial Intelligence is a term that is now known to almost everyone and is among the trends and innovations of Industry 4.0 for 2020. It is a much-discussed topic in the field of technology. Artificial Intelligence and machine training are the driving forces across different industries".

The challenges which can be solved using the efficient use of AI-ML are:

a. Delivering Routing Problem: This is one real time challenging requirement of the "30-minute delivery" model supply chain which is being researched by many researchers across the globe. There are many algorithms which are getting researched and promoted to support quick delivery, some of the famous algorithms are Dynamic Vehicle Routing Problem (dVRP), Location Routing Problem (LRP), Meal Delivering Routing Problem (MDRP), Dynamic Pickup and Delivery Problem (dPDP) etc. In their papers Damian Reyes et. al. (2018) "The Meal Delivery Routing Problem", Juan C. Pina-Pardo et. al. (2022) "Design of two-echelon last-mile delivery model" and

Dipayan Banerjee et. al. (2020) "Fleet Sizing and Service Region Partitioning for same-day delivery systems" have emphasized on the challenges the vendor faces with putting up the right mix of number of vehicles to be deployed, the right schedule routing with short drops, right assignment etc.

However, it should be noted that these algorithms are just a representation of solution approach, and it does not cover any mechanism to learn and re-implement and rectify the previous mistakes as well as optimize it. It is where, AI-ML reinforcement learning algorithms, heuristics algorithm, Q-learning algorithms will come to aid for developing mechanism where in the delivery routing and scheduling algorithms can be trained with previous set of data to act on different set of parameters.

b. Scheduling and Dynamic Pick-up Problem: This is another big challenging area for quick delivery e-commerce vendors & partners and research is being carried out particularly to address this problem by using algorithms like Location Routing Problem (LRP). As per Dipayan Banerjee et. al. (2020) "Due to low order volumes and large number of potential delivery locations, last-mile delivery is generally cost-inefficient in contrast to other parts of freight logistics system". The 30-minutes delivery model presents additional challenges due to significantly tighter time constraints, in contrast to traditional last-mile delivery systems that allow for longer response times. In 30-minutes delivery systems, request arrival, order picking and processing, vehicle loading, and delivery all occur within span of a 30 minutes bringing additional time constraint challenges."

The use of AI-ML can assist to bring a solution based on reinforced learning where in the data can be used to learn the pattern of delivery success or failures based on historical data of schedules, delivery points, delivery demography and suggest the best approach for rescheduling, routing, pickup and drop.

c. Large Neighborhood search: This is a burning topic in last mile delivery where-in the logistics problem of pickup and delivery is not only constrained to routing and delivery, but it extends to capacity, dynamic fleet of delivery, delivery time based on sliding window for customer satisfaction and how to learn from past. Wang W. et. al. (2022) in his research paper provides a two stage algorithm to optimize delivery routing on time sensitive customer satisfaction evaluation. There are algorithms like Rich Pickup and Delivery Problem with Time Windows (RPDPTW) and Adaptive Large Neighborhood Search (ALNS) but they have restrictions as they are Point to Point solutions and based on scenarios they have to be adapted and changed. Lutz R. (2014) discusses about ALNS with heuristics for rich pickup and delivery problems within sliding time windows for identifying the delivery routes based on shifting time.

   Here is where AI-ML and connected IIOT can play a big role as it can not only ingest to aggregate data from the devices like GPS, barcode/ quad code scanners, delivery data updates etc. but also create best heuristic search and implement algorithms based on historical data collected by different devices at different stages of last mile delivery. The combination of connected environment, data pooling and AI-ML can certainly help to take quick and efficient decision leading to higher success rate of delivery.

   Roman Lutz (2014) in his paper "Adaptive Large Neighborhood Search" has defined the algorithm of how ALNS and heuristic search can be used for solving the pickup and delivery problem and this paper should be combined with AI-ML practices to include learning from past and have better delivery rate.

d. Real time monitoring of almost every part of supply chain: One of the requirements of last mile delivery partners is to take decision of how efficient delivery can be done, and to assist them it is very beneficial to know the real time status of various stages in delivery supply chain. The real time monitoring can be provided by connected environment of

IIOT by using technology and hardware's, so for example a GPS fitted in the delivery vehicle (manned and un-manned) helps to gather information about precise location of delivery vehicle and whether he would be able to delivery at right time, whether he would capacity to take another delivery from somewhere in between as a short break etc.

With real time information at hand, the delivery partners will have enough data to work around minimizing efficiency and customer wait period for last mile delivery.

2.2.2 Reasoned Action: Usage of Intelligent Analytics for decision insights

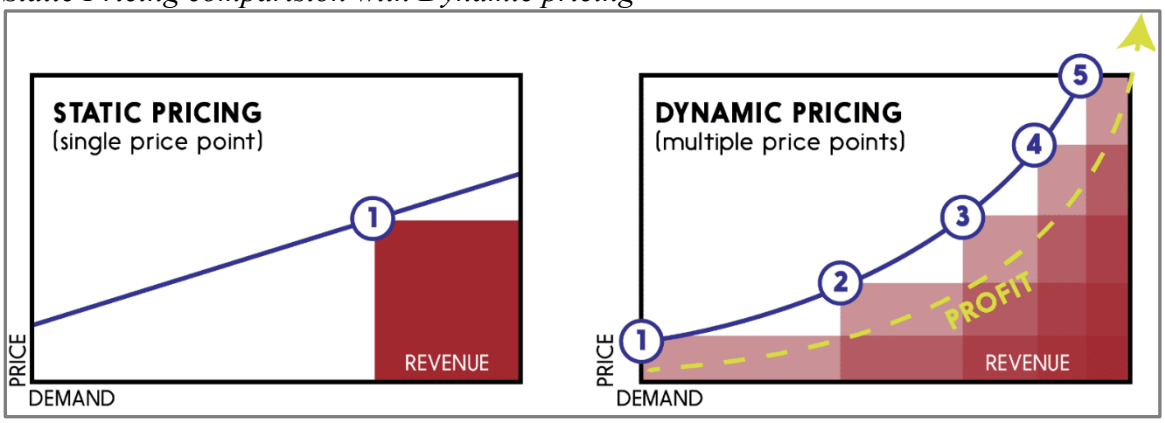
E-commerce vendors and partners need better insights to make judicious decisions for optimized and efficient supply chain process for better last-mile delivery. It is the need of hour where the last-mile delivery partners are in dire want of software's which can provide them with great insights of their business on click of button whenever and wherever needed. As per Dr. Leonard Heiling et. al. (2018) "The intelligent supply chain combines modern technologies, such as blockchain and IOT, with intelligent decision-making and analytics capability in order to improve visibility and predictability, flexibility and customer interaction, inter connectivity and collaboration as well as risk awareness and resilience."

Such intelligent analytics software would solve the following challenges:

a. Price sensitiveness and Fluctuating price problem resolution: With competition in place, paradigm shift in technology landscape, changing prices of human labor – crude oil, dynamic shift of customer loyalty due to multiple choices etc. it is becoming a daunting task for e-commerce vendors to manage price of a product to lure customer towards itself and increase product sales. Big players like Amazon are known for re-pricing strategies where the price of a product does not remain constant but changes based on competitors price, demand & supply and market trends.

This is where the Intelligent Analytics, based on the data aggregated from various customers over time, can track – monitor – analyze competitor's prices, pricing history to get a clear picture of where a respective brand stands in market and how to position itself in real time. These intelligent analytical tools configure rules for automatic pricing and provide recommendations for how the pricing strategy should be placed.

Figure-3
Static Pricing comparision with Dynamic pricing



Source: Firebear Studio website on 'Best dynamic optimization' - 2015

b. Near one real time insights at every part of supply chain: Dr. Leonard et. al. (2018) says "Companies making use of near or real time analytics and technologies supporting it only need few days to reach to market trends, or are even able to anticipate demand, in order to work with zero safety stock leading to just-in-time inventory strategies".

c. Change of operational culture from being reactive to being proactive: Dr. Leonard et. al. (2018) says "Modeling and Analytics capabilities, such as predictive analytics, assist in reducing uncertainties regarding future scenarios provisioning to respond to question – What will happen in future; rather than being traditionally descriptive and diagnostic asking – What is happening & Why did it happen".

d. Insights to understand root cause of inefficiencies, disruptions and anomalies in supply chain: Shifting from traditional descriptive and diagnostics operating culture to

proactive operating culture and responding to questions like "What is going to happen?" will provision vendors to relook at data from fundamental prescriptive analysis, automation and optimization and providing automated decisions thus answering the final question "What is the best course of action?". It is known that Amazon holds a patent for anticipatory shipping which means that products are shipped before a customer place an order.

e. Integration, coordination and collaboration between supply chain actors: With intelligent analytics and prompt decision insights there can be provisions resulting into higher flexibility between various supply chain actors. This higher flexibility will become enablers for a high degree of integration, collaboration, data sharing, coordination between supply chain actors and also supply chain vendors.

2.2.3 Reasoned Action: Usage of Robotics and autonomous vehicles for minimizing human efforts for complex deliveries.

Figure-4
Drone market contribution.

Source: Businesswire News 21st July 2023
https://www.businesswire.com/news/home/20230721993519/en

Innovations are at its peak this decade and has been embraced widely in manufacturing, healthcare, finance as well as supply chain. The last mile delivery partners and vendors have made good use of innovations done in different domains. Even though the innovations are gearing up but we find that the vendors are yet to fully utilize the capacity and capability these autonomous vehicles like drones, self-driving cars, and robots provide for participating in successful last-mile-delivery.

As per Paul Okhrem (2022) in his paper "Drone Delivery – Benefits, Obstacles and the Future of ecommerce trends" indicates "Back in 2016 The Federal Aviation Administration (FAA) – a US legislative body responsible for the air traffic regulation – predicted that by 2020 there will be 7 million drones flying in the sky. Instead, in 2020 the worldwide drone shipment reached only 5 million units. Meanwhile, in 2022 FAA announced that it registered 865,505 drones so far." This is a great example where-in the requirements of using unmanned vehicles are high from ecommerce and other players while the administration is keeping a check on the regulation of air traffic.

Such ecosystem of robots, cobots, drones, autonomous vehicles would solve the following challenges:

a. Time-sensitive critical delivery of goods to rural areas: There are countries where rural areas have much bigger transportation challenges and hence many a times critical deliveries either fail or it takes long time before the need diminishes.

As per Gayathri et. al. (2020), autonomous vehicles like Drones would be a great help in such cases as they would not get stuck in air traffic and due to GPS delivery can be done in precise location at right time. Drones are easily deployed, and most drone delivery systems are semi-automated. As soon as the package has been attached, the drone will have all the info it needs from the central command to deliver the package to its destination. Drone flight is completely autonomous and there will be no issues with traffic and congestion. Skoufi E. et. al. (2021) in his research paper talks about last mile delivery by drones and stresses on the shortest route to be easily calculated, and customers to get an accurate time of arrival.

b. Improve performance in last mile delivery: Autonomous vehicles have greater impact in countering traffic congestion, climate changes, defining fastest route at real time etc. All of these provisions for improved performance of last mile delivery which is not

possible or very challenging in case of human deliveries as humans are prone to climate changes and traffic conditions.

c. Cost reduction: In the case of autonomous vehicles the CAPEX cost is there however due to low OPEX cost it is always a cost-effective approach where-as on the other hand the OPEX cost always increases in terms of human delivery approach. These costs include petrol/ diesel, human insurance, accidental benefits cost etc. which does not happen in case of autonomous vehicles. Due to the reduction of cost at delivery operations the benefit can be passed in terms of product pricing by the ecommerce vendors to the customers.

d. Environment friendly: The autonomous vehicles running using electricity will be a great move for the environment as they become radical players in reducing carbon footprint. With global warming in picture, it would be needed to move from fossil fuel to more cleaner fuel and ecommerce and logistics team can take a lead in this area. Johnson D. et. al. (2021) in his research paper discusses about evaluating last mile delivery using traffic simulator and how the novelty has harmonized network efficiency and environmental stability in Washington D.C.

Solving these challenges would not only resolve real-time business issues but would also provide cost and time saving to ecommerce vendors. While connected environment will be responsible for collating data from various devices at different stages of supply chain and inserting them into data lake giving enormous assistance for real time information needed to know status of supply chain lifecycle, on the other hand the routines of Artificial Intelligence and Machine Learning (AI-ML) would learn from the data set and provide optimized solutions/ approach for delivery routines which will assist the decision makers to take timely decisions removing the inefficiency from the supply chain process. It would also assist the ecommerce vendors and the last mile delivery partners to take quick

business calls and be pro-active, which would help in having satisfied customer, higher market shares, chances to focus on innovations and also maximizing capacity & capability within supply chain process. Finally, it would assist the ecommerce vendors and the last mile delivery partners to save on human insurance cost (which in-fact is very costly), reduced operating cost as the number of delivery cycles can be increased without increasing the headcount.

2.3 Theory: Hybrid model of co-sourcing and co-ownership between e-commerce vendor – 3PLs – Last Mile Delivery players must need for '30-min delivery model.'

Ecommerce at any scale contains one important barrier, to manage cost, involved in supply chain operations. There is Capital Expenditure (CAPEX) as well as recurring Operating Expenses (OPEX) cost involved to start an ecommerce venture and not to forget adoption of technology. In this literature review, we propose to move from complete ownership model to co-sharing/ co-ownership model for some processes in supply chain which needs huge investment of cost and geography/ terrain knowledge. Some of the primary candidates in ecommerce roadmap would be dark stores or fulfilment centers, data sharing and last mile delivery vendors. The co-sourcing/ co-ownership model would reduce the burden of cost and operations from the ecommerce vendors, and they can focus of improving the supply chain process to position themselves as market leaders. This will involve 3rd party logistics provider, 3rd party delivery provider, 3rd party data aggregation provider.

2.3.1 Reasoned Action: Usage of Robotics and autonomous vehicles for minimizing human efforts for complex deliveries.

Amit Khare (2022) in his research paper says "The concept of 'Dark Store' in India is still one which is finding its foot in the market. It is one of the models which got famous

as an effect of long lockdowns during the COVID-19 pandemic. It can be simply explained as a store with a virtual ordering interface that supplies daily necessities including groceries to the doorstep of the customer. This can simply mean a work-from-home scenario for grocery and supply merchants."

Many ecommerce vendors are in process or in planning to create more and more fulfillment centers operating close to the customer but they are vendor owned. It would be an optimization to have co-owned and co-shared fulfilment centers and it would solve the following challenges:

a. Cost of recurring infrastructure expenses to be shared and hence reduced: It is important to note that the cost of delivery of goods will go down if the operating expenses are reduced. Ecommerce vendors can plan and think of co-souring or co-owning the fulfilment centers which will certainly reduce the CAPEX (Capital Expenditure) and OPEX (operating expenditure) cost indicating further reduction in the cost of good thereby provisioning customers to buy from those vendors adhering same quality but reduced cost or offered discounts.

b. Reaching larger audience and removing geographical obstacles: Since creation of fulfilment centers involves cost at the ecommerce vendors hence to manage economies of scale and operations ecommerce vendors are unable to break geographical barriers. With the approach recommended in this paper of co-owning or co-sourcing the fulfilment centers, by collaborating with different vendors obviously, the geographical barriers can be removed and very large audiences across the globe can be targeted. This will assist ecommerce vendors to become international vendors rather than being local vendors.

c. Effective management of perishable items using fulfilment centers: One important challenge which these fulfilment centers face is regarding managing perishable items.

They are important to be managed efficiently and delivered to the customer within the right quality parameters. Due to enablement of such fulfilment centers the ecommerce vendors specially in food and perishable items market cross the entry barrier and attend to large customers. Some good examples in India would be “Licious”, “FreshToHome”, “BigBasket”, “DMart” etc.

2.3.2 Reasoned Action: Co-ownership of data between different sourcing vendors.

There has been mushrooming of ecommerce players across the geography with large, medium and small sized vendors trying to make a mark in this domain. However, due to economies of scale there are many small ecommerce vendors who take a bow and exit the market. It should be noted that these small players do have a large set of customer and customer preference data which certainly can be of magnitude use to the mid and large sized vendors still in the game. Co-ownership of data between e-commerce vendors can solve few challenges as below:

a. Save time and energy to generate data: Data generated at different stages of the e-commerce lifecycle are important for e-commerce vendors and partners as they act as great source of learning and insights to take decision for efficiently managing supply chain process. Co-ownership of data removes the vendor process to re-invent the wheel and go through the process again to generate customer data, preferences data, transport system data, climate data, delivery data etc. Since the data can be shared (based on mutual agreement between the vendors) it can save time, lots of energy and vendors can directly focus on the delivery process.
b. Insights to the requiredet and decide course of action: One of the major challenges which will surface up in qcommerce “10-minutes delivery” model is that the vendor will need to have all required information to decide if they would like to operate in that specific

market based on the product line. Co-sourcing of data will provide them the insights and degree of freedom to manage their economies of scale.

2.3.3 Reasoned Action: Co-owned or Co-sourced delivery partners.

Delivery partners involved at last mile delivery are key actors in the entire supply chain and they are also the ones to make or break the reputation of the vendor's brand, hence, it is utmost necessary to have right set of delivery partners. The challenge does not stop here with selection of right delivery partner but also as how optimize the delivery process can be in terms of right number of delivery boys in action, right number of delivery vehicles in actions etc. and it all boils down to money. As of now, every vendor has their own delivery partners and there is a good amount of investment involved. This research paper proposes co-sourcing or delivery partners which will solve the following challenges:

a. Optimization of vehicle delivery and delivery boys: One of the major and critical problems to resolve in the supply chain process is optimal number of delivery vehicle and delivery boys so that "10-minute delivery" model can be a success. In this paper we propose to have a "Delivery-as-a-service (DaaS)" where-in an agreement can be arranged between the ecommerce vendor and the delivery operator for modulus operandi. Within the DaaS mechanism the delivery operations can be a 3rd party team which caters to the delivery needs of multiple vendors (taking an example of India post, US post, AU post etc) with a defined rate card. Since this model is based on rate card there would be no CAPEX for the ecommerce vendors but this being OPEX model reduces burden of cost and operations from the ecommerce vendors.
b. Economies of scale for innovative ways for delivery: In co-sourcing or co-ownership model, since the cost of delivery is shared, hence the ecommerce vendors will have options and opportunities to spend in innovation of delivery which earlier would be a

difficult proposition for one single vendor. Use of autonomous vehicles, drones etc can certainly be options to explore.

2.4 Disagreements to above theory

Following are the disagreements to the above theory:

a. The cost involved in developing and implementing the know-how of using drones and unmanned aerial vehicles in delivering last mile will be very high and would act as an entry barrier to the quick commerce domain. Not all ecommerce vendors and delivery partners would be in a position to fully/ optimally use this technology stack.
b. Synchromodality of transport is still a concept for increasing the supply chain intelligence and has not seen light till now. This mode of transport would need new eyes for change in traffic regulations, laws and operating model by different vendors and supply chain actors. Zhang Y. et. al. (2022) in his research paper talks about synchromodal transportation system mathematical model which can optimize routes for fixed and flexible vehicles.
c. Regulations in air and road traffic depending on country's readiness for acceptance of un-manned vehicles: This is an area which needs attention from country law-makers and is a highly debatable topic citing security and operational risks. There are very few countries who are embracing the autonomous/ unmanned vehicles future in the regular life process however they too do not have complete law and process in place. This might take years and will depend on the risk appetite of every country individually.
d. Different ecommerce vendors would not like to share their data, last mile delivery partners and fulfilment centers in target of capturing more market share and edging the competition by becoming industry leader.

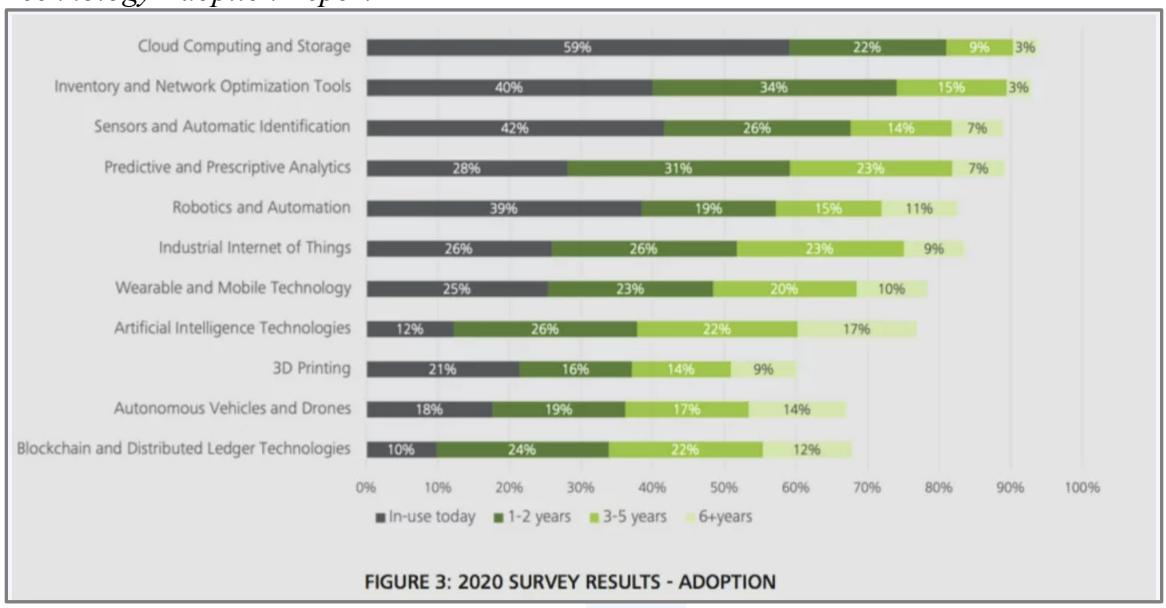
e. Due to branding competition and its impact on achieving market share there can be a reluctance among ecommerce vendors to come on same table for co-ownership model.
f. There has been no precedence of co-ownership approach between ecommerce vendors and hence the transaction errors, transaction per million, is not yet established in such scenarios. There would be a requirement of lean six sigma process to be adhered and the resultant data as well as approach to be implemented by various vendors and partners.

2.5 Human Culture as Important Factor to Technology Adoption

In today's ecommerce ecosystem vendors and partners have a very good appetite towards embracing new innovative technology and a culture has been inculcated where the ecommerce stakeholders are ready to make operational and organizational changes to embrace new technologies providing assistance to run business smoothly and seamlessly. Top players like Amazon, Walmart, Flipkart, Myntra, Alibaba are investing in AI-ML, Intelligent Analytics, Drones, Robotics, Cobots etc to take the supply chain processes to the next level. Hence the organizational culture is to use latest technology stack and improve on the process, while the end customer also has been adopting technology advancements to enjoy benefits from their home.

Following below is the report from MHI Annual Industry report where-in the technology adoption rate has been stated in terms of % use today vs adoption rate in 2 years vs adoption rate in 5 years vs adoption rate beyond 6 yrs. The below graph is evident that adoption of AI-ML and autonomous vehicles adoption is yet not matured but has a long way to go and human culture is ready to embrace it.

Figure-5
Technology Adoption Report



Source: 2020 MHI Annual Industry Report – mhi.org

2.6 Human Culture as Important Factor to Process Adoption

In current ecommerce ecosystem, the culture is to own the entire supply chain milestones starting from procurement process – logistics – order management – delivery management and ecommerce vendors in a bid to gain more market share, do not co-share or co-own the processes involved for logistics and delivery. Due to this practice the operations cost for ecommerce vendors is high, which can be brought down by the proposals outlined above in this document. The benefit obtained from reducing the cost of a product can be passed to the customer in the form of discounts or any promotional offers which will certainly increase customer satisfaction.

However, it should be noted that:

a. Movement from ownership mindset to collaborative mindset would require a cultural change in the vested interest of stakeholders. The collaborative mindset would assist stakeholders to move to co-ownership practice and reap benefits of cost sharing model.

b. The approach proposed above will also induce an operational change along with cultural change at different milestones of supply chain process. This operational change would allow the vendors to focus on innovations and optimize the processes for better reach to end customers.

2.5 Summary

Through the literature review we can conclude that if we need 10-min delivery model to succeed in its supply chain lifecycle then following will have important role to play in the success journey:

a. **A connected environment** has a big role to play in last mile delivery as it will be responsible for collection of data from various stages and lifecycle of supply chain. The data will be collected from various devices, gadgets, wearables, software apps thereby providing real time information of the supply chain stages per delivery. These connected environment data will be put into data lake for better analysis and reach.
b. **AI-ML** has a big role to play in last mile delivery as they will take burden of learning from the aggregated data and provide the best optimized approach for logistics and last mile delivery. They will be key contributors for ecommerce vendors and their partners in terms of bringing efficiency in operational process, cost and inventory management which will in turn enhance customer satisfaction. AI-ML will not only give rise to learning platforms from data lake but also give rise to **intelligent analytics** which will provide insights of how better the supply chain and process could be by analyzing the historical data in data lake.
c. **Autonomous vehicles** would be a game changer for last mile delivery as it will have its major role in safe delivery, timely delivery, reduction in accidents, reaching remote areas etc. They will also play an important role in the environment by shifting the

dependency from fossil fuel to solar fuel or any other better options of fuel there by being party to reduce carbon footprint.

d. **Collaboration & Co-ownership** between ecommerce vendors and partners would take the logistics and supply chain to next level where-in rather than focusing on owning every single stage of supply chain, they can focus on their core areas while the expert partners can take the rest of the supply chain process. This will certainly bring in a more collaborative nature of operations thereby shifting the singular ownership model to co-ownership model which will have positive impact in reduction of operating costs which finally can be transferred to customer in terms of reduced price or coupon benefits.

While doing this literature review, we find that there are many research materials which talks about last mile delivery issues and tries to resolve them but all of them are pointed solutions which focus on only one problem area, hence research is need of time where-in all these problems can be threaded into one full research providing a framework for '10-minute delivery approach'. We also promote a concept of proposing an approach of co-shared and/ or co-owned stages between ecommerce vendors and various partners to bring in higher degree of ownership, reduced process cost by optimizing efficiency, sharing/ co-owning dark stores to reduce logistics cost etc. which will help ecommerce vendors and partners to become agile, become market leaders and also have a good base of loyal and satisfied customer.

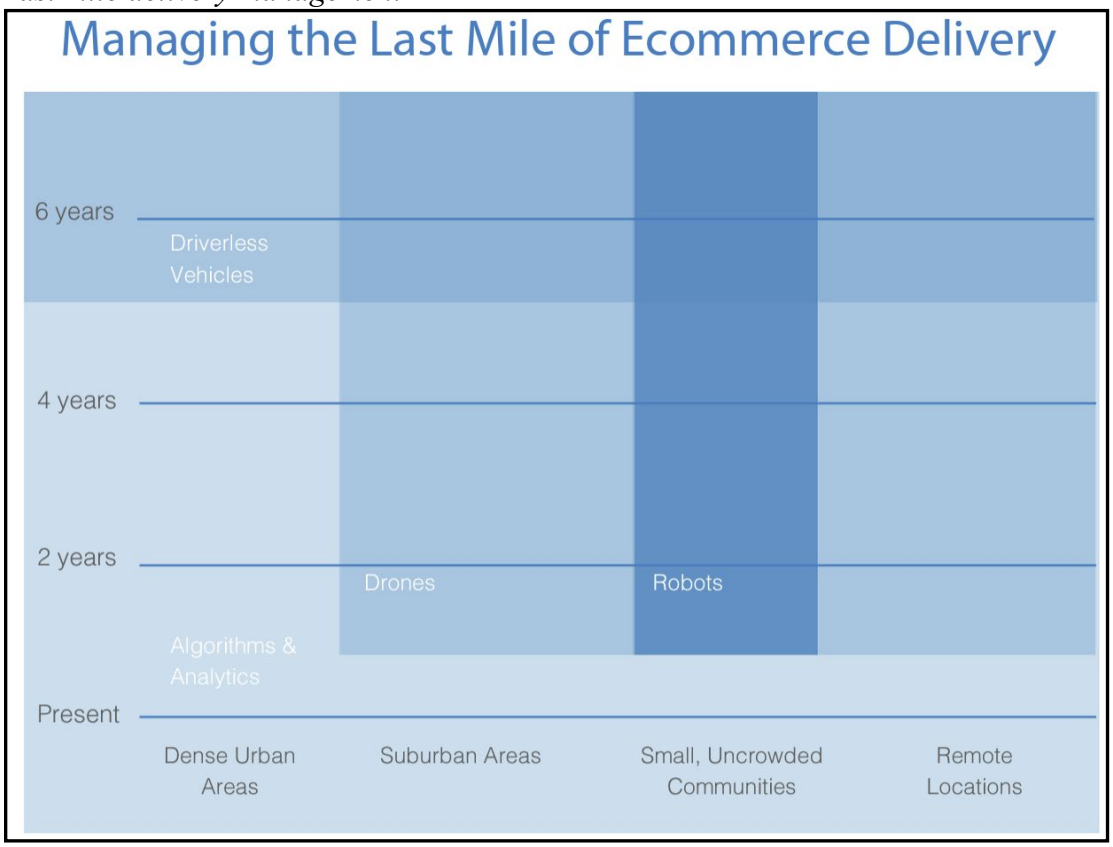
CHAPTER III:

METHODOLOGY

3.1 Overview of the Research Problem

The literature from Stanford University clearly depicts that last mile delivery would be the prime focus of the e-commerce vendors which will be slated to progress in some years as they will have to cover the urban, rural, densly populated areas using innovative technologies. The picture pasted below is from the source of Stanford University giving a comprehensive picture of last mile delivery scope.

Figure-6
Last mile delivery management



Source: Stanford Education Publication

In a literature from PriceWaterhouseCoopers (PWC), it has been made evident that 41% of consumers are willing to pay a charge of same-day delivery while nearly a quarter (24%) of shoppers said that they would pay more to receive packages within a one-or two-hour window of their choosing. After going through the mentioned literature, it is observed that there is a space to be researched on how to optimize the supply chain process for quick commerce vendors to position themselves very near to customer without sacrificing the breadth of products to be delivered. The research would then extend to how machine learning can be enforced to forecast the demand and keep the dark stored hydrated with the right demand, at the same time ensuring that the mode of transportation and the route of transportation supports last mile delivery in a very quick and efficient way without compromizing the quality parameters of delivery which could be "hot/warm for food", "undamaged fragile products", "undamaged packaged delivery" etc.

On the other hand while doing the literature review, we could not find any literature which focused on how to setup a model framework for "last mile delivery" maturing from "1 week delivery" to "30 min delivery" model, so taking this cue in accordance there are certain KPIs which we figured out obviously needing to be tapped: a) Reduction of operating cost from stores to end consumers b) speed up last mile delivery from stores to end consumers c) increasing potential of delivery of products from multiple stores d) decreasing the cost of health insurance of delivery person e) decrease in cost of car/ bike insurance of delivery person.

In the light of above the literature objective in nutshell would be to develop an approach/ framework for last mile delivery of products supporting quick e-commerce and establish KPIs which can be measured to contemplate success of defined approach/ framework

3.2 Operationalization of Theoretical Constructs

3.2.1 Objectivity/ Concept

The researcher in this reasearch study intends to setup a framework which would allow the e-commerce vendors to setup an operational framework within their supply chain ecosystem so that they define optimized SLA's for their delivery process. The primary research method for this study was to undergo various literature review, analyzing different case studies on same subject and collation of data collected from online survey questionnaires for end customers/ users, e-commerce vendors & their supply chain partners, leading to development of conceptual model to address 30-minutes last mile delivery challenges. The two concepts/ theories which are being validated as part of this research are:

- Adoption of AI-ML-IA-Robotics for faster & optimized last mile delivery
- Co-owning and co-sharing of logistics & warehouses and delivery partners.

The objectivity of this research can be defined as:

- Optimization of last mile delivery process backed by strong intelligent analytics
- Optimization of last mile delivery process backed by strong AI/ML algorithms ensuring availability of best options during delivery process
- Optimization of entire delivery process backed by real-time information network provisioning the stakeholders to take pro-active measures.
- Identification of measurable KPIs which can be horizontally deployed by various ecommerce vendors.

3.2.2 Measurable KPIs and its indicators

The above mentioned two concepts/ theories are targeting two different types of stakeholders playing pivotal role within e-commerce supply chain process. The first category of stakeholder(s) are the end consumers of the e-commerce supply chain who makes online purchases and expect the delivery in time with the right quality standards while, on the other hand, the next category of stakeholder(s) are the e-commerce vendor(s) and the last mile delivery partner(s) whose key parameter is to ensure that delivery of products happens within agreed timeline, at agreed destination and within agreed standards of delivery.

Table-1
Measurable KPIs

Measurable KPI's	Stakeholder	*SLA*	Indicators
Timely Delivery of good(s) by e-commerce vendor portal	Delivery Partner	100%	Total number of goods delivered on time vs total number of goods delivered
Quality Delivery of good(s) to the end-user	Delivery Partner	100%	Total number of goods returned back by the user vs total number of good delivered
Optimizing supply chain process for faster delivery - annually	E-commerce vendor	>=85%	Number of key business processes optimised vs benefits obtained post optimisation of processes
Optimizing logistics process at warehouse for faster search, packaging and pickup – annually	3PL	>=85%	Reduction in time to search - identify - procure – package and prepare for pickup by delivery person
Optimizing delivery resource count based on delivery destination and delivery count – quarterly	Delivery Partner	>=90%	
Reduction in road accidents and insurance claims – monthly	Delivery Partner	>=95%	Reduction in accidents and insurance claims month on month

Source: Author

3.2.3 Reliability

Reliability would be an important factor in this entire research as it will provide enough confidence to the users of this research over authenticity of the framework, data and the published results. The reliability factor will depend on two important aspects:

- Empiricism: During research our goal would be to provide quantifiable observation and measurable findings. To achieve quantified values, we intend to break down intangible concepts into recordable characteristics for example perceived vs achieved efficiency at warehouse or at delivery or at aligning delivery routes etc.

  This dissertation would be a quantitative dissertation where-in researcher intends to take particular approach to theory by setting up a hypotheses, a research strategy, a survey for stakeholders and strategizing conclusions from obtained results. Hence, this research would be a data driven and would hold for the defined theoretical approach.
- Objectivity: The researcher has singular objectivity in this research and it is to provide enough substantial data points to support the theory and the framework which can be consistently used by other researchers and they too get the similar results.

However, this research will have its own natural impediments:

- Lack of universality: Some of the topics of this research will be valid only for some countries and would not be applicable for other countries for example: challenge of road accidents due to rush in delivering, count of claim settlements due to hostile traffic conditions etc.
- Lack of acceptance: One of the strong aspect of this research is co-ownership of logistics, warehouse and delivery partners by the different e-commerce vendors and there might be a possibility that smaller players joins hands to bring in efficiency of their process and reduce operational costs but the larger players might not want to do

it to diminish their market lead or brand. In such cases, the theory will be fit only to the smaller local players.

3.3 Research Purpose and Questions

3.3.1 Research Purpose

The purpose of this research is to establish a scalable framework/ model which can be deployed by various e-commerce vendors at different geographical locations by implementing small tweaks to original framework. The scope of framework would also be extended to third party logistics partner(s) and last mile delivery partner(s) who are an integral stakeholder of this framework. The framework will attempt to answer two imporant theories of research as:

- How can co-sourcing and co-owning of logistics, warehouse and last mile delivery partners ensure quick delivery of ordered products within agreed quality parameters?
- How can latest technology adoption assist in optimizing scale of economies and operations for last mile delivery?

To bring this research to a logical conclusion an online survey has been designed for a) end consumer which is public at large, b) e-commerce vendor, c) warehouse & logistics partner, and finally, d) delivery parter. The online survey results are logged and analysed for deriving a conclusion. The intent of having these questionnaires for different stakeholders are as below:

- <u>E-commerce consumer</u>:
  - Is the ecommerce consumer ready to spend extra money for quick delivery?
  - What type of products are in demand for quick delivery?
  - What method of delivey is preferable?
- <u>E-commerce vendors:</u>

- Would the e-commerce vendors like to co-share warehouse – logistics – delivery partners with other ecommerce vendors?
- What level of risk capability are the e-commerce players displaying to embrace advance technologies like intelligent analytics, robotics and machine learning algorithms?
- What level of investments are the e-commerce vendors ready to adopt process and technology optimizations?

o Supply chain partners like logistics & warehouse, delivery partners etc:

- What level of risk capability are the supply chain partners displaying to embrace advance technologies like intelligent analytics, robotics and machine learning algorithms?
- What level of investments are the supply chain partners ready to adopt process and technology optimizations?

3.3.2 Research Questions

The research questions are developed for various stakeholders with a view to capture inputs/ responses which can prove wether the proposed theory is correct or incorrect along with various data which can assist in developing the proposed model/ framework.

Questions for End User who are online shoppers:

i. What is your age group?

[Intent of question]: This question allows researcher to understand the bifurcation of age group bracket involved in e-commerce. However, since the population of the users taking this survey would be majorly the social and personal connects of the researcher, it is expected that the data will swing more towards the age group >=35.

Still this is a good data to understand how authentic the response are and also finalize on the standard deviation as well as the expected error in response.

[Options given to respondents]:

- <16 yrs.
- 16 to 20 yrs.
- 21 to 30 yrs.
- 31 to 40 yrs.
- 41 to 50 yrs.
- >50 yrs.

ii. Where do you live?

[Intent of question]: This question allows researcher to understand the bifurcation based on geography. This data will assist to understand the sentiment of the respondents at geography level.

We ask for the country and the state they are currently living in.

iii. What is your job sector?

[Intent of question]: An important question which allows the researcher to understand the usage pattern of respondent based on the type of shopping done vis-à-vis the nature of work they do on regular basis. This question will also let the researcher analyze if the online shopping is centralized in a family or decentralized within the family.

[Options given to the respondents]:

- Government Organization
- Public Undertaking Organization
- Private Organization
- Student

- House maker
- Unemployed

iv. Do you use e-commerce for online purchases?

[Intent of question]: This question segregates the respondents based on whether they are involved in doing online purchases. For those respondents who are not doing online purchases, the online survey stops as the online survey is not meant for them and the data would be of no use to the research.

[Options given to the respondents]:

Yes or No

v. What is your average online purchase(s)?

[Intent of question]: This question allow the researcher to understand the online purchase behaviour of the respondents. The researcher is able to visualize whether the response data would pave way to propose the model. If the average online purchase is less then it makes very little sense to the e-commerce vendors and the delivery partners to invest in the optimization of process and technology advancements.

[Options given to the respondents]:

- Can be none sometimes.
- Less than 2 items a week
- Between 2 to 5 items a week
- More than 5 items a week

vi. Which e-commerce platform(s) do you use more?

[Intent of question]: This question will clearly depict the e-commerce platforms or vendors who are playing a major role in online shopping as per the geography. This also paves the foundation for which type of e-commerce vendors should the

researcher approach to know their strategy which can be a foundation for the framework/ model for this research.

[Options given to the respondents]:

- Amazon
- Flipkart
- Myntra
- Snapdeal
- Reliance Trend
- Decathlon
- BigBasket
- Blinkit
- Licious
- DMart
- StarBazaar
- Zomato
- Swiggy
- Box8
- Others, please mention

vii. What type of product(s) do you purchase from online e-commerce vendors?

[Intent of question]: This is a very important question for the research to understand if the type of products purchased online are really a candidate for the quick delivery or not. Hence if the respondents choose more of perishable items, it gives high value of confidence to the researcher for moving ahead with the research.

[Options given to the respondents]:

- Kitchen Groceries

- Fresh Meat and Sea Food
- Fresh Vegetables and Fruits
- Clothes
- Electronics Items
- Medicines
- Healthcare products
- Cosmetics
- Children Stationary and Toys
- Jewellery Items
- Hardware and tools
- Others

viii. What is/ are the reason(s) you prefer online shopping?

[Intent of question]: This question is of high value to the researcher to understand the sentiment of the respondent in terms of whether the proposed framework/ model would be of any value to the respondents at large. If the reasons to prefer online shopping are thin or random then the model would not have many buyers.

[Options given to the respondents]:

- Convenience for purchase at click of button and delivery at doorsteps.
- Ease of trial at home comfort and return back at will.
- Discounts and coupons provided during online sales.
- Delivery at my desired location and at desired time
- Price competitiveness between all vendors displayed online for customer ease.
- Others than mentioned above.

ix. What are the reasons you would leave a e-commerce vendor?

[Intent of question]: This question allows the researcher to capture sentiment of the respondent to not use online shopping. The question is a very strategic question in terms of how the e-commerce vendors should percieve their success rate of having more customers and not loose market share.

[Options given to the respondents]:

- Bad reputation in quality of delivery
- Not having enough variety as compared to other vendors
- High price of product as compared to other vendors
- Bad reputation on returnable items process
- Bad reputation on post sales customer service

x. If your e-commerce vendor(s) provide you the purchased product(s) in 10 minutes will you be excited?

[Intent of question]: This is a very strategic question to the entire research as this creates the demand of the framework. If there are good number of respondents who are interested in quick delivery then certainly it makes a huge sense formulating the framework/ model.

[Options given to the respondents]:

- I will certainly be interested to get my purchased product(s) in 10 minutes
- Well, I will like it but it will depend on type of product(s) I am purchasing
- I would not bother about quick delivery, but I would expect a reasonable time of delivery
- I seriously do not bother at all, they should deliver whenever they can

xi. If you had been interested in 10 minutes delivery, what products would you prefer to be quickly delivered?

[Intent of question]: This is a very strategic question to the entire research as this supports the demand of the framework based on what type of products the end customer is looking for quick delivery. This question is not only helpful to setup the framework/ model but also to the e-commerce vendor for how to optimize their process based on products to be delivered.

[Options given to the respondents]:

- Medicines
- Healthcare products and Cosmetics
- Fresh Meat and Sea Food
- Fresh Vegetables and Fruits
- Electronics Equipment's needed for my work
- Hardware Tools needed for my work
- Everything I online purchase from e-commerce

xii. Will you be willing to pay extra more for a 10-min delivery?

[Intent of question]: This is one of the strategic question for the research as it provides the direct relationship between the research output i.e. framework/ model and the supporters from the end user perspective. Commonized theory here is that if there are online buyers who are interested in spending more money to get quick delivery then the ecommerce vendors can strategically optimize their delivery model to suit the customers need.

[Options given to the respondents]:

- Yes, I will be ready to pay 10% – 15% more
- Yes, I will be ready to pay 7% - 10% more but not beyond
- Yes, I will be ready to pay 5% - 7% more but not beyond
- Yes, I will be ready to pay max 1% - 4% more but not beyond

- No, I am not willing to pay anything extra

xiii. Which of the facilities below would you like to have during 10 minutes delivery model?

[Intent of question]: A very strategic question where-in the researcher gets more insights on the type of services end users are expecting from e-commerce vendors. This question also provides base for the researcher to prepare the right framework/ model supporting the research.

[Options given to the respondents]:

- I am interested only in the delivery of my goods in 10 minutes.
- Clear communication provides me to track goods I have ordered.
- Safe delivery with quality adherence
- Delivery only by delivery humans
- I don't care if delivery is done by humans or robots.

<u>Questions for e-commerce vendors</u>

i. Please provide name of your organisation and the year of its establishment

[Intent of question]: This question is to capture the e-commerce vendor name but it is important to notice that the year of establishment directly relates to the experience the online vendor is carrying in this research space. Hence the response from this vendor is equally important to establish the credibility of the process for quick delivery.

[Options given to the respondents]: Just text to enter the name of the organization and the inception year

ii. Where is the corporate office of your organisation?

[Intent of question]: This question is to understand the origin of the e-commerce vendor and this reveals the fact as what would be the base mindset of e-commerce and supply chain for this vendor. This question allows an insight into how quick the organization would be adapt to process optimization and technology adaptation.
[Options given to the respondents]: Textual field to enter the corporate office of the organization.

iii. Which geographical region(s) does your e-commerce organisation operate on?

[Intent of question]: This question establishes the e-commerce vendor credentials of his exposure to multi-geography supply chain insights. If an e-commerce vendor is operating at multiple geographic locations then there are many insights which can be derived related to operating partners in specific geography, adoption/ deployment to technology enhancements in various geographic locations etc.
[Options given to the respondents]:

- North America
- South America
- Africa
- Europe
- Asia
- Middle East

iv. What is your average annual revenue per year for last 5 financial years (in terms of million US $)?

[Intent of question]: This question is to ascertain the revenue of the e-commerce organization. This is an important insight as it allows researcher to visualize if the e-commerce vendor has risk taking capability while process optimization and technology adaption transformation is proposed.

[Options given to the respondents]:

- Less than 1 million USD
- 1 million to 5 million USD
- 5 million to 10 million USD
- More than 10 million USD

v. Does your organisation deal into end-to-end e-commerce processes and supply chain or do you have partners associated with you?

[Intent of question]: This question provides a good insight to understand if the total cost of ownership is only borne by the e-commerce vendor or is it shared between the e-commerce vendor and the delivery partners. This question has another view where-in it also provides insights about end to end responsibility of managing the logistics, supply chain and the delivery of the product ordered for.

[Options given to the respondents]:

- We take care of end to end e-commerce as a vendor
- We have partners who take care of different life cycle of e-commerce supply chain

vi. What stage in ecommerce is your organization involved with?

[Intent of question]: This question is an extension of the last question where-in researcher gets more information about the direct and indirect involvement of the e-commerce vendor in the entire supply chain process of e-commerce.

[Options given to the respondents]:

- E-commerce strategy and branding
- Sourcing materials and supply chain
- Warehousing and logistics
- Last mile delivery

- Developing digital solutions (mobile and web app, algorithms for better delivery, right product estimation etc.)
- Providing market insights and SEO
- Accounting, billing and record keeping
- Customer care call centre

vii. You have partners for which part of e-commerce life cycle?

[Intent of question]: This is a validation question from the last question where-in we try to understand better about the partnerships done by the e-commerce vendor to operationally execute the day to day operations of e-commerce supply chain and delivery. This also provides a right intent to understand the fact as in which geographical locations has the e-commerce vendor done partnership and which ones he owns the full supply chain.

[Options given to the respondents]:

- E-commerce strategy and branding
- Sourcing materials and supply chain
- Warehousing and logistics
- Last mile delivery
- Developing digital solutions (mobile and web app, algorithms for better delivery, right product estimation etc.)
- Providing market insights and SEO
- Accounting, billing and record keeping
- Customer care call centre

viii. Identify from below options regarding the challenges you have been facing with?

[Intent of question]: This question is to understand the daily operation challenges in e-commerce, and it is important to know this because this will direct the attention

of the e-commerce vendor to resolve first rather than pay attention to the proposed framework. However, it should be noted that the options given to the respondent in this question will directly relate to the framework/ model development.

[Options given to the respondents]:

- Dynamic shift in customer loyalty
- Dynamic pricing as per market shift
- Adhering to quality while delivering
- Managing customer expectations of delivery
- Supply chain dilemma for best combination of routing and delivery
- Adoption to latest technology for faster and safe delivery fulfilment
- Adoption to latest technology for real time insights for intelligent decision making and analysis
- Reducing operating cost and abreast market edge

ix. What is your quarterly investment related to latest technology stacks for AI-ML, robots, digital web apps, reporting & dash-boarding etc.

[Intent of question]: This question is of importance to the researcher as it allows to understand the investment pattern of the e-commerce vendor. This response from the respondent allows researcher to finalize the primary candidate to approach for proposing the model once it is approved.

[Options given to the respondents]:

- We have not yet done any investment.
- Less than 10000 USD
- Between 10000 USD to 25000 USD
- Between 25000 USD to 50000 USD
- Between 50000 USD to 75000 USD

- Between 75000 USD to 100000 USD
- More than 100000 USD

x. Which of the following technology stack is already in place within your organisation?

[Intent of question]: This question is to understand the maturity of the e-commerce vendor regarding the technology adoption in its organization. This question also provision the researcher to understand which all vendors would be the right candidate of this research adoption once the framework/ model is developed and promoted.

[Options given to the respondents]:

- Artificial Intelligence and Machine Learning for logistics and warehousing
- Artificial Intelligence and Machine Learning for mapping location wise customer interest
- Artificial Intelligence and Machine Learning for delivery operations and routing optimisations
- Robotics, Autonomous vehicles (road and air) for last mile delivery
- Intelligent Analytics and Dash-boarding for real time and time-series status
- Real time notification based on real time supply chain life cycle insights
- None of the above

xi. Which of the following technology stack is your organisation planned to deploy in next 6 months?

[Intent of question]: This question is adjacent to the previous question for those vendors who have not yet invested or adopted to the technology as of now, but are preparing for its adoption in next 6 months. These vendors are of interest to the

researcher as they are another prime candidate to whom the framework can be proposed.

[Options given to the respondents]:

- Artificial Intelligence and Machine Learning for logistics and warehousing
- Artificial Intelligence and Machine Learning for mapping location wise customer interest
- Artificial Intelligence and Machine Learning for delivery operations and routing optimisations
- Robotics, Autonomous vehicles (road and air) for last mile delivery
- Intelligent Analytics and Dash-boarding for real time and time-series status
- Real time notification based on real time supply chain life cycle insights
- None of the above

xii. Which of the following technology stack is your organisation planned to deploy in next 12 to 18 months?

[Intent of question]: Same as above question with only difference of timescale.

[Options given to the respondents]:

- Artificial Intelligence and Machine Learning for logistics and warehousing
- Artificial Intelligence and Machine Learning for mapping location wise customer interest
- Artificial Intelligence and Machine Learning for delivery operations and routing optimisations
- Robotics, Autonomous vehicles (road and air) for last mile delivery
- Intelligent Analytics and Dash-boarding for real time and time-series status
- Real time notification based on real time supply chain life cycle insights
- None of the above

xiii. What is the reason for not investing in technology stacks? (If you have selected 'None of the above' in above 2 questions)

[Intent of question]: This question is very important to researcher as it provides insights to the fact that there are e-commerce vendors who would have challenges to adopt the process optimization and technology adoption. Such e-commerce vendors are prime candidates of this research where a framework/ model is being proposed for co-sharing/ co-owning of physical infrastructure and the technology along with its research and investment.

[Options given to the respondents]:

- We do not have funds for investing in technology stacks
- We do not have adequate skills to identify the right technology stack needed for us
- We are yet to earn our break-even from our business

xiv. What is your logistics model, do you have your own logistics team and warehousing?

[Intent of question]: This question is to ascertain if the e-commerce is taking full ownership and responsibility of e-commerce platform and logistics setup.

[Options given to the respondents]:

- Yes
- No, we have a 3rd party logistics vendor working with us as a partner

xv. What is your expense in having your own logistics warehouse setup?

[Intent of question]: This question is to ascertain the overall cost the e-commerce vendor is having to setup the logistics and warehouse. The imporatnt aspect here is how the e-commerce vendor can be a market leader in dynamic pricing by reducing the total cost of ownership.

[Options given to the respondents]:

- Less than 1000 USD per quarter
- Between 1000 USD to 5000 USD per quarter
- Between 5000 USD to 10000 USD per quarter
- Between 10000 USD to 20000 USD per quarter
- More than 20000 USD per quarter
- We don't have our own logistics setup

xvi. If you are having one, then, what is your expense in maintaining logistics by a 3rd party logistics partner?

[Intent of question]: The question is asked to understand the expenses done by the e-commerce vendor in maintaining logistics by a partner. This provides a direct comparision of cost of ownerhsip if the logistics and warehouse is done in-house by the e-commerce vendor or by 3rd party partner.

[Options given to the respondents]:

- Less than 1000 USD per quarter
- Between 1000 USD to 5000 USD per quarter
- Between 5000 USD to 10000 USD per quarter
- Between 10000 USD to 20000 USD per quarter
- More than 20000 USD per quarter
- We don't use 3rd party logistics and we have our own setup

xvii. What is your organisations product delivery model?

[Intent of question]: Just like above questions, this question allows the researcher to have a view as how the e-commerce vendors are managing their last mile delivery. This is important start to understand if there could be optimization to have operational efficiency and better last mile delivery.

[Options given to the respondents]:

- We have our own end to end delivery team starting from Apex centre to last mile delivery
- We have partnered with delivery operators for our product delivery

xviii. What is your expense in product delivery by using your own employee and team?

[Intent of question]: This question allows the researcher to gauge the expenses borne by the e-commerce vendor when the product last mile delivery is done by the e-commerce vendor himself. This is a great insight to see if there can be an optimization and the proposed model of co-owning and co-sharing can come into play.

[Options given to the respondents]:

- Less than 1000 USD per quarter
- Between 1000 USD to 5000 USD per quarter
- Between 5000 USD to 10000 USD per quarter
- Between 10000 USD to 20000 USD per quarter
- More than 20000 USD per quarter
- We don't have our own team for delivery and we have outsourced to delivery partner

xix. If you are using a delivery partner, then, what is your expense in product delivery by using a delivery partner?

[Intent of question]: This question is in accordance with the last question to capture details of investment/ expense done by the e-commerce vendor if delivery partner is being used. It also provides a good insight regarding whether there is any cost benefit with those vendors who are using delivery partners vis-à-vis the vendors who are delivering it by their own.

[Options given to the respondents]:

- Less than 1000 USD per quarter
- Between 1000 USD to 5000 USD per quarter
- Between 5000 USD to 10000 USD per quarter
- Between 10000 USD to 20000 USD per quarter
- More than 20000 USD per quarter
- We don't use delivery partners but have our own delivery team

xx. Are you aware of the concept of co-owned or co-shared logistics and delivery model in e-commerce supply chain?

[Intent of question]: This is a very important question for this research so that researcher can gauge the amount of e-commerce vendors are aware of this concept or there is a need to have more informational sessions with the vendors on this concept.

[Options given to the respondents]:

- No, we are not aware of it and not interested to know about it
- No, we are not aware of it and are interested to know about it
- Yes, we are aware of it, but we do not want to use it
- Yes, we are aware of it, and want to work on it in next 6 months time
- Yes, we are aware of it, and we do not know how to start as there are geographical local players
- Yes, we are aware of it, and we have already started exploring for the opportunities in current geography as well as external geography
- Yes, we are aware of it, and we are in implementation stage

xxi. If your answer to above question is (c) then what is the reason you do not want to use it?

[Intent of question]: This question is aligned to the last question where-in researcher want to gauge the reason as why the e-commerce vendor is not interested in the co-ownership/ co-sharing model.

[Options given to the respondents]:

- Our e-commerce model is a time tested model and we do not have any strategic plan to change it
- We have analysed the cost of co-sharing/ co-ownership but it is not making much of difference in terms of cost
- It does make sense in terms of cost, but we are not sure of brand security in co-sharing/ co-ownership model

xxii. If you are planning to go with co-sourcing/ co-ownership model, then what is the expected amount you will save per quarter?

[Intent of question]: This question is also aligned with the above two questions to understand the cost saving expected for co-sharing/ co-owneship model.

[Options given to the respondents]:

- Less than 1000 USD per quarter
- Between 1000 USD to 5000 USD per quarter
- Between 5000 USD to 10000 USD per quarter
- Between 10000 USD to 20000 USD per quarter
- More than 20000 USD per quarter
- I don't know if we have details as of now

<u>Questions for Logistics & Warehouse partners</u>

i. Please provide name of your organisation and the year of its establishment

[Intent of question]: This question is to capture the logistics partner name but it is important to notice that the year of establishment directly relates to the experience the logistics partner is carrying in this research space. Hence the response from this logistics partner is equally important to establish the credibility of the process for quick delivery.

[Options given to the respondents]: Just text to enter the name of the organization and the inception year

ii. Where is the corporate office of your organisation?

[Intent of question]: This question is to understand the origin of the logistics partner and this reveals the fact as what would be the base mindset of logistics and supply chain for this vendor. This question allows an insight into how quick the organization would be adapt to process optimization and technology adaptation.

[Options given to the respondents]: Textual field to enter the corporate office of the organization

iii. Which geographical region(s) does your organisation operate on?

[Intent of question]: This question establishes the logistics credentials of his exposure to multi-geography supply chain insights. If an logistics partner is operating at multiple geographic locations then there are many insights which can be derived related to operating partners in specific geography, adoption/ deployment to technology enhancements in various geographic locations etc.

[Options given to the respondents]:

- North America
- South America
- Africa
- Europe

- Asia
- Middle East

iv. What was your revenue across the financial years (in terms of million US $)

[Intent of question]: This question is to ascertain the revenue of the logistics vendor organization. This is an important insight as it allows researcher to visualize if the logistics partner has risk taking capability while process optimization and technology adaption transformation is proposed.

[Options given to the respondents]:

- Less than 1 million USD
- 1 million to 5 million USD
- 5 million to 10 million USD
- More than 10 million USD

v. Does your organisation deal into end-to-end logistics processes of supply chain or do you have sub-partners associated with you?

[Intent of question]: This question provides a good insight to understand if the total cost of ownership is only borne by the logistics partner or is it shared between the e-commerce vendor and the delivery partners. This question has another view where-in it also provides insights about end to end responsibility of managing the logistics, supply chain and the delivery of the product ordered for.

[Options given to the respondents]:

- We take care of end to end logistics partner for our e-commerce vendors
- We have sub-partners who are involved take care of different life cycle of e-commerce supply chain
- In certain cases when we have extra load we use sub-partners to clear load

vi. What warehousing and logistics processes is your organisation involved with?

[Intent of question]: This question is an extension of the last question where-in researcher gets more information about the direct and indirect involvement of the logistics partner in the entire supply chain process of e-commerce.

[Options given to the respondents]:

- Warehousing and logistics at self
- Managing warehousing and logistics at sub-partners end
- Transport facility for pickup and drop
- Export and Import
- Last mile delivery to customers
- Accounting, billing and record keeping

vii. For what part of logistics process have you partnered?

[Intent of question]: This is a validation question from the last question where-in we try to understand better about the partnerships done by the logistics partner to operationally execute the day to day operations of e-commerce supply chain and delivery. This also provides a right intent to understand the fact as in which geographical locations has the logistics partner done partnership and which ones he owns the full logistics supply chain.

[Options given to the respondents]:

- Warehousing and logistics at sub-partner's warehouses
- Last mile delivery directly from sub-partner to customer
- Something else, please explain _____

viii. Do you have multiple e-commerce vendors partnered for warehousing and logistics?

[Intent of question]: This is a validation question from the last question where-in we try to understand better about the partnerships done by the logistics partner to

operationally execute the day to day operations of e-commerce supply chain and delivery. This also provides a right intent to understand the fact as in which geographical locations has the logistics partner done partnership and which ones he owns the full logistics supply chain.

[Options given to the respondents]:

- Yes, I have multiple e-commerce vendors for whom I support warehousing and logistics in my warehouse
- No, I am a dedicated 3rd party logistic partner for an e-commerce vendor

ix. Identify from below options regarding the challenges you have been facing with?

[Intent of question]: This question is to understand the daily operation challenges in logistics and warehousing, and it is important to know this because this will direct the attention of the logistics partner to resolve first rather than pay attention to the proposed framework. However, it should be noted that the options given to the respondent in this question will directly relate to the framework/ model development.

[Options given to the respondents]:

- Adhering to quality while delivering at customer
- Warehousing of materials during festival seasons
- Dynamic warehousing of materials in case of multiple customers
- Adoption of latest technology for real time information and better insights for dynamic warehousing to increase business share
- Supply chain dilemma for best combination of routing and delivery to customer
- Adoption to latest technology for faster and safe delivery fulfilment

- Adoption to latest technology for real time insights for intelligent decision making and analysis thereby reducing operating costs

x. Are you using robots and cobots in your warehousing and logistics processes?

[Intent of question]: This question is intended from the purpose to understand the technology maturity a logistics partner and his team has currently in his supply chain process. This question gives researcher a view of technology roadmap logistics partner has prepared.

[Options given to the respondents]:

- No, we are doing logistics manually and we have no intent of upgrading to cobots and robots
- No, we are doing logistics manually and we intend to use robots/ cobots in 6 to 12 months time
- No, we are doing logistics manually and we are exploring the ROI for our business to use robots/ cobots
- Yes, we have started using robots/ cobots in our logistics process in last 12 months
- Yes, we have started using robots/ cobots in our logistics process for more than 12 months now

xi. What is your quarterly investment related to latest technology stacks for AI-ML, robots, digital web apps, reporting & dash-boarding etc.

[Intent of question]: This question is of importance to the researcher as it allows to understand the investment pattern of the logistics partner. This response from the respondent allows researcher to finalize the primary candidate to approach for proposing the model once it is approved.

[Options given to the respondents]:

- We have not yet done any investment.
- Less than 10000 USD
- Between 10000 USD to 25000 USD
- Between 25000 USD to 50000 USD
- Between 50000 USD to 75000 USD
- Between 75000 USD to 100000 USD
- More than 100000 USD

xii. Which of the following technology stack is already in place within your organisation?

[Intent of question]: This question is to understand the maturity of the logistics partner regarding the technology adoption in its organization. This question also provision the researcher to understand which all logistics partner would be the right candidate of this research adoption once the framework/ model is developed and promoted.

[Options given to the respondents]:

- Artificial Intelligence and Machine Learning for logistics and warehousing
- Artificial Intelligence and Machine Learning for mapping location wise customer interest
- Artificial Intelligence and Machine Learning for delivery operations and routing optimisations
- Robotics, Autonomous vehicles (road and air) for last mile delivery
- Intelligent Analytics and Dash-boarding for real time and time-series status
- Real time notification based on real time supply chain life cycle insights
- None of the above

xiii. Which of the following technology stack is your organisation planned to deploy in next 6 months?

[Intent of question]: This question is adjacent to the previous question for those logistics partners who have not yet invested or adopted to the technology as of now, but are preparing for its adoption in next 6 months. These logistics players are of interest to the researcher as they are another prime candidate to whom the framework can be proposed.

[Options given to the respondents]:

- Artificial Intelligence and Machine Learning for logistics and warehousing
- Artificial Intelligence and Machine Learning for mapping location wise customer interest
- Artificial Intelligence and Machine Learning for delivery operations and routing optimisations
- Robotics, Autonomous vehicles (road and air) for last mile delivery
- Intelligent Analytics and Dash-boarding for real time and time-series status
- Real time notification based on real time supply chain life cycle insights
- None of the above

xiv. Which of the following technology stack is your organisation planned to deploy in next 12 to 18 months?

[Intent of question]: Same as above question with only difference of timescale.

[Options given to the respondents]:

- Artificial Intelligence and Machine Learning for logistics and warehousing
- Artificial Intelligence and Machine Learning for mapping location wise customer interest

- Artificial Intelligence and Machine Learning for delivery operations and routing optimisations
- Robotics, Autonomous vehicles (road and air) for last mile delivery
- Intelligent Analytics and Dash-boarding for real time and time-series status
- Real time notification based on real time supply chain life cycle insights
- None of the above

xv. What is the reason for not investing in technology stacks? (If you have selected 'None of the above' in above 2 questions)

[Intent of question]: This question is very important to researcher as it provides insights to the fact that there are logistics vendors who would have challenges to adopt the process optimization and technology adoption. Such logistics partners are prime candidates of this research where a framework/ model is being proposed for co-sharing/ co-owning of physical infrastructure and the technology along with its research and investment.

[Options given to the respondents]:

- We do not have funds for investing in technology stacks
- We do not have adequate skills to identify the right technology stack needed for us
- We are yet to earn our break-even from our business
- We have already invested in the tech stacks

xvi. What is your logistics model, do you have partners for logistics process?

[Intent of question]: This question is to ascertain if the logistics partner is taking full ownership and responsibility of logistics platform and logistics setup.

[Options given to the respondents]:

- No

- Yes, we have a 3rd party logistics vendor working with us as a partner

xvii. What is your logistics model, do you have partners for warehousing?

[Intent of question]: This question is to ascertain if the logistics partner is taking full ownership and responsibility of logistics platform and logistics setup.

[Options given to the respondents]:

- No
- Yes, we have a 3rd party logistics vendor working with us as a partner

xviii. What is your expense in having your own logistics setup?

[Intent of question]: This question is to ascertain the overall cost the logistics partner is having to setup the logistics and warehouse. The imporatnt aspect here is how the e-commerce vendor can be a market leader in dynamic pricing by reducing the total cost of ownership.

[Options given to the respondents]:

- Less than 1000 USD per quarter
- Between 1000 USD to 5000 USD per quarter
- Between 5000 USD to 10000 USD per quarter
- Between 10000 USD to 20000 USD per quarter
- More than 20000 USD per quarter
- No, we have 3rd party logistics partner managing our logistics

xix. What is your expense in maintaining your logistics by a 3rd party logistics partner?

[Intent of question]: The question is asked to understand the expenses done by the logistics team in maintaining logistics by a partner. This provides a direct comparision of cost of ownerhsip if the logistics and warehouse is done in-house by the e-commerce vendor or by 3rd party partner.

[Options given to the respondents]:

- Less than 1000 USD per quarter
- Between 1000 USD to 5000 USD per quarter
- Between 5000 USD to 10000 USD per quarter
- Between 10000 USD to 20000 USD per quarter
- More than 20000 USD per quarter
- No, we have our own logistics team managing logistics internally

xx. What is your expense in product delivery by self?

[Intent of question]: The question is asked to understand the expenses done by the logistics team in maintaining logistics by a partner. This provides a direct comparision of cost of ownerhsip if the logistics and warehouse is done in-house by the e-commerce vendor or by 3rd party partner.

[Options given to the respondents]:

- Less than 1000 USD per quarter
- Between 1000 USD to 5000 USD per quarter
- Between 5000 USD to 10000 USD per quarter
- Between 10000 USD to 20000 USD per quarter
- More than 20000 USD per quarter

xxi. What is your expense in product delivery by using a delivery partner?

[Intent of question]: The question is asked to understand the expenses done by the logistics team in maintaining logistics by a partner. This provides a direct comparision of cost of ownerhsip if the logistics and warehouse is done in-house by the e-commerce vendor or by 3rd party partner.

[Options given to the respondents]:

- Less than 1000 USD per quarter
- Between 1000 USD to 5000 USD per quarter

- Between 5000 USD to 10000 USD per quarter
- Between 10000 USD to 20000 USD per quarter
- More than 20000 USD per quarter

xxii. Are you interested in co-ownership or co-shared logistics and delivery model in e-commerce supply chain for better business and revenue model?

[Intent of question]: This is a very important question for this research so that researcher can gauge the amount of logistics partners are aware of this concept or there is a need to have more informational sessions with the vendors on this concept.

[Options given to the respondents]:

- Yes, we are interested and we are exploring the opportunities
- Yes, we are interested and our business model is based on same
- No, we are dedicated logistics partner and we are happy not to change the business model

xxiii. If your answer to above question is (c) then what is the reason you do not want to use it?

[Intent of question]: This question is aligned to the last question where-in researcher want to gauge the reason as why the logistics partner is not interested in the co-ownership/ co-sharing model.

[Options given to the respondents]:

- Our model is a time tested model and we do not have any strategic plan to change it
- We have analysed the cost of co-sharing/ co-ownership but it is not making much of difference in terms of cost
- Our agreement does not allow us to have any other vendor

xxiv. If you are planning to go with co-sourcing/ co-ownership model, then what is the expected amount you will save per quarter?

[Intent of question]: This question is also aligned with the above two questions to understand the cost saving expected for co-sharing/ co-owneship model.

[Options given to the respondents]:

- We expect a saving of less than 5%
- We expect a saving of around 5% - 10%
- We expect a saving of around 11% - 20%
- We expect a saving of around 21% - 30%
- We expect a saving of more than 30%
- We do not have enough data to calculate saving %

Questions for Delivery partners

i. Please provide name of your organisation and the year of its establishment

[Intent of question]: This question is to capture the delivery partner name but it is important to notice that the year of establishment directly relates to the experience the delivery partner is carrying in this research space. Hence the response from this delivery partner is equally important to establish the credibility of the process for quick delivery.

[Options given to the respondents]: Just text to enter the name of the organization and the inception year

ii. Where is the corporate office of your organisation?

[Intent of question]: This question is to understand the origin of the delivery partner and this reveals the fact as what would be the base mindset of delivery and supply

chain for this vendor. This question allows an insight into how quick the organization would be adapt to process optimization and technology adaptation.

[Options given to the respondents]: Textual field to enter the corporate office of the organization

iii. Which geographical region(s) does your organisation operate on?

[Intent of question]: This question establishes the last mile delivery partner credentials of his exposure to multi-geography supply chain insights. If an delivery partner is operating at multiple geographic locations then there are many insights which can be derived related to operating partners in specific geography, adoption/ deployment to technology enhancements in various geographic locations etc.

[Options given to the respondents]:

- North America
- South America
- Africa
- Europe
- Asia
- Middle East

iv. What was your revenue across the financial years (in terms of million US $)

[Intent of question]: This question is to ascertain the revenue of the delivery partner organization. This is an important insight as it allows researcher to visualize if the delivery partner has risk taking capability while process optimization and technology adaption transformation is proposed.

[Options given to the respondents]:

- Less than 1 million USD
- 1 million to 5 million USD

- 5 million to 10 million USD
- More than 10 million USD

v. Does your organisation deal into end-to-end delivery processes of supply chain or do you have sub-partners associated with you?

[Intent of question]: This question provides a good insight to understand if the total cost of ownership is only borne by the delivery partner or is it shared between the e-commerce vendor and the logistics partners. This question has another view where-in it also provides insights about end to end responsibility of managing the logistics, supply chain and the delivery of the product ordered for.

[Options given to the respondents]:

- We take care of end to end delivery which involves pickup from warehouse/ dark stores to end customer
- We have sub-partners based on locations who are also involved in last mile delivery

vi. What are the different modes of delivery your organisation deals in?

[Intent of question]: Through this question, researcher is trying to gauge the maturity of delivery partner in terms of adaption to the technology. The response will clearly highlight if the delivery is a fully functional manual process or a hybrid mode of operations between physical delivery boy or a unmanned vehicle.

[Options given to the respondents]:

- Only through physical delivery boys using motor vehicles
- Only through un-manned aerial vehicles
- Only through un-manned road vehicles
- We use delivery boys and un-manned road vehicles
- We use delivery boys and combination of un-manned vehicles

vii. Do you have multiple e-commerce vendors/ logistics team partnered for last mile delivery?

[Intent of question]: This is a validation question from the last question where-in we try to understand better about the partnerships done by the delivery partner to operationally execute the day to day operations of e-commerce supply chain and delivery. This also provides a right intent to understand the fact as in which geographical locations has the logistics partner done partnership and which ones he owns the full logistics supply chain.

[Options given to the respondents]:

- Yes, we work for multiple e-commerce vendors as well as logistics & warehousing organisation.
- No, I am a dedicated delivery partner for an e-commerce vendor/ logistics & warehousing organisation

viii. Identify from below options regarding the challenges you have been facing with?

[Intent of question]: This question is to understand the daily operation challenges in last mile delivery, and it is important to know this because this will direct the attention of the delivery partner to resolve first rather than pay attention to the proposed framework. However, it should be noted that the options given to the respondent in this question will directly relate to the framework/ model development.

[Options given to the respondents]:

- Finalising the best delivery route to ensure dynamic pickup and drop
- Location and neighbourhood search
- Real time monitoring of delivery boys
- Mapping delivery route - delivery boys against delivery schedules

- Timely delivery during bad weather
- Adoption to latest technology for faster and safe delivery fulfilment
- Adoption to latest technology for real time insights for intelligent decision making and analysis thereby reducing operating costs.

ix. What is your quarterly investment related to latest technology stacks for AI-ML, robots, digital web apps, reporting & dash-boarding etc.

[Intent of question]: This question is of importance to the researcher as it allows to understand the investment pattern of the delivery partner. This response from the respondent allows researcher to finalize the primary candidate to approach for proposing the model once it is approved.

[Options given to the respondents]:

- We have not yet done any investment.
- Less than 10000 USD
- Between 10000 USD to 25000 USD
- Between 25000 USD to 50000 USD
- Between 50000 USD to 75000 USD
- Between 75000 USD to 100000 USD
- More than 100000 USD

x. Which of the following technology stack is already in place within your organisation?

[Intent of question]: This question is to understand the maturity of the last mile delivery partner regarding the technology adoption in its organization. This question also provision the researcher to understand which all delivery partner would be the right candidate of this research adoption once the framework/ model is developed and promoted.

[Options given to the respondents]:

- Artificial Intelligence and Machine Learning for logistics and warehousing
- Artificial Intelligence and Machine Learning for mapping location wise customer interest
- Artificial Intelligence and Machine Learning for delivery operations and routing optimisations
- Robotics, Autonomous vehicles (road and air) for last mile delivery
- Intelligent Analytics and Dash-boarding for real time and time-series status
- Real time notification based on real time supply chain life cycle insights
- None of the above

xi. Which of the following technology stack is your organisation planned to deploy in next 6 months?

[Intent of question]: This question is adjacent to the previous question for those delivery partners who have not yet invested or adopted to the technology as of now, but are preparing for its adoption in next 6 months. These last mile delivery players are of interest to the researcher as they are another prime candidate to whom the framework can be proposed.

[Options given to the respondents]:

- Artificial Intelligence and Machine Learning for optimising delivery schedule with availability of delivery boys
- Integrated digital applications made available to delivery boys and managers allowing them to see the delivery pickup points, best routes, weather and traffic information
- Robotics, Autonomous vehicles (road and air) for last mile delivery

- Intelligent Analytics and Dash-boarding for real time and time-series status on business optimisation
- None of the above

xii. Which of the following technology stack is your organisation planned to deploy in next 12 to 18 months?

[Intent of question]: Same as above question with only difference of timescale.

[Options given to the respondents]:

- Artificial Intelligence and Machine Learning for optimising delivery schedule with availability of delivery boys
- Integrated digital applications made available to delivery boys and managers allowing them to see the delivery pickup points, best routes, weather and traffic information
- Robotics, Autonomous vehicles (road and air) for last mile delivery
- Intelligent Analytics and Dash-boarding for real time and time-series status on business optimisation
- None of the above

xiii. What is the reason for not investing in technology stacks? (If you have selected 'None of the above' in above 2 questions)

[Intent of question]: This question is very important to researcher as it provides insights to the fact that there are last mile delivery vendors who would have challenges to adopt the process optimization and technology adoption. Such delivery partners are prime candidates of this research where a framework/ model is being proposed for co-sharing/ co-owning of physical infrastructure and the technology along with its research and investment.

[Options given to the respondents]:

- We do not have funds for investing in technology stacks
- We do not have adequate skills to identify the right technology stack needed for us
- We are yet to earn our break-even from our business

xiv. What is your expense in product delivery by self?

[Intent of question]: The question is asked to understand the expenses done by the delivery team in maintaining delivery by a partner. This provides a direct comparision of cost of ownerhsip if the logistics and warehouse is done in-house by the e-commerce vendor or by 3rd party partner.

[Options given to the respondents]:

- Less than 1000 USD per quarter
- Between 1000 USD to 5000 USD per quarter
- Between 5000 USD to 10000 USD per quarter
- Between 10000 USD to 20000 USD per quarter
- More than 20000 USD per quarter

xv. What is your expense in product delivery by using a delivery partner?

[Intent of question]: The question is asked to understand the expenses done by the delivery team in maintaining delivery by a partner. This provides a direct comparision of cost of ownerhsip if the logistics and warehouse is done in-house by the e-commerce vendor or by 3rd party partner.

[Options given to the respondents]:

- Less than 1000 USD per quarter
- Between 1000 USD to 5000 USD per quarter
- Between 5000 USD to 10000 USD per quarter
- Between 10000 USD to 20000 USD per quarter

- More than 20000 USD per quarter

xvi. Are you interested in co-ownership or co-shared logistics and delivery model in e-commerce supply chain for better business and revenue model?

[Intent of question]: This is a very important question for this research so that researcher can gauge the amount of delivery partners are aware of this concept or there is a need to have more informational sessions with the vendors on this concept.

[Options given to the respondents]:

- Yes, we are interested and we are exploring the opportunities
- Yes, we are interested and our business model is based on same
- No, we are dedicated delivery partner and we are happy not to change the business model

xvii. If your answer to above question is (c) then what is the reason you do not want to use it?

[Intent of question]: This question is aligned to the last question where-in researcher want to gauge the reason as why the delivery partner is not interested in the co-ownership/ co-sharing model.

[Options given to the respondents]:

- Our model is a time tested model and we do not have any strategic plan to change it
- We have analysed the cost of co-sharing/ co-ownership but it is not making much of difference in terms of cost
- Our agreement does not allow us to have any other vendor

xviii. If you are planning to go with co-sourcing/ co-ownership model, then what is the expected amount you will save per quarter?

[Intent of question]: This question is also aligned with the above two questions to understand the cost saving expected for co-sharing/ co-owneship model.

[Options given to the respondents]:

- We expect a saving of less than 5%
- We expect a saving of around 5% - 10%
- We expect a saving of around 11% - 20%
- We expect a saving of around 21% - 30%
- We expect a saving of more than 30%
- We do not have enough data to calculate saving %

3.4 Research Design

The current research is based on quantitative research design, where-in researcher has used deductive reasoning to prove his hypothesis. Researcher started the research journey by forming a hypothesis regarding co-ownership and co-sharing of logistics – warehouse – delivery partner(s) and adopting the latest technology available for optimizing the operations for better efficiency. Once the hypothesis was formed, researcher collected data from various stakeholders on basis of online surveys, interviews and case study researches. Post data collection, the data was analysed to ensure if there are correlations between the different variables of hypothesis and whether the conclusions prove if hypothesis is true or false

Hence the research is designed on "Causal-comparative" experimental research where-in attempts are made to establish cause-effect relationships amongs the different components of this research. In this research design:

- There is an unknown variable "Quick commerce viability"

- There are known variables “end user sentiment on quick delivery” , “pay extra for quick delivery”, “co-sharing of supply chain services”, “process optimization”, “adoption of technology advancement”.

By end of this research, based on the collected data from online surveys, interviews, case studies and data on public environment, the correlation between variables would be analysed and a relationship between variables would be established. The cause-effect relationship between variables will lead to an important question on whether the hypothesis is true or false.

3.5 Population and Sample

This research has four different stakeholders, and the online survey are different for each stakeholder, and this is the prime reason for the population sample and size to be different because of the virtue of involvement of each stakeholder in this research. To calculate the sample size for each stakeholder population we will use the formulae as below:

$$\text{Sample Size} = \frac{\frac{Z^2 * p(1-p)}{e^2}}{1+\left(\frac{Z^2 * p(1-p)}{P^2 N}\right)}$$

Where:

N —> Population Size

Z —> Confidence Score

E —> Margin of Error

P —> Standard Deviation

This formulae will provision the reasearch to calculate the sample size of respondents from the different stakeholders population based on various parameters like confidence of

response from respondent, errors while responding and deviation of results between the respondents.

Below we discuss population size and sample size of each stakeholder in this research:

- Online Shopper: This group of stakeholder consists of people who are using online e-commerce portals on regular basis to make online purchases and form the very important first segment of stakeholders for this research. Since they are the end users of e-commerce apps hence, they provide the right sentiment for last mile delivery and through their response we come to know if there is any demand for quick last mile delivery of items. Since they are spread across the globe and have a very big footfall, hence the population size of this group of stakeholders is very large. Having said so, it is impossible to capture online survey from such a very large pool. Thus, after judicious thinking the sample population size has been set with the boundary of researcher connects from his personal and social profile.

  Hence to calculate the sample size for particpation of end users we will use the formulae given above with following values to parameters:

  Population size (N) = 500

  Confidence score (Z) = 95%

  Margins of Error (E) = 5%

  Standard Deviation (P) = 50%

  Applying the values in the formulae:

$$\text{Sample Size (ss)} = \frac{\frac{(1.96)^2 * 0.5(1-0.5)}{(0.05)^2}}{1+\frac{(1.96)^2 * 0.5(1-0.5)}{(0.5)^2 * 500}}$$

Sample Size (ss) = 197 respondents; hence there should be around 197 expected respondents from the known contacts of the researchers.

- E-commerce vendors: They are the second group of stakeholders with a very important stake in driving decision for this research. This group is involved in providing the required base to the end users for creating a demand which then is translated into supply supported by logisftics, warehouses, last mile delivery partners etc. As per some research study, there are around 10 million to 25 million e-commerce companies in this world and there are around 19000 e-commerce businesses running in India. Since the researcher would not be able to cover all 19000 e-commerce entities of India, hence he will restrict his circle of research only in the city he lives in which is Pune, Maharashtra, India. However, during the research it was found that there are more than 1000 e-commerce companies which are operating in Pune but having legal entities registered across multiple geographies. So the judicious choice was to limit the e-commerce vendors to the top 20 players in Pune, India.
- Supply chain partners: This group of stakeholders consists of third party logistics & warehouse and delivery partners who ensures that the ordered goods reaches the end customers within agreed timeline and quality delivery. As per the survey from "EasyLeadz" there are around 870,000 logistics and warehouse companies in the world and 48,000 of them are operating out of India. Again, as the population size is very big, it would be impossible for the researcher to connect with all of them hence the researcher would set up boundary to the place where he lives. Considering the fact that, there would be a lots of supply chain partners for logistics, warehousing, last mile delivery hence researcher will setup a boundary of only those partners who work with those identified 13 e-commerce vendors of Pune, India who has a major share in the market.

3.6 Participant Selection

This research is based on developing a framework/ model for efficient last mile delivery adhering quality standards and within agreed delivery timelines, hence, there are various stakeholders who will be respondents to the online survey which is a part of this research strategy.

The participant selection approach would be as follows:

a. Online Shoppers: They are public at large who are involved in online shopping using various e-commerce platforms. They form a very important group and with most heavy footfall. Since their numbers are huge it is important to derive a strategy to decide on selection of participants. Researcher has decided that he will use his direct connections in office and society where he lives along with the proffessional social media LinkedIn. In office and living place, researcher has cherry picked some of the known acquaintaince who are known to use online shopping while he has created an online survey and posted it on LinkedIn for anyone to respond. This way, researcher aims to cater to a large public so that rate of error will be less than 5% and the standard deivation rule of 50% can be applied to cover large population.
b. E-commerce vendors: It will be very challenging for researcher to reach all the e-commerce vendors in this globe, hence researcher will analyze the responses from the online purchaser and based on the target location will pick up the top 15 ecommerce vendors for further analysis.
c. Logistics and Warehouse partners: Smilar to the approach of e-commerce vendors, researcher will analyze the logistics and warehouse partners working along with the e-commerce vendors identified from the response of online purchaser respondents.

d. Last mile delivery partners: Smilar to the approach of e-commerce vendors, researcher will analyze the logistics and warehouse partners working along with the e-commerce vendors identified from the response of online purchaser respondents.

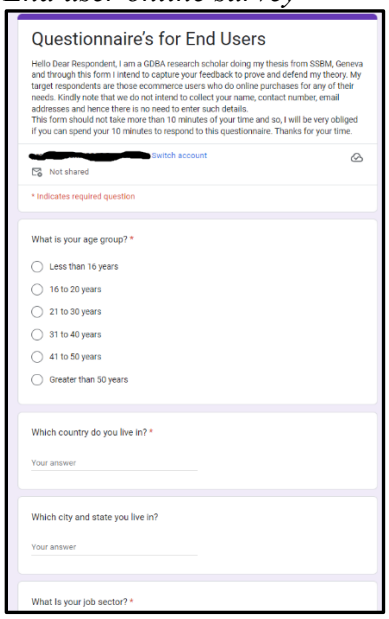
3.7 Instrumentation

During the research phase, researcher will use online surveys, organization data publicly available, case study papers to collect data. Researcher has developed online survey(s) using Google Forms for every stakeholde as discussed in sec 3.6. The online surveys can be accessed by respondents using the link which is shared on researcher LinkedIn profile and also given in person to the right stakeholders.

Some screenshots from the online surveys are as below:

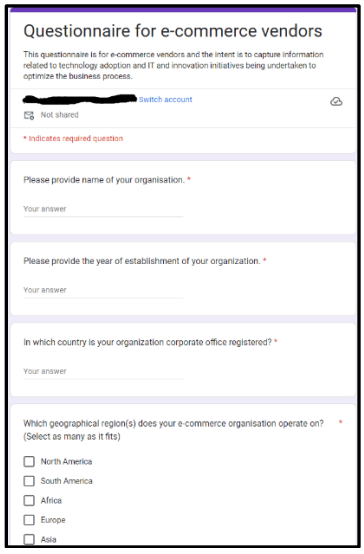
Figure-7

End user online survey



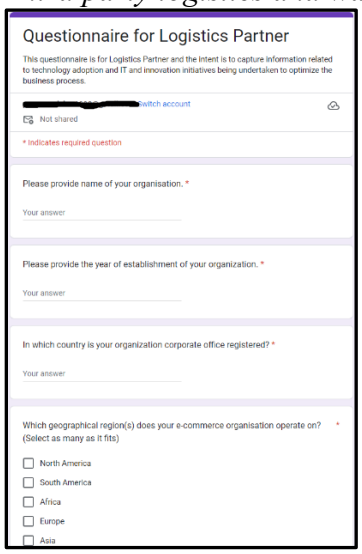
Source: Author

Figure-8
E-commerce vendor online survey



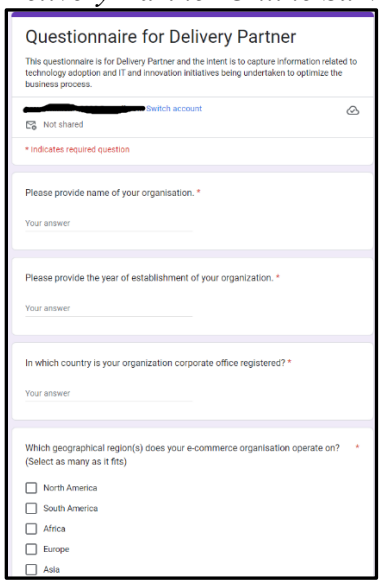
Source: Author

Figure-9
Third party logistics and warehouse partner online survey



Source: Author

Figure-10
Delivery Partner Online Survey



Source: Author

3.8 Data Collection Procedures

Researcher will publish online suveys as mentioned in section 3.7 and all responses of the respondents will be collected into online Google Forms database (which is accessible only to the researcher as it is abstracted to view based on authentication) which can then be exported to Google Sheets, an excel format for analysis and derivations. Apart from the above, there will be interviews for e-commerce vendors, logistics & warehouse partners, last mile delivery partners, case studies of the e-commerce organizations. The questions for surveys (which also would be used in interviews) have been developed so that the right set of data can be collected from various stakeholders pointing directly to the demand of proposed theories in the research to fulfilling demand by means of process optimization and technology adaptation.

Inclusion and Exclusion Crtieria: There will be inclusion and exclusion criteria for this research which will ensure what target audience will be used for online surveys and this has been explicitly called out in section 3.6

3.9 Data Analysis

Researcher has defined a process to extract data from online surveys and then reduce data into a story for interpreting data and deriving results out of it pertaining to the proposed theory of this research. The data analysis process for this research is defined below:

a. Data Organization: First of all, researcher intends to organize various data received from the online surveys from different stakeholders. The organization of data is important from the categorization pespective which will provide a thread of data knowledge base originating from online shoppers extending to ecommerce vendors and finally closing at the supply chain partners like 3rd party logistics and last mile delivery partners.

b. Data Validation: Once the data is organized, it will be validated to ensure that the data is fulfilling the standards required for this research. Data validation will ensure that the data is matching the necessary format and will not result into unambiguity during derivation. Data validation will be done in Excel sheet to ensure that all data are formatted and ready to yield results.

c. Data Cleaning: During data validation the data anomalies will be found, for example there can be some null data, there can be same data with different spellings, the same data type in different format etc. all these data will be cleaned and re-validated. Cleaning of data would mean removing data anomalies, removing duplicate data, removing inconsistencies in data and ensuring that data format is correct. To do data cleaning, researcher will use Microsoft Excel and Python programming code whose libraries will assist researcher to do data cleaning faster and with accuracy.

d. Exploratory Data Analysis (EDA): Once the data cleaning activities are done, researcher intends to do EDA to find trends within data, correlation between data from different stakeholders, identifying patterns between data categories, identifying outliers among data on which deviation and anomaly rules need to be executed. The EDA process would require Python programming libraries and Excel Analysis feature to extract the right data relationships.
e. Interpretation of Result: Post EDA, researcher would develop interpretation of data into visual results which finally will be pointing to support for success or failure of the theory based on collected data. The results will be done in Excel tool or Python programming language.

3.10 Research Design Limitations

Researcher acknowledges that this research has some limitations which are as below:

a. Populations constrained: This research has a very high potential and involves all the users on this earth involved in online shopping. Researcher has no means to cater to all these users and hence this research will be constrained on the population for survey. The population for survey will be restricted to known acquaintainces of researcher or in the social contact of researcher via LinkedIn.
b. Geography constrained: The researcher has no means to execute this research for all the geographies where-in users are situated across globe, hence based on the inputs from the survey, researcher will opt a geography where-in the research can be conducted.

c. Sample size limitations: Due to the limiation in the population size the sample size of the population for whom the data will be analyzed will also be restricted leading into sample size limitations.
d. Target audience selection biasness: Researcher believes that there would be a possibility of selection biasness of target audience based on the fact that the geography and audience population are constrained.
e. Confounding variables: This research can be prone to confounding variables which can influence the study of the outcome of result. For example, one of the variable is to understand intent of online purchaser to pay extra for quick delivery and if not answered judiciously can sway the entire result to one direction.
f. Measurement errors: Researcher believes that there is a very less chance of measurement errors in this research because all data (without any biasness metric) will result into direct relationship of result. However, there are cases like sample size calculation where-in there can be measurement errors due to wrong formulation.

3.11 Conclusion

The methodology of this research study is based on Quantitative Research analyis supported by causal-comparative data analysis. The strucuture of data instrumentation is based on online surveys, in-person interviews, case study reviews and extraction of organization data available in public domain. The target sample size of the population is based on various factors like confidence score based on normalized bell curve, margin of error calculation and standard deviation percentage covering the large population. Data analysis undegoes various sequential steps like organization of data, validation and cleaning of data, exploratory data analysis and interpretation of results in various formats like graphical, tabular and chart based. The entire research methodology has its own

limitations which is constrained with geographical location, sheer size of the population, limitation with the sample size calculations, confounding variables especially with sample size calculation and any measurement errors.

Having said so, the research methodology supported by research questions, audience interviews and data analysis are all aligned with final results to setup the framework for efficient last mile delivery. The data was collected for a period of 11 months starting from February 2023 to December 2023 where-in around 360 online surveys were done with 43 interviews of various stakeholders like e-commerce vendors, logistics partner and last mile delivery partners.

CHAPTER IV:

RESULTS

Researchers have used online survey tools, personalized interviews, case study and corporate website for data collection to support the proposed hypothesis. The questions in the online survey and interviews differ based on stakeholder type, there are four types of stakeholders, and each plays an important role in this research.

a. Online Buyer: This group of stakeholders plays a very important role where-in based on the survey responses, researcher is able to identify if there is a need for quick delivery and whether the online buyer is also willing to pay more for quick delivery. The other aspect of the survey is to understand the type of products which an online buyer would like to be delivered quickly and whether there is any affinity towards delivery only by humans. The entire hypothesis of research will be futile if there is no demand for quick delivery by online buyers. The research started with a view that there would be very few online buyers (apx. 15% to 20%) who will be willing to pay extra for quick delivery.

b. E-commerce vendor: Post the Online Buyers, next important group of stakeholder in discussions is e-commerce vendors. While Online Buyers establishes the demand of quick delivery, it is the e-commerce vendors who form the supply group of quick delivery. As part of research the author studied 13 e-commerce vendors by means of questionnaires, common public available data as well as interviews. The e-commerce vendors studied were:

   i. Amazon India
   ii. Flipkart
   iii. Zomato
   iv. Swiggy

v. Myntra
vi. BigBasket
vii. Blinkit/ Grofers
viii. DMart
ix. DCathlon
x. Licious
xi. Tata 1Mg
xii. SnapDeal
xiii. Box8

c. Logistics and warehouse partner: As a part of the research study there were thirteen (13) e-commerce vendors who were selected from the responses given by the online users, and from the responses provided by e-commerce vendors fifteen (15) logistics and warehouse partners have been identified for further research on this subject which are as below:
    a. Gati
    b. Aramex
    c. India Post
    d. India Rails
    e. Ecom Xpress
    f. BlueDart
    g. FedEX
    h. Delhivery
    i. ShadowFax
    j. Mahindra Logistics
    k. E-Kart

l. XpressBees
m. Rapido
n. Porter
o. TCI

d. Last mile delivery partner: As a part of the research study there were thirteen (13) e-commerce vendors who were selected from the responses given by the online users, and from the responses provided by e-commerce vendors fifteen (15) last mile delivery partners have been identified for further research on this subject which are as below:
    a. Gati
    b. Aramex
    c. India Post
    d. India Rails
    e. Ecom Xpress
    f. BlueDart
    g. FedEX
    h. Delhivery
    i. ShadowFax
    j. Mahindra Logistics
    k. E-Kart
    l. XpressBees
    m. Rapido
    n. Porter
    o. TCI

The sections in this chapter have questions from the online survey and interviews arranged by different stakeholders. Every question has a summarized view of the result captured from online survey in form of data table & data charts and is followed by the fact whether online survey response supports hypothesis proposed by researcher.

4.1 Research questions for online buyers

Researcher, in this research, has used online survey method for capturing responses from the online buyers, respectively to understand the demand of quick last mile delivery and capture sentiments of the online buyer related to type of products required for quick delivery. The online survey is drafted in such a way that it will capture the interest of online buyer(s) for quick delivery and their willingness to pay extra for quick delivery. It also captures the factors like online buyers age group, job type, demography, choice of last mile delivery method etc. The online survey was conducted via Google Platform and 316 respondents took part in this online survey. In order to maintain anonymity, the researcher has not captured email address, name and other personal data so that the online buyer respondents could respond without any prejudice of getting known and identified.

4.1.1 Research Question One: What is your age group?

Through this question, researcher intends to understand the acceptance trend of online e-commerce platform categorized by respondent's age. From the received 316 responses for this survey, the results depicted in table below highlights that people between the age group 21 to 40 years form a large share of e-commerce platform users. Through the survey responses it is evident that respondents of age group between 31 to 40 years form 37.7% of the respondent's population, followed by the age group of 21 to 30 years with a share of 31%. On further analysis, it is evident that the age group beyond 40 years also are strong contributors to the online e-commerce platforms with around 21% share.

Analysis of the responses evidently states that e-commerce platform is well accepted at all age level and the this is a good result for discussion of research results and in support of hypothesis.

Table-2
Age wise respondents breakup

Age Group	Total Number of respondents	% wise breakup
Less than 16 years	0 respondents	0%
16 to 20 years	4 respondents	1.2%
21 to 30 years	98 respondents	31%
31 to 40 years	119 respondents	37.7%
41 to 50 years	64 respondents	20.3%
More than 50 years	31 respondents	9.8%
Total respondents	**316 respondents**	**100%**

Source: Author

4.1.2 Research Question Two: Where do you live?

The previous question establishes acceptance of e-commerce platform at all ages, and this question, intends to analyze the geographical diversity of the respondents. This analysis will chart the geographical diversity of respondents which will further assist researcher to zero-in the geography & region for focus of the further research including targeting the audience from e-commerce vendors, logistics & warehouse partners and last mile delivery partners. The data provisions researcher to draw a pattern/ trend for online buyers in different geography and region, and it is a very good data to understand the regional culture which will be revealed from the survey response data. The analysis on the geographical breakup will assist researcher to conclude if the framework is good enough to be horizontally deployed with some tweaks.

Out of 316 respondents, the chart below highlights that around 83.5% respondents are from India and rest 16.5% respondents were from rest of the world. The other 16.5% of the respondents are from Germany, United States of America (USA), United Kingdom (UK), Australia, Croatia, Singapore and Dubai. From the responses it is very evident that

majority of respondents are primarily from India, hence the analysis of the responses will assist researcher to analyze and support the hypothesis from Indian online buyer culture.

Table-3
Respondents Breakup geography wise

Geography	Total Number of respondents	% wise breakup
India	264 respondents	83.5%
Germany	14 respondents	4.4%
United States of America	13 respondents	4.1%
Australia	8 respondents	2.5%
United Kingdom	11 respondents	3.4%
Croatia	3 respondents	0.94%
Singapore	2 respondents	0.63%
Dubai	1 respondent	0.31%
Others	0 respondents	
Total Respondents	**316 respondents**	**100%**

Source: Author

4.1.3 Research Question Three: Which city and state you live in?

From previous question researcher gets an understanding regarding breakup of respondents geography wise, and through this question, researcher makes a deep dive to understand the regional diversity of respondents within the geography. With this set of information, researcher will compare the trend of online purchases segregated by the regional diversity as there will be enough data to plot regional diversification of respondents within the geography and region. One interesting fact which also gets derived from the respondents data is the market share of e-commerce platforms in a specific region.

The respondents data clearly indicates that the majority of respondents (71.2% of the population) are from Maharashtra state of India, and so, it would be safe to conclude that the local culture of Maharashtra state will get reflected in the forthcoming questions. Hence, it is also prudent to say that the researcher's mail focus is towards the quick commerce and last mile delivery in Maharashtra region of India geography.

Table-4
Top 5 Respondents Breakup region wise (78% of the respondents)

Region	Total Number of respondents	% wise breakup
Maharashtra	176 out of 316 respondents	56%
Karnataka	33 out of 316 respondents	11%
New Delhi	14 out of 316 respondents	4%
Bavaria	14 out of 316 respondents	4%
Uttar Pradesh	8 out of 316 respondents	3%

Source: Author

4.1.4 Research Question Four: What is your job sector?

Researcher intends to study the job sector of the respondents as there is a belief that respondents who would be lacking time because of their life style and job would prefer to use online shopping. This belief will be backed by the respondents data as it will be evidently clear as researcher is tagging type of job vis-à-vis amount of availability to do physical window shopping. Hence, if we ponder over the options the people who are in private job would be preferring more towards online shopping as compared to who is in-employed or house maker or student. Going forward these respondents also will drive the rationality of type of products they are inclined to purchase online and also will answer the base fundamental question, if there is a demand of quick delivery.

In the responses received from the online survey, it is evidently clear that 90.2% of the respondent are working in private sector job while rest (9.8%) of the other respondents come from government job, public sector job, house makers, un-employed or student. Since the responses majority of respondents are from private sector jobs hence it is always be a safe assumption that the survey response will be swayed more favorable to private jobs people and their attitude and mindset towards quick commerce.

Table-5
Respondents Breakup job sector wise

Job Sector	Total Number of respondents	% wise breakup
Private Organisation	285 respondents	90.2%

Government organisation	10 respondents	3.16%
Public taking organisation	9 respondents	2.84%
Student	6 respondents	1.89%
House makers	5 respondents	1.58%
Un-employed	1 respondent	0.31%
Total Respondents	**316 respondents**	**100%**

Source: Author

4.1.5 Research Question Five: Do you use e-commerce for online purchases?

Researcher through this question, intends to filter out those respondents who are not doing online purchases, because they are not the right audience for this research and it is prudent that they do not pursue this research study at all. Hence for all practical reasons, researcher in his online survey exits them from the survey after this question. Since we have a result of 97.2% respondents are using online e-commerce platforms while 2.8% respondents does not do online purchases hence the data strongly puts the case of very high acceptance of e-commerce platforms for online purchases.

In graphical format the response can be viewed as:

Figure-11
Respondents whether they use online purchase platform

Source: Author

4.1.6 Research Question Six: What is your average online purchase?

In the last question, online survey segregates the online buyer from not being an online buyer and now the path forks for those who are using online e-commerce platform for purchasing their products. From this question, researcher tries to quantify the regularity of purchases made by the respondents. It is important to know the mindset of online purchase from the perspective because less frequency of online purchases obviously means that there is no demand for quick delivery. However, much to the delight of researcher, there are 30% of respondents who sometimes do no online purchases in some weeks, but there are 70% of respondents who can be classified as regular online purchasers every week and within these 70% respondents there are 36% respondents who make more than at least 2 items purchases every week.

Table-6
Respondents average online purchases

Average online purchases	Total Number of respondents	% wise breakup
Can be none sometimes	91 respondents	29.6%
Less than 2 items / week	103 respondents	33.6%
3 – 5 items/ week	70 respondents	22.8%
More than 5 items/ week	43 respondents	14%
Blank responses	4 respondents	1.3%
Total Respondents	**307 respondents**	**100%**

Source: Author

4.1.7 Research Question Seven: Which e-commerce platform(s) do you use?

From the previous questions in this online survey, researcher has tried to capture age, demography and quantified the average purchases done through online platforms, while in this question, researcher tries to analyze the market share of the e-commerce vendors and their platforms in the geographical region of the respondents. This question is important from the research strategy perspective as it will provide right e-commerce vendors and platform names that should be focused by researcher to study-analyze-

document the quick commerce last mile delivery impact. The responses from these e-commerce vendors and their delivery partners would provision the researcher to formulate the right framework for quick and efficient last mile delivery.

From the responses of the online survey it is clearly evident that Amazon is leading within the geography regions of the participants as 292 respondents out of 307 are using Amazon, followed by, 168 out of 307 respondents using Flipkart, followed by, 156 out of 307 respondents using Zomato. The survey results also highlight that there are many other local e-commerce vendors which has presence in the geography, however, they are small e-commerce players with a potential to grow and some of them have gain lots of popularity as they are trying to do quick delivery but still in couple of hours. These e-commerce vendors are trying a daunting task of ensuring quick delivery for the perishable items like vegetables, fruits, meat products etc.

Table-7
Respondents preference of e-commerce vendors and platforms based on survey data

E-Commerce vendor	Total Number of respondents	% wise breakup
Amazon	292 out of 307 respondents	95.1%
Flipkart	168 out of 307 respondents	51.7%
Zomato	156 out of 307 respondents	50.8%
Swiggy	153 out of 307 respondents	49.8%
Myntra	153 out of 307 respondents	49.8%
BigBasket	87 out of 307 respondents	28.3%

Source: Author

4.1.8 Research Question Eight: What type of products do you purchase from e-commerce vendors?

Now that through the research the geographical presence of e-commerce vendors is established based on the online buyer choice, it is important for the researcher to understand as what type of products online buyers are interested for online purchases. This data is very relevant to understand and correlate whether the products in demand are real

candidates for quick delivery. For example if it is an electronics item researcher is of a view that it can be delivered in normal business routine but medicine, perishable products are ideal candidates for quick last mile delivery.

The results obtained from the online survey depicts that clothes top the list for online purchase and is followed by electronics items then followed by kitchen groceries. There is also a good demand for fresh vegetables and fruits as well as medicines while we see that fresh meat and sea food expectation is average from online purchases. This result also indicates the consumer culture and behavioral pattern of the region from where most of the respondents are.

Table-8
Respondents preference of products via online purchases

Products purchased online	Total Number of respondents	% wise breakup
Clothes	253 out of 307 respondents	82.4%
Electronic Items	223 out of 307 respondents	72.6%
Kitchen Groceries	203 out of 307 respondents	66.1%
Fresh vegetables & fruits	153 out of 307 respondents	49.8%
Health care products	150 out of 307 respondents	48.9%
Medicines	117 out of 307 respondents	38%
Children stationary & toys	100 out of 307 respondents	32.6%
Fresh meat & sea food	84 out of 307 respondents	27.6%

Source: Author

4.1.9 Research Question Nine: What are the reasons you would leave an e-commerce vendor?

Through this question, researcher intends to understand and analyze the sentiments of an online purchaser regarding what would make an online buyer stick to an e-commerce vendor and what would move the online buyer away from a specific e-commerce vendor. The two options related to delivery standard and cost of product in the online survey will also be important from defining the framework.

The results of this question shows that all the options have nearly equal weightage for the online buyers and they can leave an e-commerce vendor on any of these options provided in the survey. This clearly indicates that e-commerce vendors will face stiff challenge in the future from perspective of keeping a customer engaged and loyal to its platform.

Table-9
Respondents reasons for leaving e-commerce vendors

Reasons to leave vendor	Total Number of respondents	% wise breakup
High price by an e-commerce vendor	219 out of 307 respondents	71.3%
Delivery standard/ adherence issues	218 out of 307 respondents	71%
Issue with returnable processes	193 out of 307 respondents	62.9%
Post sales customer service issues	165 out of 307 respondents	53.7%
Lack of variety of products	139 out of 307 respondents	45.3%

Source: Author

4.1.10 Research Question Ten: What are the reasons you prefer online shopping?

In the last question, researcher gauged the reasons for an online buyer to leave specific e-commerce vendors, while on the other hand, researcher using this question wants to establish a connected view of the reasons for an online buyer to prefer online shopping using online shopping platforms provided by various e-commerce vendors. This question does not have direct impact to the research but has indirect bearings with the fact as they would be provide inputs for developing the framework. The response from online survey indicates that the most important factor for online purchases is the convenience of purchase from home and then the other reasons are bearing equal weightage where-in online buyers can compare price between the e-commerce vendors at click of button which is a very difficult task in the windows shopping culture. The online buyers are also equally keen to avail discounts and coupons which is more dependent on individual negotiation within windows shopping culture.

Table-10
Respondents reasons for doing online purchases

Reasons to do online purchases	Total Number of respondents	% wise breakup
Convenience of purchase	282 out of 307 respondents	91.9%
Ease of trial at home	200 out of 307 respondents	65.1%
Avail discounts & coupons	201 out of 307 respondents	65.5%
Price comparisons between vendors	200 out of 307 respondents	65.1%

Source: Author

4.1.11 Research Question Eleven: If your e-commerce vendor provided you the purchased product in 10 min, will you be excited?

This question in the online survey is very important for research as it actually quantifies the ratio of online consumers who would create a demand for quick last mile delivery. Researcher has provided the options in such a way which clearly identifies the intent of the online buyers for quick delivery. The response data states that 39.7% of the respondent population is interested in quick delivery of ordered products and there are equal number of respondents (39.7% share of population) of an opinion that the choice would differ based on the type of products ordered. It is important to note that there were negligible respondents who chose the option that they did not bothered at all for quick delivery which is a very positive sign for this research.

Table-11
Respondents acceptance for quick delivery

Respondents acceptance for qcommerce	Total Number of respondents	% wise breakup
Certainly interested	122 out of 307 respondents	39.7%
Depends on type of product ordered	122 out of 307 respondents	39.7%
Expect reasonable time but not quick	61 out of 307 respondents	19.9%
Do not bother at all	2 out of 307 respondents	0.7%

Source: Author

4.1.12 Research Question Twelve: If you had been interested in 10 min delivery, what products would you prefer to be quickly delivered?

In the previous question, researcher based on the survey response establishes that online buyers are interested to have quick delivery, and with this question, researcher intends to capture the products which an online buyer would love to be delivered within 10 min. It is an important question for the research as it not only complements the previous question of whether online buyer would be excited in 10 min delivery if the e-commerce vendor provides it but also provides the required base for proving the hypothesis of the researcher.

In the online survey response from the respondents it is found that the online buyers have unanimously voted for medicines (83.7%) and fresh vegetables and fruits (77.2%) as ideal type of products for quick delivery which is matching the previous responses and the thought process of the researcher. Healthcare products has a good standing at 45.9% followed by Fresh meats at 39.1%. This data is crucial to the hypothesis of this research while setting up framework for quick delivery.

Table-12
Respondents type of products for quick delivery

Respondents products choice	Total Number of respondents	% wise breakup
Medicines	257 out of 307 respondents	83.7%
Fresh vegetables and fruits	237 out of 307 respondents	77.2%
Health care products & cosmetics	141 out of 307 respondents	45.9%
Fresh Meat and sea good	120 out of 307 respondents	39.1%
Electronic equipment	64 out of 307 respondents	20.8%
Everything purchased online	52 out of 307 respondents	16.9%

Source: Author

4.1.13 Research Question Thirteen: Will you be willing to pay extra for a 10-min delivery?

This question is of very importance to the research as this establishes a connection between the choice of quick delivery and the willingness to pay extra for this quick delivery. This question establishes a lot of credibility on the research and ensures that there

is a good demand for quick delivery and the e-commerce vendors and last mile delivery partners should invest in the technology and process efficiency for quick last mile delivery.

In the response from 307 respondents, it has been found that 35.5% of the respondents are not interested/ willing to pay anything extra for quick delivery but on the other hand 64.5% are willing to pay extra for quick delivery and this is a very positive discovery for this research. This data provides the necessary kick start to prove the hypothesis for this research.

Table-13
Respondents willingness to pay extra for quick delivery

Respondents willingness to pay extra	Total Number of respondents	% wise breakup
No	109 out of 307 respondents	35.5%
Yes 1% - 4%	93 out of 307 respondents	30.3%
Yes 5% - 7%	71 out of 307 respondents	23.1%
Yes 7% - 10%	20 out of 307 respondent	6.5%
Yes 10% - 15%	14 out of 307 respondents	4.6%

Source: Author

4.1.14 Research Question Thirteen: Which of the facilities below would you like to have during 10-min delivery model?

This is the final question of the questionnaire where-in researcher is intending to understand the behavior of online buyer in terms of their expectation of facilities they would like to receive within quick delivery model. This question is important from the perspective to understand the type of investment and approach an e-commerce vendor has to establish to satisfy customer need. From the survey responses it is evident that customer is more oriented towards safe delivery with quality standards followed by real time tracking of the ordered products. One of the important fact which has come out from this survey is that only 11.4% of respondents has selected the option where-in they embark that the delivery should be only done by the humans where-as 40.7% are open to the fact whether the delivery is done by autonomous vehicles or robots or even by humans.

Table-14
Respondents choice of facilities they want to avail for quick delivery

Facilities during quick delivery model	Total Number of respondents	% wise breakup
Interested only in delivery	144 out of 307 respondents	46.9%
Clear communication and tracking	189 out of 307 respondents	61.6%
Safe delivery with quality adherence	241 out of 307 respondents	78.5%
Delivery only by humans	35 out of 307 respondent	11.4%
I don't care if delivery is by humans or not	125 out of 307 respondents	40.7%

Source: Author

4.2 Research questions for e-commerce vendors

Three hundred seventeen (317) online e-commerce end users responded to the published online survey, and among the top twenty two (22) individual ecommerce vendors highlighted by the online buyers, thirteen (13) e-commerce vendors were identified (based on the share of business greater than 1%) for this specific research. The e-commerce vendors selected from the responses of end user questionnaires for assessment and research are as below based on their decreasing share of business (SOB) %:

a. Amazon India
b. Flipkart India Pvt. Ltd.
c. Zomato
d. Bundl Technologies Pvt. Ltd. (Swiggy)
e. Myntra Designs Pvt. Ltd.
f. SuperMarket Grocery Supplies Pvt. Ltd. (BigBasket)
g. Blink Commerce Pvt. Ltd. (Blinkit)
h. Avenue SuperMarts Ltd. (DMart)
i. DCathlon Sports India Pvt. Ltd. (DCathlon)
j. Delightful Gourmet India Pvt. Ltd. (Licious)
k. Tata1mg

l. SnapDeal

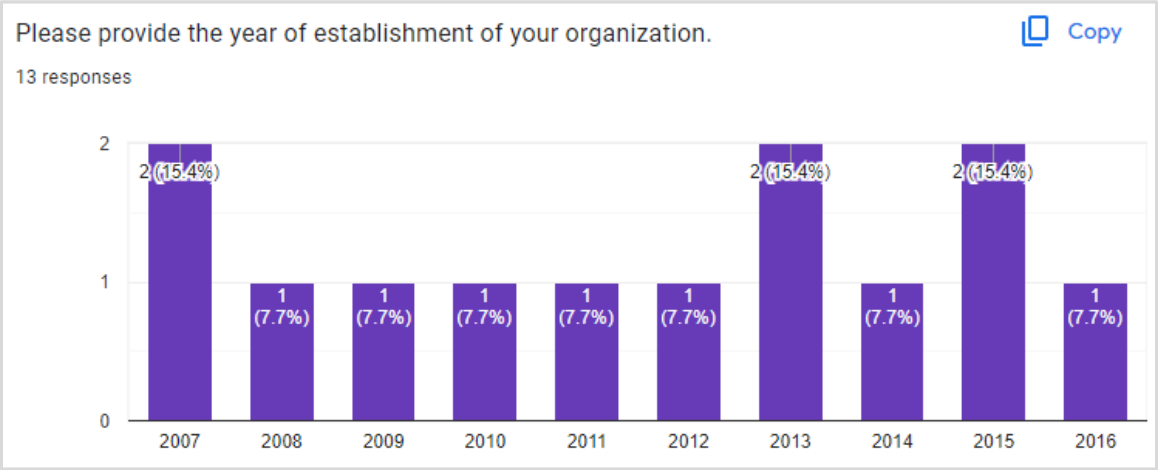
m. Box8

The above mentioned e-commerce vendors were given an opportunity to respond to an online questionnaire which was curated by the author and his mentor in such a way that enough information could be derived from the e-commerce vendors regarding the technology investment and co-sharing model to establish a seamless last mile delivery.

4.2.1 Research Question One and Two: Year of Establishment and Registered Country

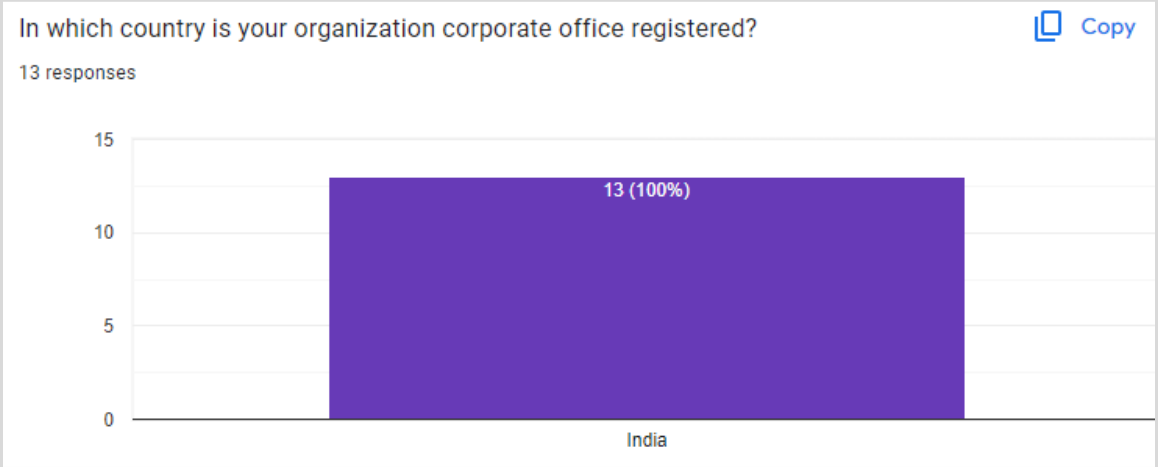
The intent of the first two questions is to understand the experience of identified e-commerce players, respective to Indian geography and market, also, if they are registered owners of business following the law of lands. From the charts below, we come to know that the operating experience is huge as couple of organizations are operating in Indian environment and economy since 2007, and the inceptions has been increasing year on year witnessing the addition of e-commerce vendors trying to exploit Indian markets for its share of business in e-commerce and quick delivery for last mile. Since these organizations are registered under Indian Board of Chamber of Commerce, hence is safe to assume that they have been very aware of the land of laws and the economic and infrastructure factors which play a major role in logistics, transportation, and last mile delivery.

Figure-12
Organization Establishment Year plotted on the time chart.



Source: Author

Figure-13
Country where the organization is registered.



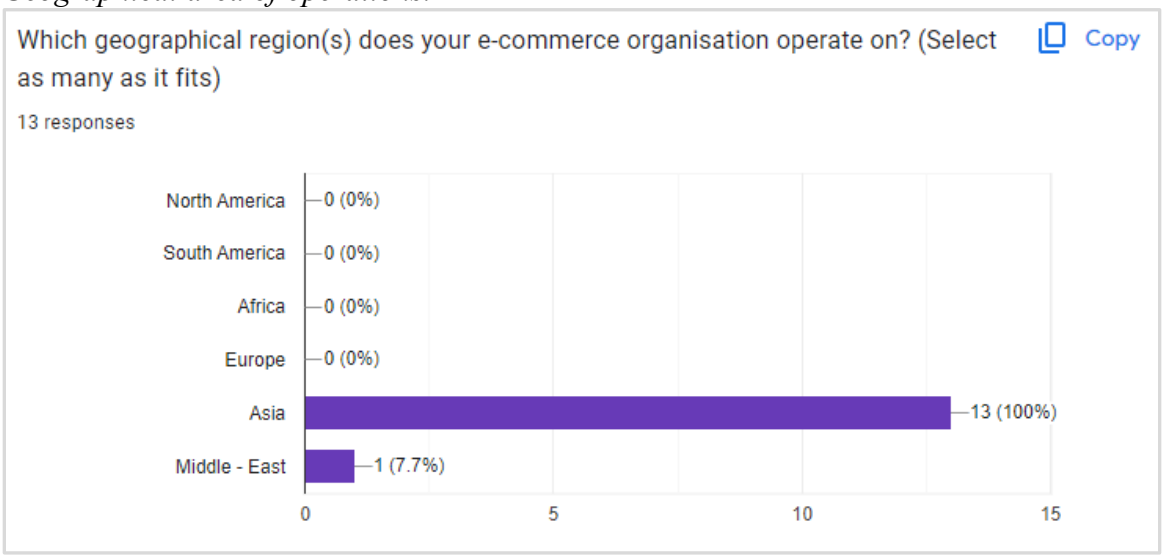
Source: Author

4.2.2 Research Question Three: Geographical area of operations

Through this question, researcher intends to gauze the location of primary operations of the identified e-commerce vendors. This question helps the researcher to understand the expertise of e-commerce operations globally and whether the e-commerce vendors have access to the best practices which are followed across the globe.

The responses received from the e-commerce vendors clearly highlights in the chart below that the primary geographical location of operations is India and only one (1) e-commerce vendors also have geographical presence in Middle-East. Hence if we corroborate the two charts of years of operations and geographical regions presence, it is safe to assume that, the experience is majorly in Indian Market, hence the responses will be more attuned towards Indian geography and the results derivation will represent India market predominantly.

Figure-14
Geographical area of operations.



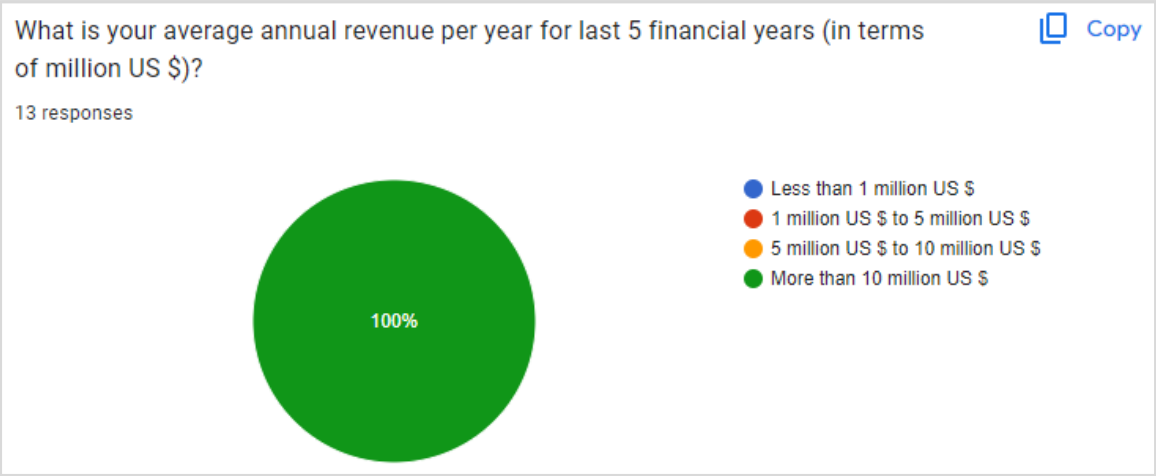
Source: Author

4.2.3 Research Question Four: What is the Average annual revenue in USD million for last 5 financial years?

Through this question, researcher intends to find the scale of operations for every e-commerce organization selected based on SOB% via the online end user survey. The parameters were based on an average of 5 years annual revenue in USD Millions. The result has been astonishing as it highlights that the annual average revenue in the last 5 years have been more than 10 million USD for each identified e-commerce organization.

This depicts that all these e-commerce vendors have done very well in the last mile delivery business and they have enough budget to explore different opportunities related to adoption of technology and observing process of co-sharing of delivery & logistics partner.

Figure-15
Average annual revenue for last 5 years.



Source: Author

4.2.4 Research Question Five: Do you deal in end-to-end supply chain or have partners associated with you?

Through this question, researcher is trying to understand the operating model of identified e-commerce vendors for this research. This question is of importance from the fact that it provides information whether the e-commerce vendor is a solo player for entire supply chain or it has partnered with some channel partner(s) to take care of logistics, warehousing and last mile delivery. From the chart below it is evident that most of the e-commerce organizations around 76.9% have their end to end operations done by themselves and have channel partners with them, while 15.4% of e-commerce vendors have outsourced last mile delivery to their partners. It is also interesting to know that there are around 7.7% of e-commerce vendors who do not have any channel partners involved but they deal with entire end to end supply chain process.

Figure-16
Vendor wise end to end process ownership bifurcation.

Source: Author

4.2.5 Research Question Six and Seven: What stage of e-commerce is your organization involved in? Which stage of e-commerce do you have channel partners?

These two questions makes a deeper dive to the response received from e-commerce vendors in last question where-in researcher would like to understand the contribution of e-commerce vendors for different stages of e-commerce. While curating the question, researcher provisioned the different options to e-commerce vendors for their selection(s). Through responses to these options, researcher can gauge on different aspects of e-commerce operations like:

a. Is the e-commerce vendor involved in the organization online commerce branding and strategy, or do they have channel partner employed for this?
b. Is the e-commerce vendor involved in sourcing of materials and supply chain or use channel partners for sourcing of products?
c. Is the e-commerce vendor involved in managing warehouses and logistics or get it done through third party logistics (3PL) partners?
d. Is the e-commerce vendor involved in Last mile delivery or get it delivered by using their locale partners?

e. Is the e-commerce vendor involved in developing digital solutions using mobile and web application technologies for better delivery, right product estimation etc or they have partnered with technology solution companies to get the digital apps delivered?

f. Is the e-commerce vendor involved in providing market insights and Search Engine Optimizations or they use the digital marketing partners?

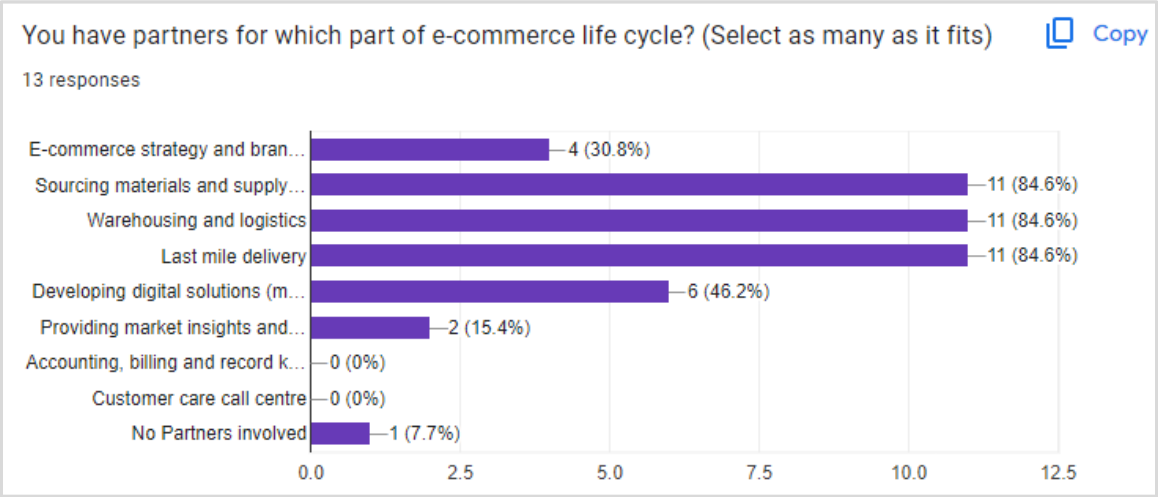
g. Is the e-commerce vendor manage accounting, billing and record keeping or have they outsourced them to some third party?

h. Does the e-commerce vendor have its own customer care center or have they outsourced them to some third party?

Figure-17
Stages in which E-commerce vendors are involved in.

Source: Author

Figure-18
Stages in which partners of e-commerce vendors are involved in.



Source: Author

4.2.6 Research Question Eight: Identify the challenges as an organization you are facing with?

Every e-commerce vendor in the supply chain process will face one or the other challenges regarding online commerce process to execute last mile delivery. In this question, research author has mapped some important challenges and intends to understand the percentage ratio of e-commerce vendors who face those challenges. It is important to note that these challenges are curated by research author to get aligned with the research theory in question.

The research author intends to understand if challenges faced by e-commerce vendors are due to Technical Complexity Factors (TCF) or External Complexity Factors (ECF). The TCF can be managed by adopting to the latest technology advancements and research done in the domain, while ECF, can only be resolved based on optimizing the process to make seamless operations and management. Response to this question indicates that the ECF is more challenging than TCF for these e-commerce vendors in question. The challenges which author intends to track are:

a. Whether the dynamic shift in customer loyalty a challenge for e-commerce vendor?

b. Whether the dynamic price in market a challenge for e-commerce vendor?

c. Is quality delivery adherence a challenge for e-commerce vendors?

d. Is managing customer expectations regarding delivery a challenge for e-commerce vendors?

e. Is defining the best combination for routing and delivery a challenge for e-commerce vendors?

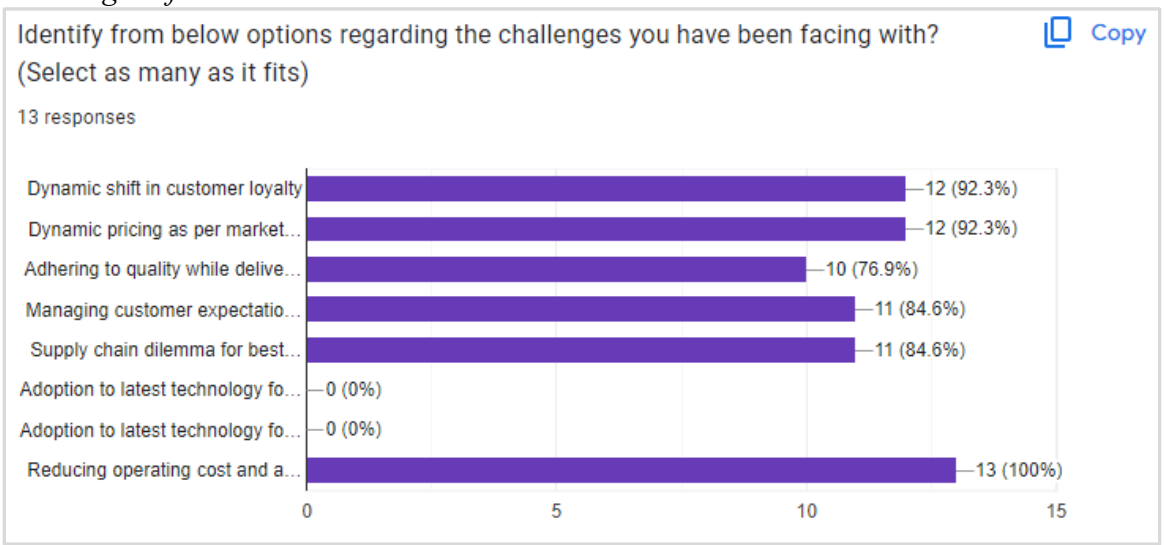
f. Is adoption of the latest technology for optimized delivery a challenge for e-commerce vendors?

g. Is adoption of the latest technology for real time insights and intelligent decision making a challenge for e-commerce vendors?

h. Is reducing operating cost a challenge for e-commerce vendors?

Response of the finalized e-commerce vendors are in the graph pasted below:

Figure-19
Challenges of an e-commerce vendor.

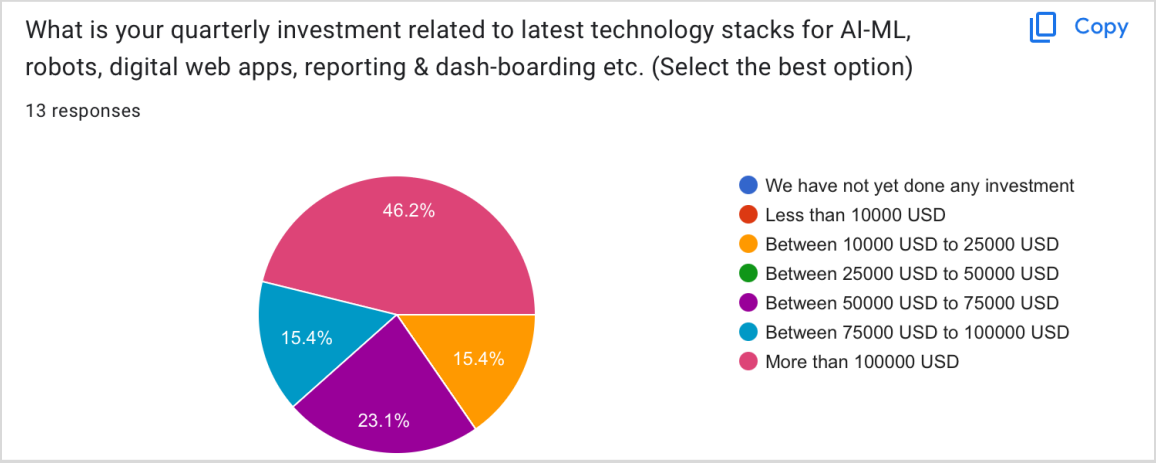


Source: Author

4.2.7 Research Question Nine: Quarterly investment related to latest technology stacks for AI-ML, robots, digital web apps, reporting & dashboarding etc?

This question is important from the researcher's perspective as he intends to understand the annual spend an e-commerce vendor has been investing or has the appetite to invest. On analysis of the chart derived from the response of online questionnaires, it is very evident that all e-commerce vendors have invested in technology adoption and most of the e-commerce vendors have ability to invest more than USD 100,000 quarterly. It is also clear that minimum quarterly investment for technology adoption by the e-commerce vendors is between USD 10,000 to USD 25,000.

Figure-20
Quarterly investment by an e-commerce vendor.



Source: Author

4.2.8 Research Question Ten: Technology stacks already present in the organization?

This question is complementary to the previous question, where-in after establishing the quarterly budgetary spent by the e-commerce vendors in previous question, researcher wants to understand the technology landscape already adopted by the e-commerce vendors via this question. The questions have been curated by researcher to observe the response of technology adoption using Artificial Intelligence & Machine

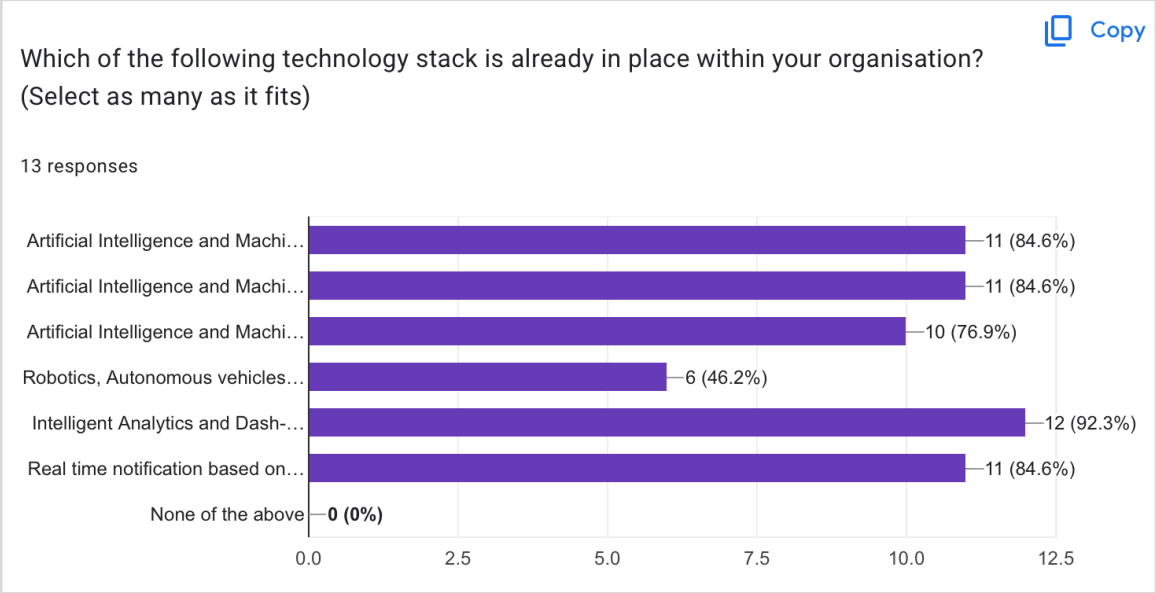
Learning (AI-ML) for logistics & warehousing, delivery & routing optimizations, mapping location wise customer interest, robotics & autonomous drivings. There are question options to also understand if e-commerce vendors have technology stack for intelligent analytics & dash-boarding as well as real time notifications.

From the graph below, it is evident that all e-commerce vendors have one or more technology stacks in their organization. The detailed analysis represents that most of them have real time monitoring & dash-boarding technology stacks available within their organisation which is followed by AI-ML based technology stacks for logistics, warehousing, delivery & routing optimizations. Nearly less than half of the e-commerce vendors have some technology stacks respective to autonomous driving and robotics.

Researcher intends to understand the technology stacks being employed by the e-commerce vendors as below:

a. Implementation of Artificial Intelligence and Machine Learning for logistics and warehouse
b. Implementation of Artificial Intelligence and Machine Learning for identifying customer wise interest location wise
c. Implementation of Artificial Intelligence and Machine Learning for delivery operations and routing optimizations
d. Implementation of Robotics and autonomous vehicles (air and road) for last mile delivery
e. Implementation of Intelligent Analytics and Dashboarding for real time status
f. Implementation of real time notifications based on real time supply chain status indicators.

Figure-21
Technology stack adopted by e-commerce vendors.



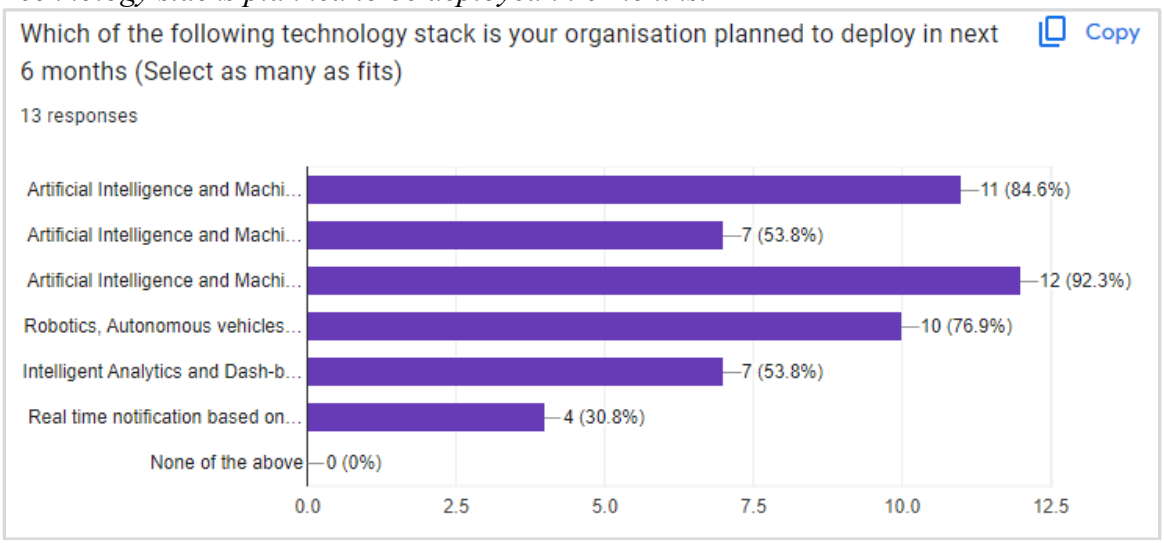
Source: Author

4.2.9 Research Question Eleven: Technology stacks e-commerce organization planning to deploy in next 6 months?

From the last question, researcher will come to know about the technology landscape, which is present in the e-commerce vendor's ecosystem, while from this question, researcher intends to gauge if there are any deployments planned in next six months using the technology landscape identified in previous question.

As we can see, there is an inclination to setup efficiency in operations by adopting to technology for seamless delivery operations & routing optimizations as well as managing logistics and warehouse along with managing efficiency in last mile delivery operations. The response also indicates that the e-commerce vendors have already deployed some technology solutions for getting real time insights for intelligent analytics and understanding location wise customer preferences. Questions asked for responses are same as of last question.

Figure-22
Technology stacks planned to be deployed in 6 months.

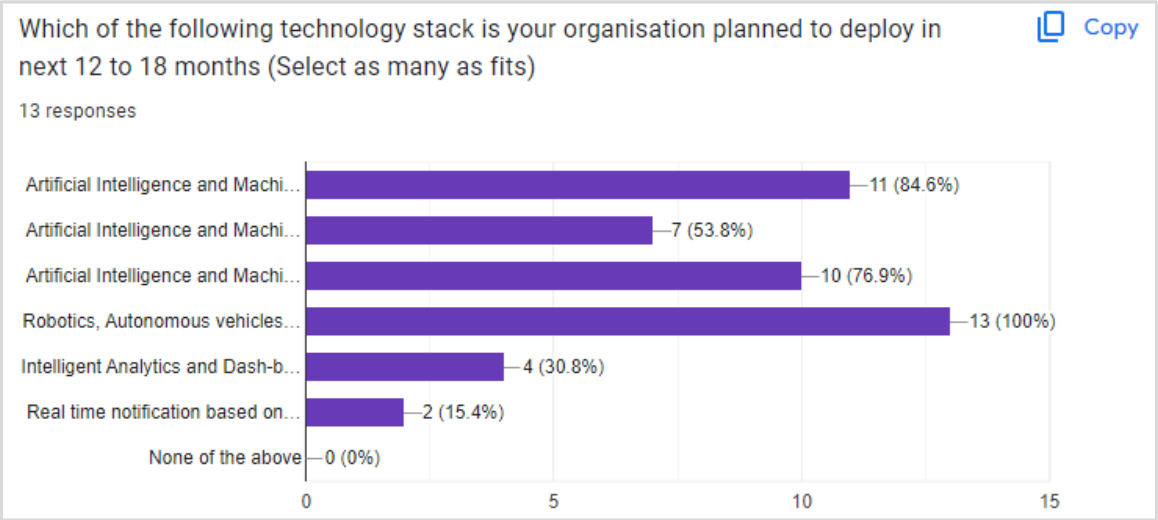


Source: Author

4.2.10 Research Question Twelve: Technology stacks e-commerce organization planning to deploy in next 12 to 18 months?

While in the last question, intent was to understand the technology stacks which were planned for deployment in next 6 months, this question intends to gauge more on the technology stacks planned for deployment in next 12 to 18 months. From the responses it is evident that the focus is being shifted towards implementing robotics and autonomous driving vehicles for various supply chain and last mile delivery process. Questions remains same as of the last question.

Figure-23
Technology stacks planned to be deployed in next 18 months.



Source: Author

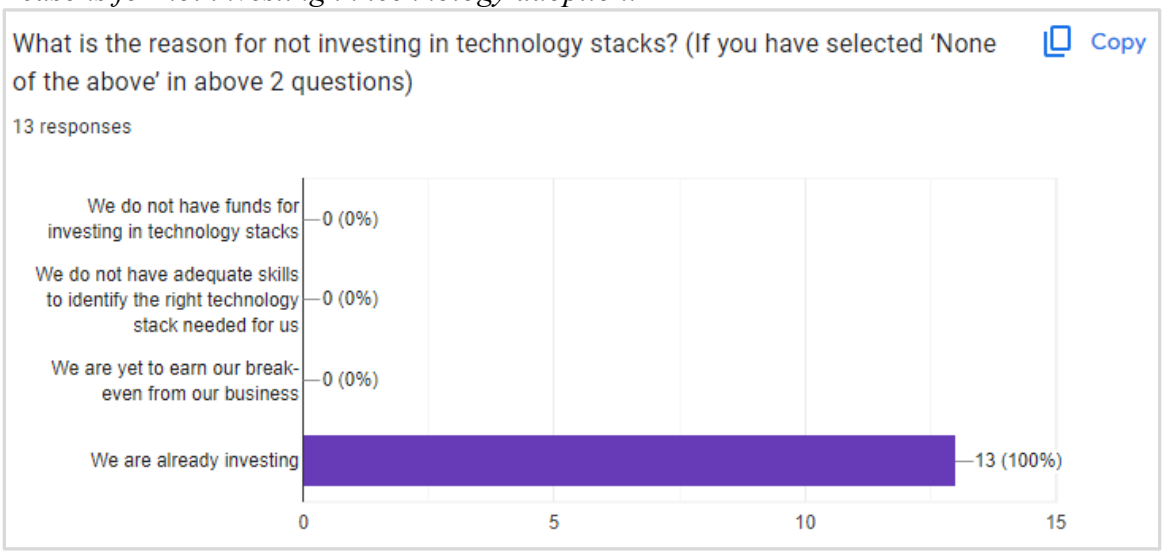
4.2.11 Research Question Thirteen: Reason for not investing in technology stack?

This question is important from the perspective to understand reasons due to which an e-commerce vendor would not invest much in technology and innovations or efficiency. The questions asked were:

a. 'We do not have funds for investing in technology stacks'.
b. 'We do not have adequate skills to identify right technology stack needed'
c. 'We are yet to earn our break even'
d. 'We are already investing'

As we can see from the responses captured, all of the e-commerce vendors claim that they are already investing to adopt the technology to ensure seamless and efficient operations for entire supply chain finally leading to last mile delivery.

Figure-24
Reasons for not investing in technology adoption.

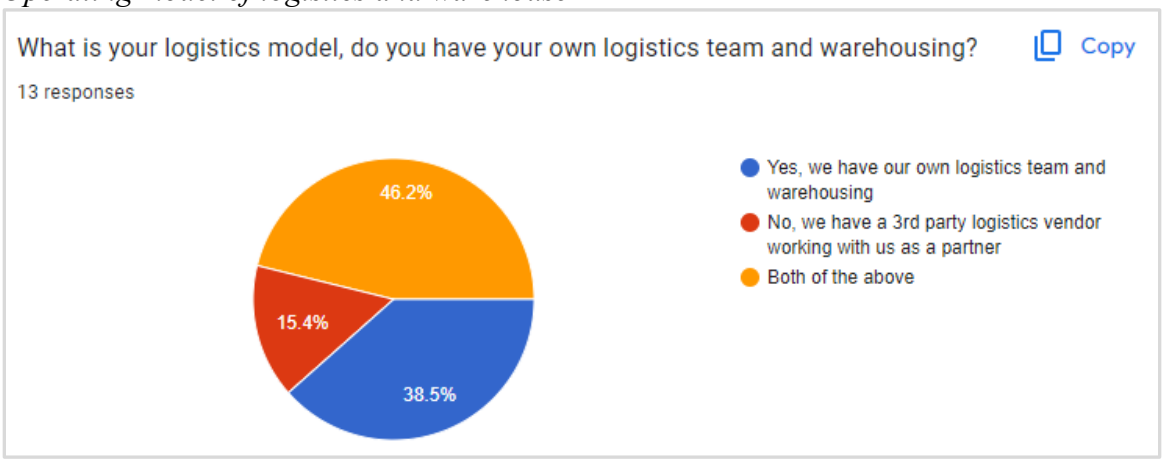


Source: Author

4.2.12 Research Question Fourteen: What is your logistics model, do you have your own logistics and warehouse team?

Using this question, researcher is intending to gauge, whether they have partnerships with third party logistics for logistics and warehouse stages in the entire supply chain and last mile delivery process. From the responses, we find that around 46% of the e-commerce vendors have a hybrid model where they also have their operations of logistics and warehouse and at the same time have partnerships to also execute the same operations as an extended arm. The second contribution is around 39% where-in the e-commerce vendors manage their own operations of logistics and warehouses, and, on the other hand around 15% of the e-commerce vendors have outsourced their logistics and warehouse processes to third party logistics partners.

Figure-25
Operating model of logistics and warehouse

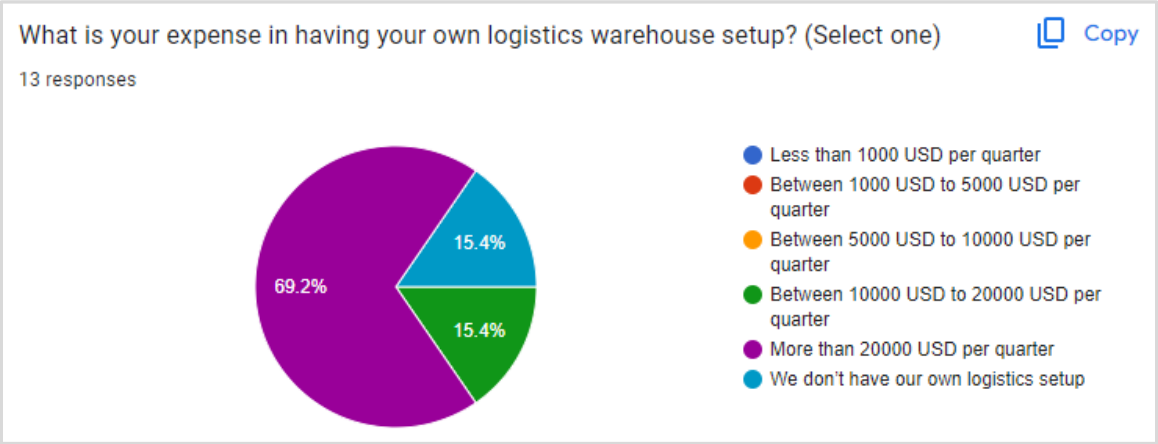


Source: Author

4.2.13 Research Question Fifteen: What is your expense in having your own logistics warehouse set up?

This question is to understand the expenses made by e-commerce vendors for operating using own logistics and warehouse team. From the responses we observe that 70% of the e-commerce vendors spend more than $20,000 per quarter, while 16% of the e-commerce vendors spend between $10,000 to $20,000 per quarter. It is also witnessed that around 16% of the e-commerce vendors do not have their own logistics setup but have outsourced the same to third party logistics team.

Figure-26
Expenses ratio breakup of managing self-logistics and warehouse



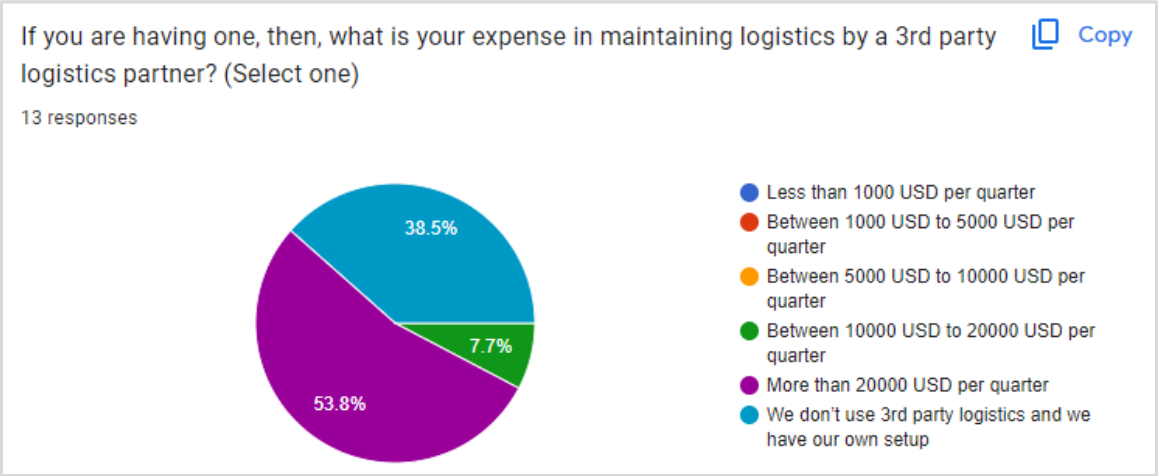
Source: Author

4.2.14 Research Question Sixteen: What is your expense in having logistics warehouse set up operated by third party logistics partner?

In question 4.2.12, there are around 62% of e-commerce vendors who have outsourced part or whole of their logistics and warehouse process to third party. Through this question, we want to know the cost of operations when a third-party logistics and warehouse partner is involved. From the responses it is evident that 54% of the e-commerce vendors spend more than $20,000 per quarter while around 8% spend between $10,000 to $20,000 per quarter.

The responses from question 4.2.13 and 4.2.14 indicate that the cost of operations using self or using partners for logistics and warehouse are high.

Figure-27
Expenses ratio breakup by managing logistics and warehouse by using partners

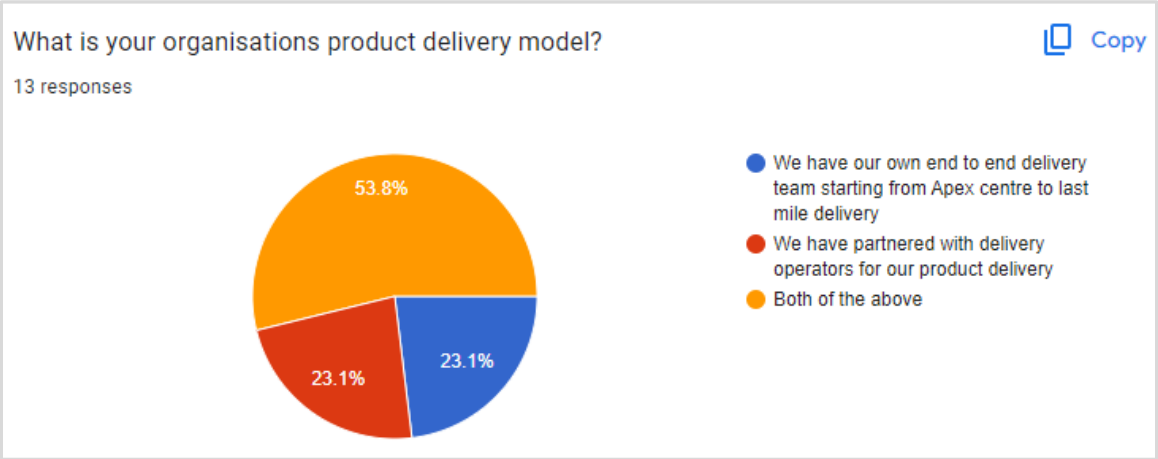


Source: Author

4.2.15 Research Question Seventeen: What is your product delivery model?

One of the important aspects of this research is efficient & quality adhered last mile delivery and through this question, researcher intends to know the product delivery model of these e-commerce vendors. Researcher wants to know whether the e-commerce vendors do the last mile delivery themselves or they employ third party delivery partners for doing last mile delivery. Based on the responses, it is clear that around 54% e-commerce vendors are using hybrid model where they are directly involved in last mile delivery and have also partnered with the last mile delivery partners. At the same time there are 23% e-commerce vendors who manage the last mile delivery themselves and on the other hand 23% of the e-commerce vendors have outsourced their last mile delivery to the last mile delivery partners.

Figure-28
Operating model of last mile delivery

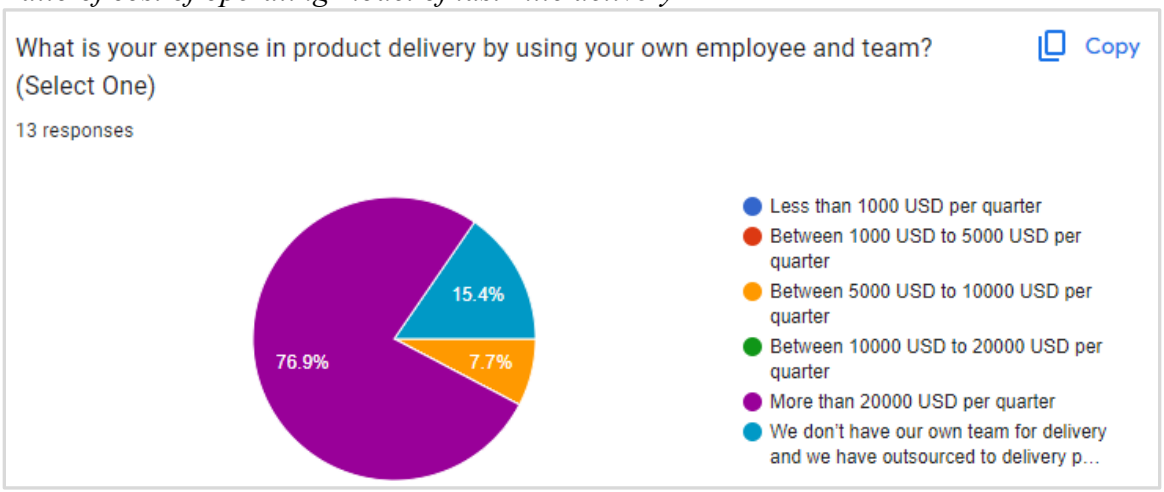


Source: Author

4.2.16 Research Question Eighteen: What is your expense in product delivery using your own employee and team?

In the last question, once the researcher understands the breakup of e-commerce vendors regarding the last mile delivery operating model, there is an intent to dig more and understand the cost of operating model opted in the last question. From the responses we find out that 77% of e-commerce vendors spend more than $20,000 per quarter irrespective of the fact if they are doing last mile delivery themselves or using partners or both. Around 8% of the e-commerce vendors are spending between $5000 to $10,000 per quarter and around 15% e-commerce vendors say they have outsourced.

Figure-29
Ratio of cost of operating model of last mile delivery

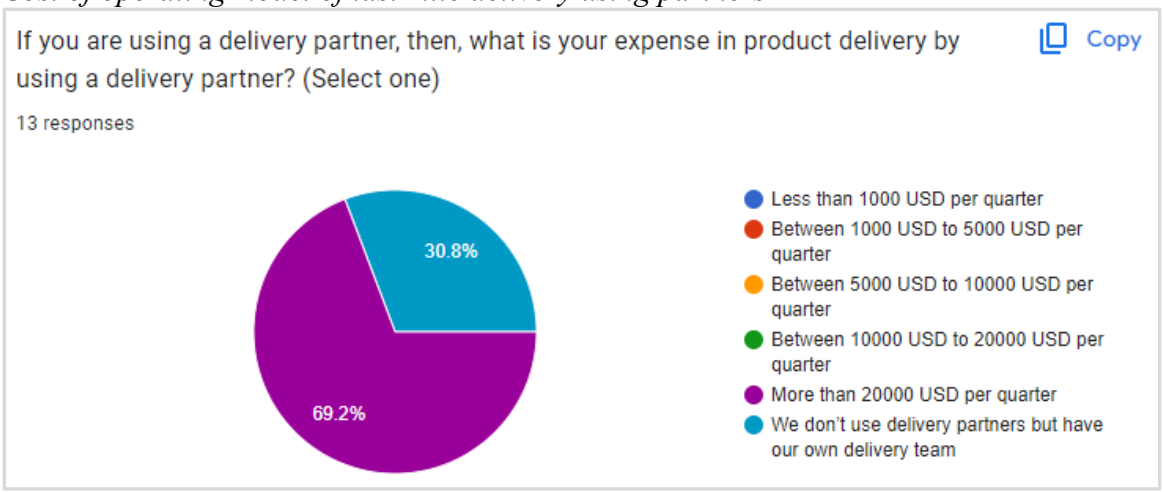


Source: Author

4.2.17 Research Question Nineteen: What is your expense in product delivery using delivery partner?

This question is complementary to the previous question where author intends to know the cost of last mile delivery operations using last mile delivery partners. As we can conclude from the responses, around 70% of the e-commerce vendors spend more than $20,000 per quarter while using last mile delivery partners.

Figure-30
Cost of operating model of last mile delivery using partners



Source: Author

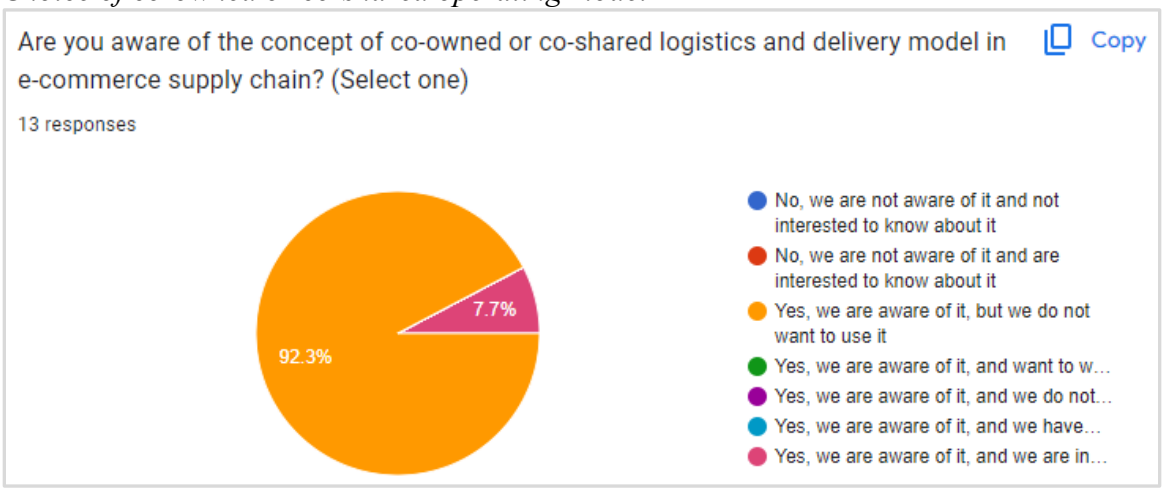
4.2.18 Research Question Twenty: Are you aware of the concept of co-owned or co-shared logistics and delivery model in e-commerce supply chain?

This is a very important question from the research perspective as the author wants to gauge the level of maturity related to co-ownership and co-sharing of logistics and delivery model in e-commerce supply chain. Hence, author provides following options to the respondents for their selection:

a. No, we are not aware of it and not interested to know about it
b. No, we are not aware of it and we are interested to know about it
c. Yes, we are aware of it, but we do not want to use it
d. Yes, we are aware of it, and want to work on it in next 6 months time
e. Yes, we are aware of it, and we do not want to know how to start as there are geographical local players
f. Yes, we are aware of it, and we have started exploring the opportunities in current geography as well as external geography
g. Yes, we are aware of it and we are in implementation stage

The assessment of the response indicates that around 92% of the e-commerce vendors are not aware of how the co-ownership and co-shared operating model works and they are neither interested to go on this road, while 8% of the e-commerce vendors are of this model in question, but they are not aware of how to start the same.

Figure-31
Choice of co-owned or co-shared operating model



Source: Author

4.2.19 Research Question Twenty-one: If your answer to above question is (c) then what is the reason you do not want to use it?

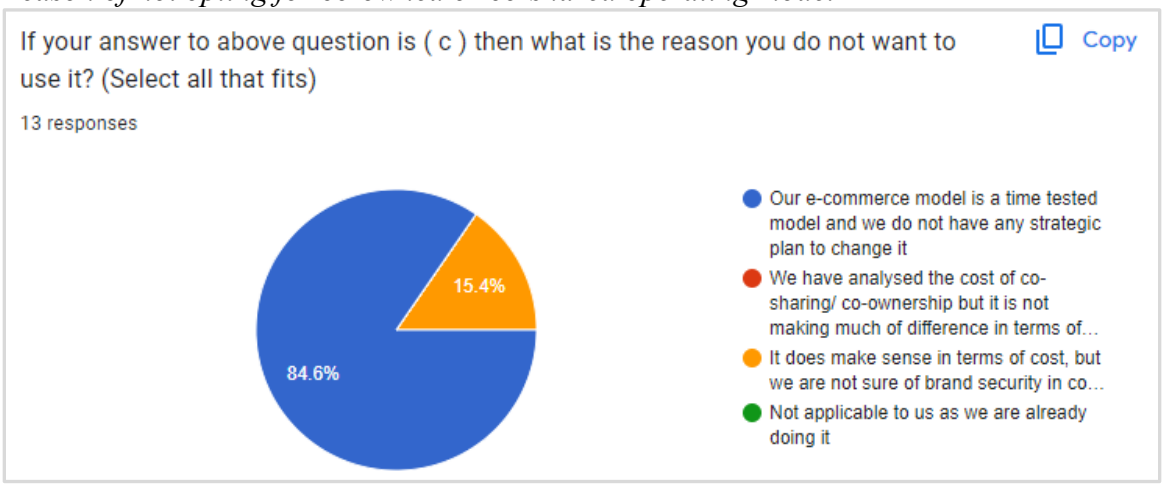
In the last question, out of various options, if the respondent choses to not use the co-sharing and co-ownership model even though they are aware of process methodology, actually arises the interest for next level question which tries to understand the reason behind it. The various options given to respondent are:

a. Our e-commerce model is time tested model and we do not have any strategic plan to change it.
b. We have analyzed the cost of co-sharing/ co-ownership, but it is not making much of difference in cost.
c. It does make sense in terms of cost, but we are not sure of brand security in co-sharing/ co-ownership model
d. Not applicable to us as we are already doing it

From the responses received by respondents we find that 85% of e-commerce vendors believe that they have a time tested model and they have no strategy to change the already working model while 15% of the e-commerce vendors believe that it does make

sense to use the model but they are not sure of the security of the brand during co-sharing and co-owning of the logistics and last mile delivery process.

Figure-32
Reason of not opting for co-owned or co-shared operating model



Source: Author

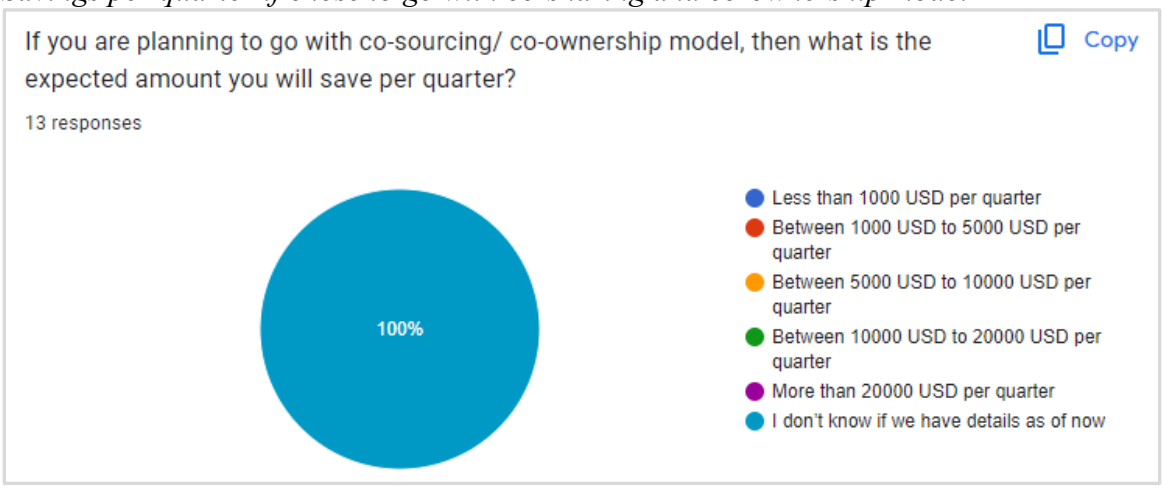
4.2.20 Research Question Twenty-two: If you are planning to go with co-sourcing/ co-ownership model, then what is the expected amount you will save per quarter?

This final question for e-commerce vendor is to understand if they have developed any costing model to calculate the expected amount of saving per quarter. Author gave following options:

a. Less than $1000 per quarter
b. Between $1000 to $5000 per quarter
c. Between $5000 to 10,000 per quarter
d. Between $10,000 to $20,000 per quarter
e. More than $20,000 per quarter
f. I don't know if we have details as of now

From the responses given all e-commerce vendors have indicated that they do not have any details as of now.

Figure-33
Savings per quarter if chose to go with co-sharing and co-ownership model



Source: Author

4.3 Research questions for logistics & warehouse partners

There were thirteen (13) e-commerce vendors who were selected from the responses given by the online users, and from the responses provided by e-commerce vendors fifteen (15) logistics and warehouse partners have been identified for further research on this subject which are as below:

p. Gati
q. Aramex
r. India Post
s. India Rails
t. Ecom Xpress
u. BlueDart
v. FedEX
w. Delhivery
x. ShadowFax
y. Mahindra Logistics
z. E-Kart

aa. XpressBees

bb. Rapido

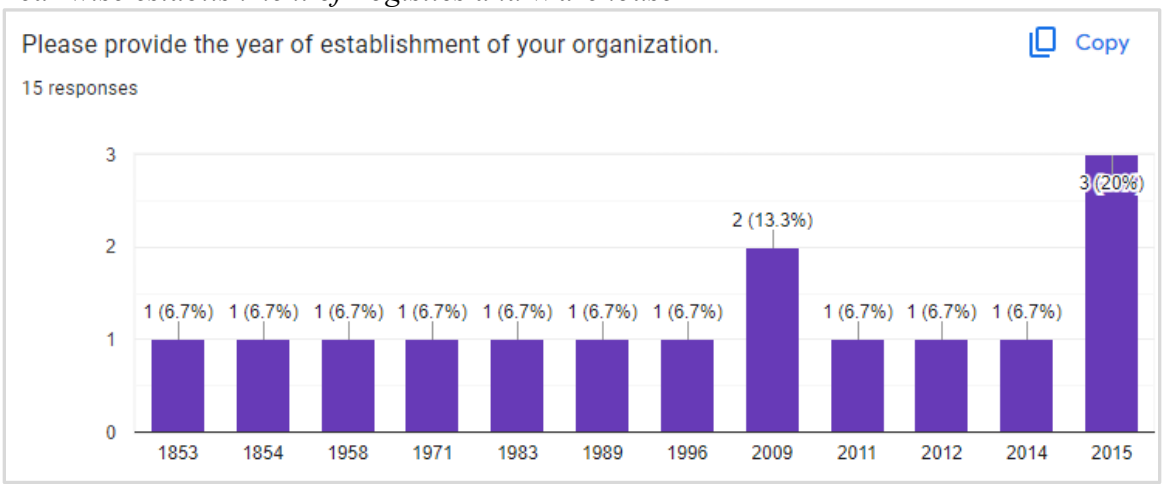
cc. Porter

dd. TCI

4.3.1 Research Question One and Two: Year of Establishment and registered office

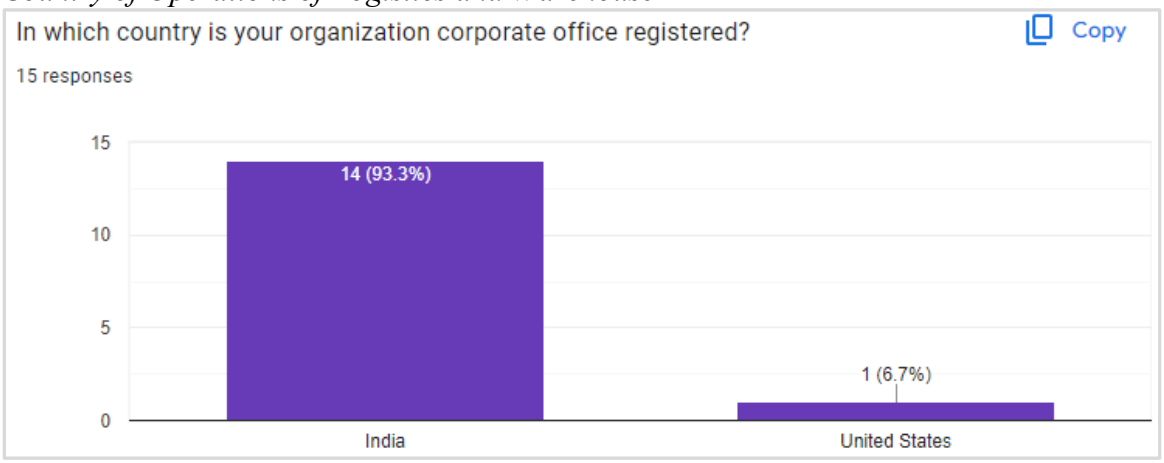
The intent of the first two questions is to understand the experience of identified e-commerce players, respective to Indian geography and market, also, if they are registered owners of business following the law of lands. From the charts below, we come to know that the operating experience is huge as couple of organizations are operating in Indian environment and economy since 1853, and the inceptions has been increasing year on year witnessing the addition of logistics and warehouse playing in Indian markets for its share of business in e-commerce and quick delivery for last mile.

Figure-34
Year wise establishment of Logistics and Warehouse



Source: Author

Figure-35
Country of Operations of Logistics and Warehouse



Source: Author

4.3.2 Research Question Three: Which geographical region(s) does your logistics and warehouse organization operate in?

Through this question, researcher intends to gauze the location of primary operations of the identified logistics and warehouse process for e-commerce vendors and their partners. This question helps the researcher to understand the expertise of logistics and warehouse operations globally and whether the logistics & warehouse operation people have access to the best practices which are followed across the globe.

The responses received from the e-commerce vendors and their logistics and warehouse partners clearly highlights in the chart below that the primary geographical location of operations is spread majorly across Asia and then followed by Europe, Middle-East and America. Hence, it is safe to assume that, the experience is majorly in Indian Market, hence the responses will be more attuned towards Indian geography and the results derivation will represent India market predominantly

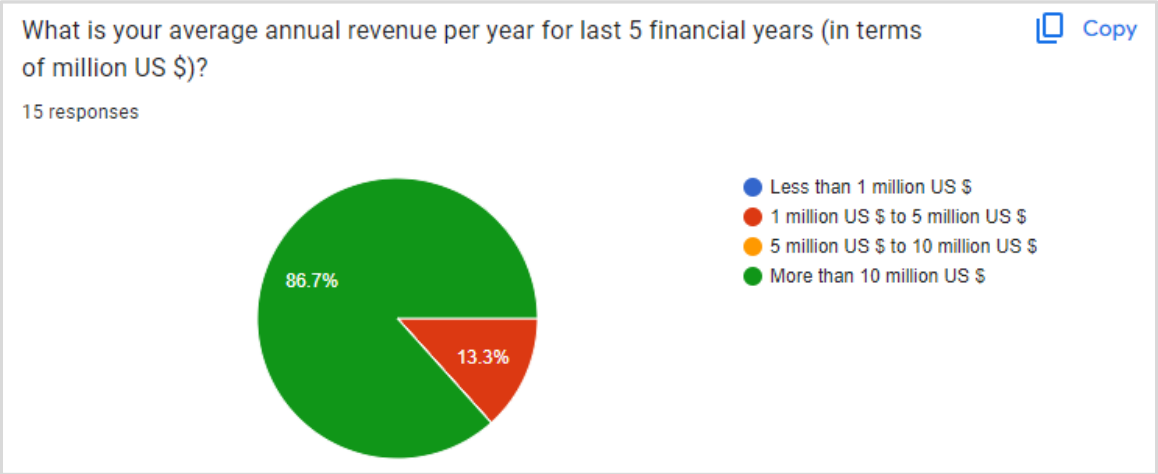
Figure-36
Country of Operations of Logistics and Warehouse

Source: Author

4.3.3 Research Question Four: What is your average annual revenue per year for last 5 financial years?

Through this question, researcher intends to understand the financial position of the logistics and warehouse team of e-commerce vendors or their partners. The understanding of financial status assists the researcher to analyze the potential of logistics and warehouse partners capability to adopt to technology innovations, co-own and/ or co-source with other logistics and warehouse players. From the response of this question we find that 87% of the logistics and warehouse team were having a revenue of more than $10 million while 13% of the team or partners had a revenue between $1 million and $5 million. Hence it is safe to assume that most of logistics and warehouse teams and partners are financially stable to support adoption of technology as well as promote the model of co-ownership and/ or co-sharing of logistics and warehouse premises and processes.

Figure-37
Last 5 years average annual revenue chart

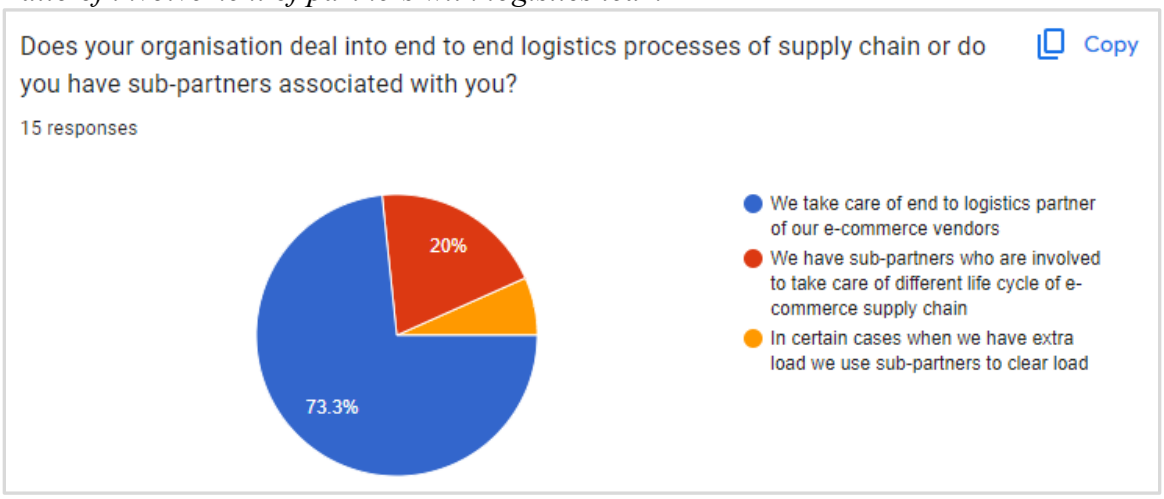


Source: Author

4.3.4 Research Question Five: Does your organization deal with end-to-end logistics process of supply chain, or do you have sub-partners with you?

This question gauges on the perspective if the logistics and warehouse teams take care of end-to-end process of logistics and warehouse for the e-commerce vendors or they have employed sub-partners to carry out logistics and warehouse process of supply chain. From the response we find that around 73% of the logistics teams take care of end to end logistics and warehouse process while 20% of the logistics team have also involved sub-partners to take care of the load of logistics and warehouses at rural areas. It should also be noted that around 7% of the logistics team have established sub-partners for support during the main peak season like festivals, new years etc.

Figure-38
Ratio of involvement of partners with logistics team



Source: Author

4.3.5 Research Question Six: What warehouse and logistics processes is your organization involved with?

In the last question, we analyzed the ratio of logistics and warehouse operations model w.r.t sub-contracting the process to next level of contractors. In this question, we take a deeper dive to understand the various logistics processes the team operates on. The options provided were:

a. Warehousing and logistics at self: This would mean that the logistics team is fully equipped and an expert to manage warehousing processes by themselves. They are the best candidates to provide end-to-end solution to the e-commerce vendors whether being an internal department or being an external agency.

b. Managing warehousing and logistics at partners end: This is a very important point to understand from the fact that the logistics team if managing logistics process at partners end would mean that not only the process but the systems and validations would also be followed of the primary or L1 logistics team.

c. Transport facility for pick and drop: Many logistics team would not only manage warehouse but also manage transportation which would be important from the

perspective of local transportation, inter-state transportation and overseas transportation. This also depicts the overall geography of business.

d. Export and Import: If any logistics team or their partner are involved in export and import business then it would mean that they are involved in international business too and have experience of various processes of exporting and importing goods.

e. Last mile delivery to customers: Logistics team if involved in last mile delivery would mean that they take care of end-to-end supply chain process.

f. Accounting, billing and record keeping: This is a standard process and logistics team would be having their own accounting and billing team to take care of accounting transactions.

Figure-39
Warehousing and logistics process with logistics team

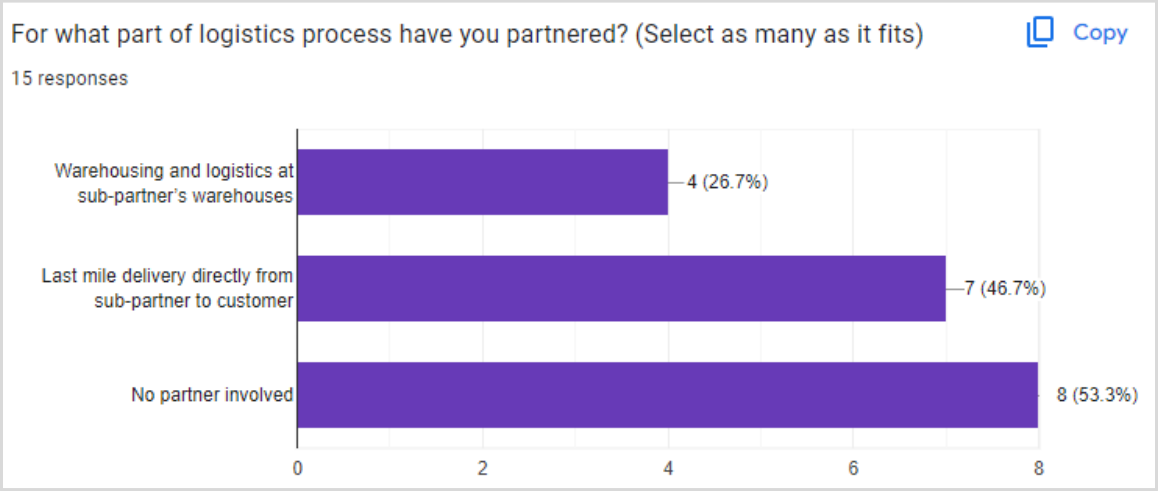
Source: Author

4.3.6 Research Question Seven: For what part of logistics process have you partnered?

The logistics process has important processes like warehousing, transportation, inbound and outbound logistics, yard management and finally last mile delivery. Based on the response, we find that around 53% of logistics teams do not have partners involved and

they are doing of their own. Around 47% of the logistics team have partnered for last mile delivery which means they have extended their coverage, on the other hand around 27% logistics team are also involved in managing the logistics and warehouses at sub-partner's level.

Figure-40
Partnership breakup by logistics team



Source: Author

4.3.7 Research Question Eight: Do you have multiple e-commerce vendors partnered for warehousing and logistics process?

Through this question, researcher wants to know if a logistics team is a dedicated partner for an e-commerce vendor or it is a partner for multiple e-commerce vendors. Through the response from the logistics team, we find that 93% of the logistics team have multiple e-commerce vendors for whom they act as third party logistics & warehouse partners while there are 7% logistics team who are dedicated to one single e-commerce vendor.

Figure-41
Breakup of logistics partnership (dedicated vs multiple e-commerce vendors)

Source: Author

4.3.8 Research Question Nine: Identify challenges you face as a logistics and warehouse partner?

Logistics and warehousing team has their own set of challenges to take care of, and, researcher here is interested to understand the challenges the team faces. The intent is not only to understand the challenges but also to see if the research can provide a set of solution(s) or framework(s) to solve these challenges via the research output. The options have been curated to keep in mind that they serve the purpose to provide a response to the research. The options provided to the team were:

a. Adhering to quality while delivering to customer
b. Warehousing of materials during festival seasons
c. Dynamic warehousing of materials in case of multiple customers
d. Adoption of technology for real time information and insights for dynamic warehousing
e. Supply chain dilemma for best combination of routing and delivery to customer
f. Adoption of latest technology for faster and safer fulfilment of delivery
g. Adoption of latest technology for real time insights and intelligent decision making

As per the response from the various logistics and warehousing team we find that most of the partners and team apx 93% face challenges in 'Adhering to quality delivery' and 'Setting up best combination of routing and delivery', and it clearly means that technology adoption can play a greater role to solve this problem. If we take a look at the second set of problematic situation, we find that managing 'dynamic warehousing for multiple e-commerce vendors' is a big challenge, followed by 'technology adoption for real time monitoring' and 'high volume management during festive seasons'. All these challenges clearly depict that with technology adoption these problems can be removed and it serves the purpose of the research.

Figure-42
Challenges faced by logistics and warehousing partners

Source: Author

4.3.9 Research Question Ten: Are you using robots and cobots in your warehousing and logistics process?

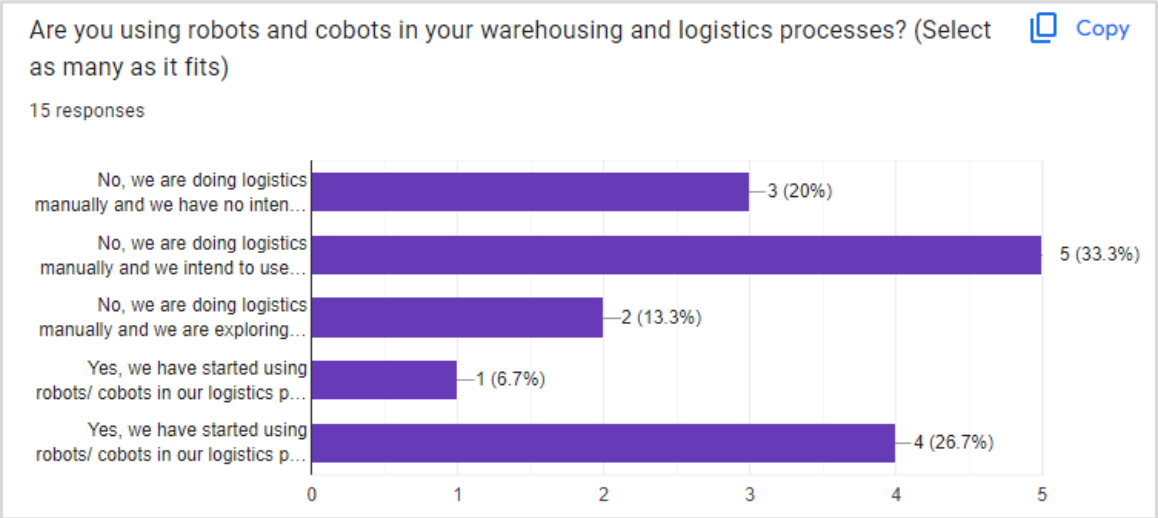
This question is important to understand if the logistics and warehouse team have already adopted to technology innovation respective to autonomous machines which will

also involve Artificial Intelligence (AI) – Machine Learning (ML) practices. The question offers following options to the respondents:

a. No, we are doing logistics manually and have no intent of upgrading to robots and cobots: Such logistics team are the ones who might have challenges in terms of budgets or technology leadership etc. and they would not be a prime candidate for this research.
b. No, we are doing logistics manually and have the intent to use robots and cobots in 6 to 12 months' time: A prime candidate to the research as they are doing the best to adopt to technology and process to make faster last mile delivery.
c. No, we are doing logistics manually and we are exploring the ROI for our business to use robots and cobots: These are teams who are still in the process of exploration but still remains a potential candidate for this research based on the findings they have about their future strategy approach.
d. Yes, we have started using robots and/ or cobots in our logistics process in last 12 months: A prime candidate to the research as they are doing the best to adopt to technology and process to make faster last mile delivery.
e. Yes, we have started using robots/ cobots in our logistics process for more than 12 months now: A prime candidate to the research as they are doing the best to adopt to technology and process to make faster last mile delivery.

The responses from the respondents clearly indicate that one third of the respondents have intention to induct robots/ cobots in their system in next 12 months. Similarly, around next one-third of the respondents have already been using cobots/ robots in their process past 12 months and there is another one-third who either have no intent or are still struggling at ROI level for inducing robots/ cobots in their process.

Figure-43
Acceptance breakup in % for adopting to robots/ cobots in logistics process

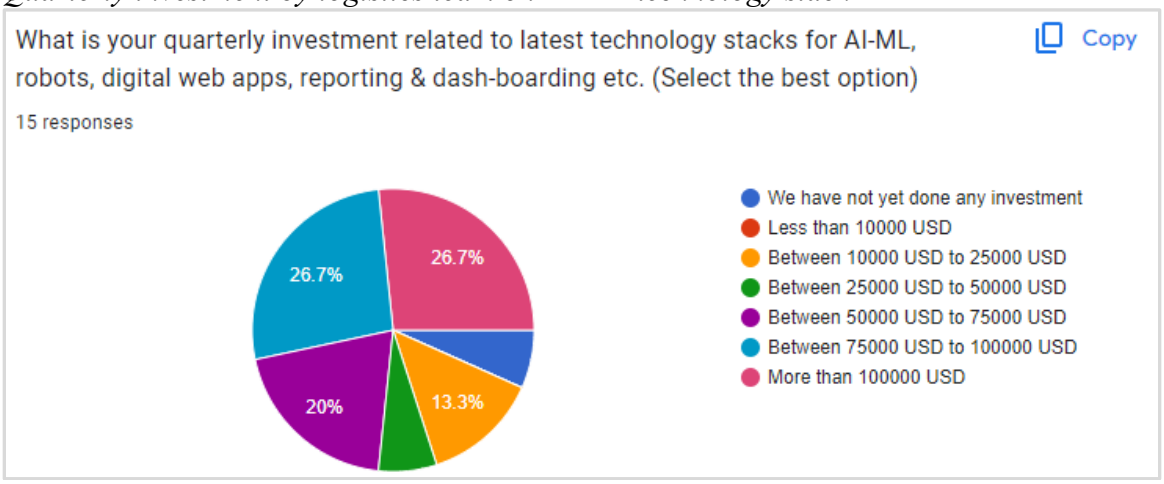


Source: Author

4.3.10 Research Question Eleven: What is your quarterly investment related to latest technology stacks for AI-ML, robots, digital web-apps, reporting & dashboarding etc?

From the last question, researcher gauged about the readiness or acceptance of the robots/ cobots within various logistics team. In this question, researcher tries to understand the quarterly investment a logistics team had made to adopt technology related to AI-ML, robots/ cobots, digital apps, intelligent dashboarding etc. From the responses, it is evident that 27% of the logistics team have been investing heavily to a tune of more than $100,000 per quarter equally followed by 27% of logistics team having spent between $75,000 and $100,000 and so on. It is interesting to note that around 7% of the logistics team have declared that they have not spent any budget on above mentioned technology stacks.

Figure-44
Quarterly investment by logistics team on AI-ML technology stack



Source: Author

4.3.11 Research Question Twelve: Which of the following stack is already in place within your organization?

This question is complementary to the previous question, where-in after establishing the quarterly budgetary spent by the logistics team in previous question, researcher wants to understand the technology landscape already adopted by the logistics team via this question. The questions have been curated by researcher to observe the response of technology adoption using Artificial Intelligence & Machine Learning (AI-ML) for logistics & warehousing, delivery & routing optimizations, mapping location wise customer interest, robotics & autonomous drivings. There are question options to also understand if e-commerce vendors have technology stack for intelligent analytics & dash-boarding as well as real time notifications.

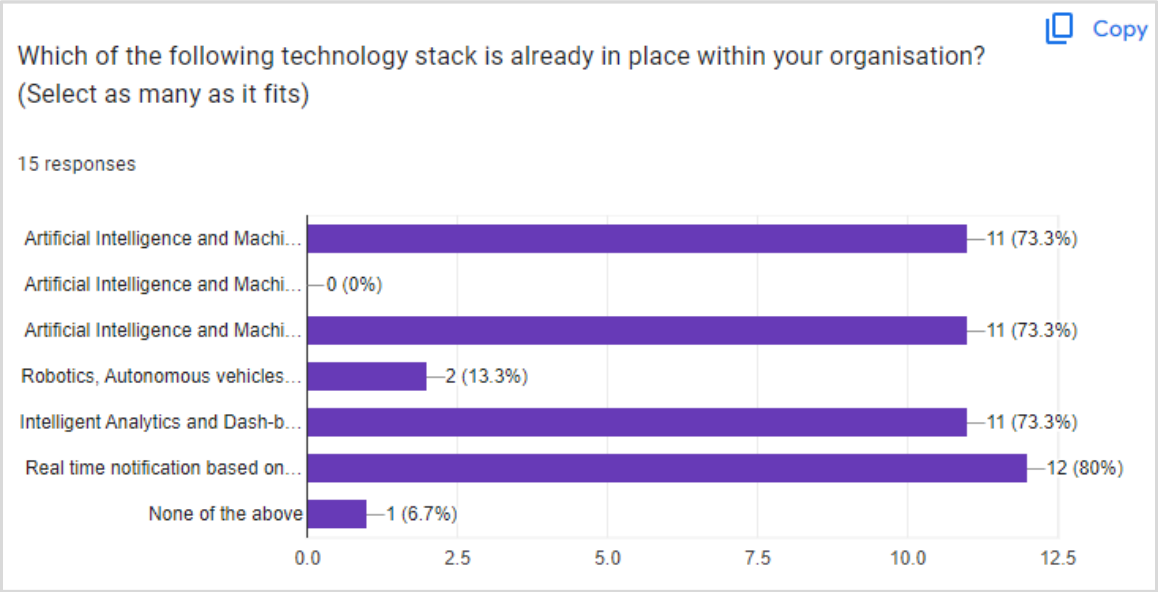
From the graph below, it is evident that all logistics have one or more technology stacks in their organization. The detailed analysis represents that most of them have real time monitoring & dash-boarding technology stacks available within their organization which is followed by AI-ML based technology stacks for logistics, warehousing, delivery

& routing optimizations. Nearly less than half of the e-commerce vendors have some technology stacks respective to autonomous driving and robotics.

Researcher intends to understand the technology stacks being employed by the e-commerce vendors as below:

a. Implementation of Artificial Intelligence and Machine Learning for logistics and warehouse
b. Implementation of Artificial Intelligence and Machine Learning for identifying customer wise interest location wise
c. Implementation of Artificial Intelligence and Machine Learning for delivery operations and routing optimizations
d. Implementation of Robotics and autonomous vehicles (air and road) for last mile delivery
e. Implementation of Intelligent Analytics and Dashboarding for real time status
f. Implementation of real time notifications based on real time supply chain status indicators.

Figure-45
Technology stack adopted by e-commerce vendors.



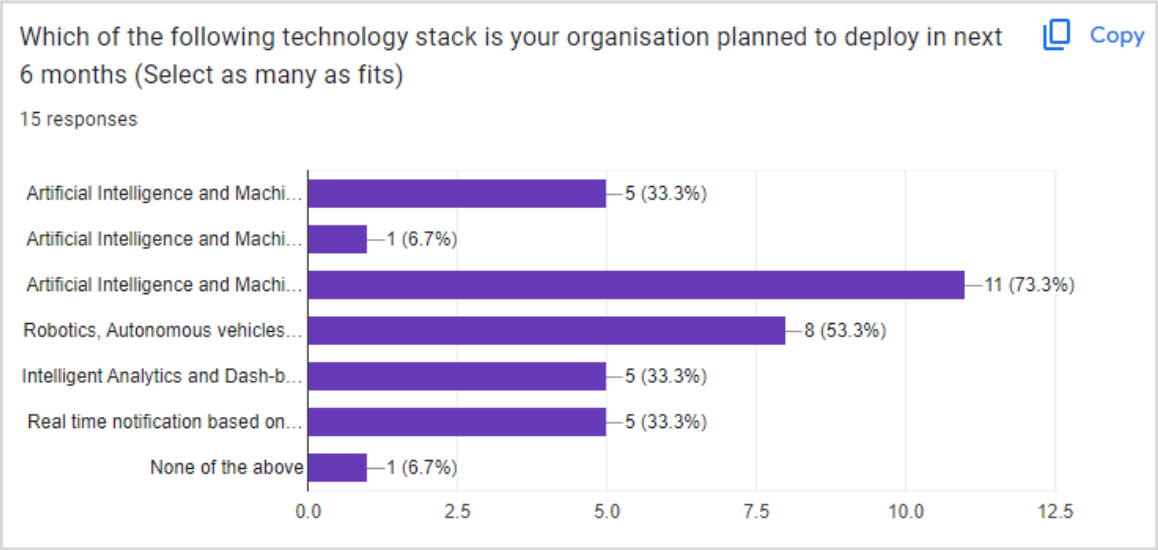
Source: Author

4.3.12 Research Question Thirteen: Which of the following stack is your organization planning to deploy in the next 6 months?

From the last question, researcher will come to know about the technology landscape, which is present in the logistics partner ecosystem, while from this question, researcher intends to gauge if there are any deployments planned in next six months using the technology landscape identified in previous question.

As we can see, there is an inclination to setup efficiency in operations by adopting to technology for seamless delivery operations & routing optimizations as well as managing logistics and warehouse along with managing efficiency in last mile delivery operations. The response also indicates that the logistics and warehouse partners have already deployed some technology solutions for getting real-time insights for intelligent analytics and understanding location-wise customer preferences. The questions asked for responses are same as of last question.

Figure-46
Technology stacks planned to be deployed in 6 months.

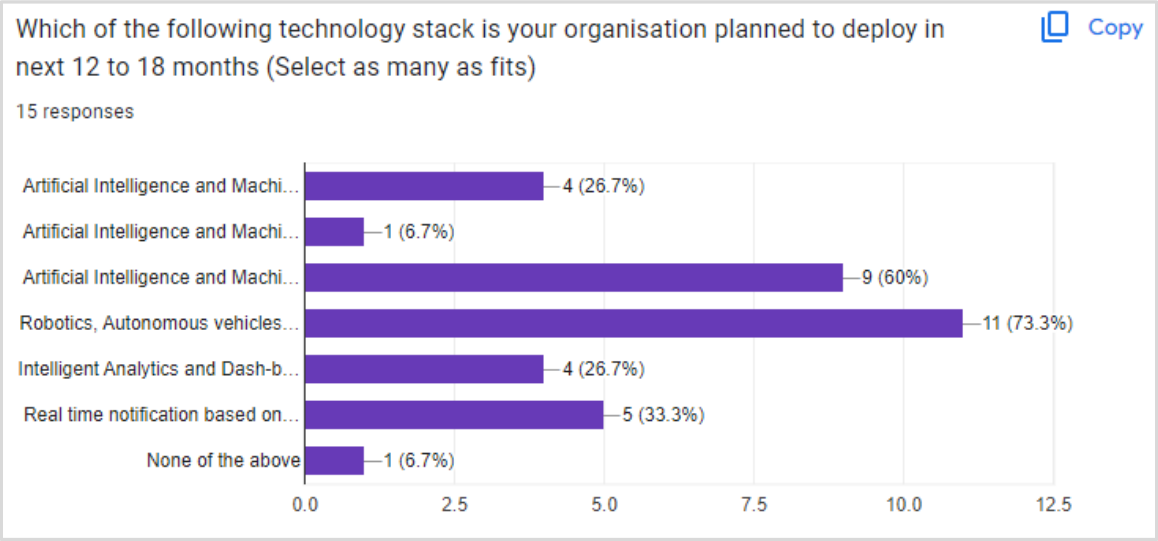


Source: Author

4.3.13 Research Question Fourteen: Which of the following stack is your organization planning to deploy in the next 12 to 18 months?

While in the last question, intent was to understand the technology stacks which were planned for deployment in next 6 months, this question intends to gauge more on the technology stacks planned for deployment in next 12 to 18 months. From the responses it is evident that the focus is being shifted towards implementing robotics and autonomous driving vehicles for logistics and warehouse process. The questions remain the same as of the last question.

Figure-47
Technology stacks planned to be deployed in the next 18 months.



Source: Author

4.3.14 Research Question Fifteen: What is the reason for not investing in technology stacks?

This question is important from the perspective to understand reasons due to which an logistics and warehouse partner would not invest much in technology and innovations or efficiency. The questions asked were:

e. 'We do not have funds for investing in technology stacks'.

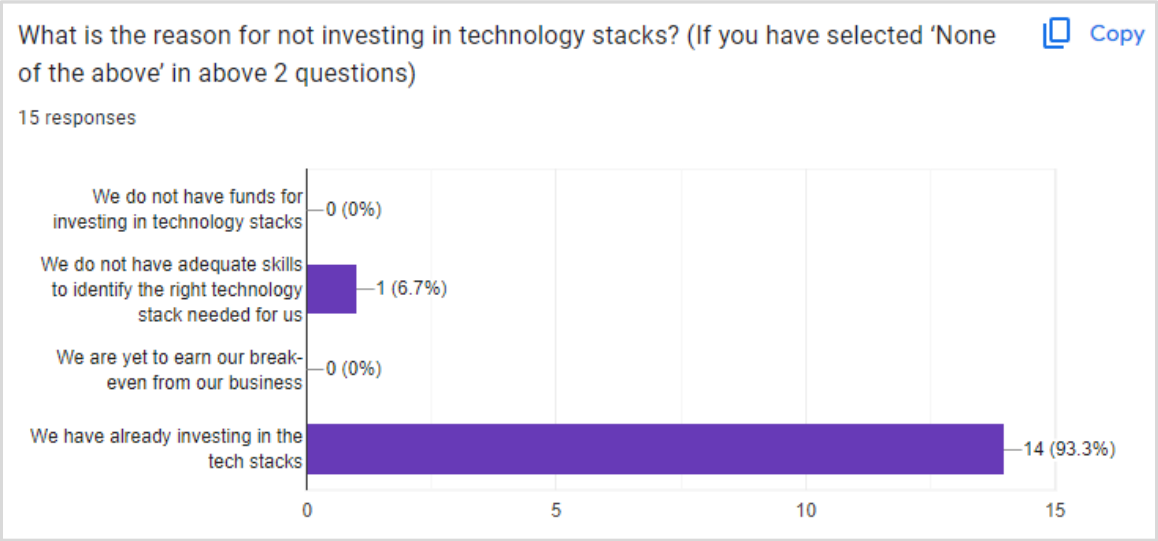
f. 'We do not have adequate skills to identify right technology stack needed'

g. 'We are yet to earn our break even'

h. 'We are already investing'

As we can see from the responses captured, all of the e-commerce vendors claim that they are already investing to adopt the technology to ensure seamless and efficient operations for logistics and warehouse process finally leading to last mile delivery. On the other hand there are 7% of the logistics partner who claim that they do not have adequate skills to identify the right technology stack which would be helpful for them.

Figure-48
Reasons for not investing in technology adoption.

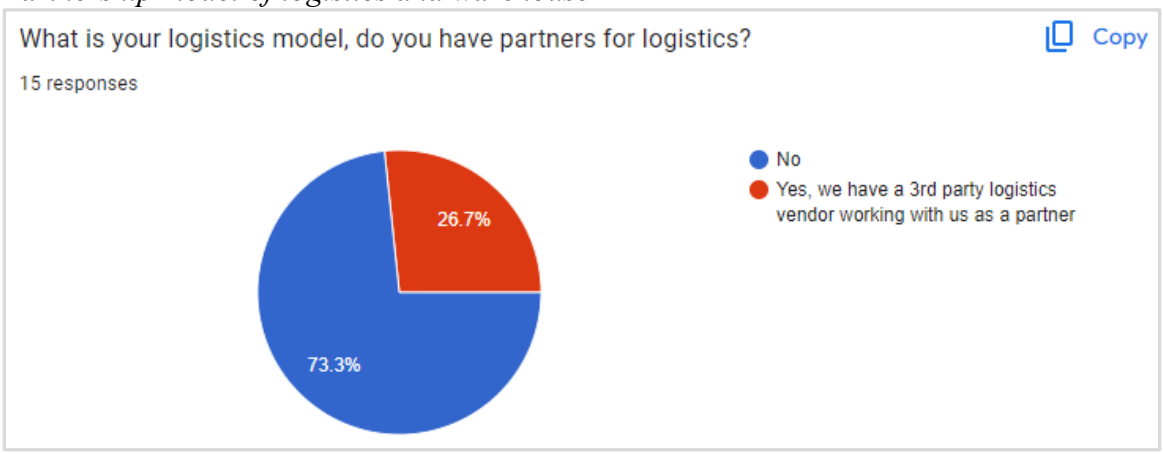


Source: Author

4.3.15 Research Question Sixteen: What is your logistics model, do you have partners for logistics?

Using this question, researchers are intending to gauge, whether they have partnerships with third party logistics for logistics and warehouse stages in the entire supply chain and last mile delivery process. From the responses, we find that around 73% of the logistics and warehouse team do not have extended arm using third party logistics team while on the other hand around 27% of the logistics and warehouse partners have sub-contracted for extended support.

Figure-49
Partnership model of logistics and warehouse



Source: Author

4.3.16 Research Question Seventeen: What is your expense in having your own logistics warehouse setup?

This question is to understand the expenses made by logistics and warehouse teams and partners for operating using own logistics and warehouse team. From the responses we observe that 87% of the logistics team spend more than $20,000 per quarter, while 7% of the logistics team spend between $10,000 to $20,000 per quarter and equally spend between $5,000 to $10,000. So it is safely assume that everyone invests.

Figure-50
Expenses ratio breakup of managing self-logistics and warehouse

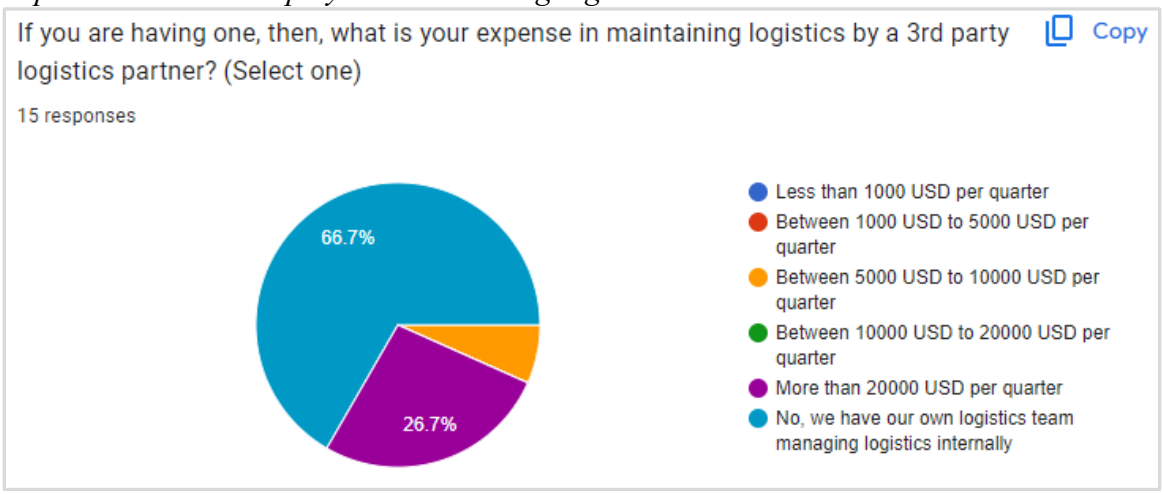
Source: Author

4.3.17 Research Question Eighteen: What is your expense in managing logistics using third party logistics partners?

In question 4.3.15, there are around 27% of logistics team who have sub-contracted part or whole of their logistics and warehouse process to third party. Through this question, we want to know the cost of operations when a sub-contracting logistics and warehouse partner is involved. From the responses it is evident that 67% of the logistics team manage the process by themselves and 27% spend more than $20,000 per quarter while around 3% spend between $5,000 to $10,000 per quarter.

The responses from question 4.3.16 and 4.3.17 indicate that the cost of operations using self or using partners for logistics and warehouse are high.

Figure-51
Expenses ratio breakup by sub-contracting logistics and warehouse



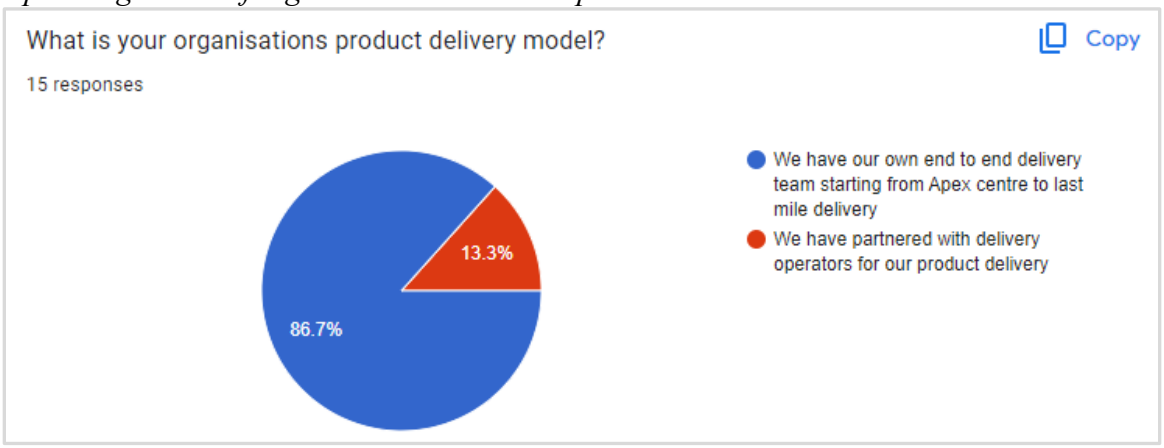
Source: Author

4.3.18 Research Question Nineteen: What is your organization product delivery model?

One of the important aspects of this research is efficient & quality adhered last mile delivery and through this question, researcher intends to know the product delivery model of these logistics and warehouse teams and partners. Researcher wants to know whether the logistics team do the logistics and warehouse process by themselves or they sub-

contract third party logistics partners for logistics and wareshousing process of last mile delivery. Based on the responses, it is clear that around 87% logistics team are directly involved in logistics and warehousing process. At the same time there are 13% logistics team who have sub-contracted their logistics and warehouse process to third party.

Figure-52
Operating model of logistics and warehouse partner



Source: Author

4.3.19 Research Question Twenty: What is your expense in product delivery by using your own employee and team?

In the last question, once the researcher understands the breakup of logistics team break-up regarding the logistics and warehouse operating model, there is an intent to dig more and understand the cost of operating model opted in the last question. From the responses we find out that 87% of e-commerce vendors spend more than $20,000 per quarter irrespective of the fact if they are doing last mile delivery themselves or using partners or both. Around 7% of the logistics team are spending between $5000 to $10,000 per quarter and equal 7% of the logistics team are spending between $10,000 to $20,000 per quarter.

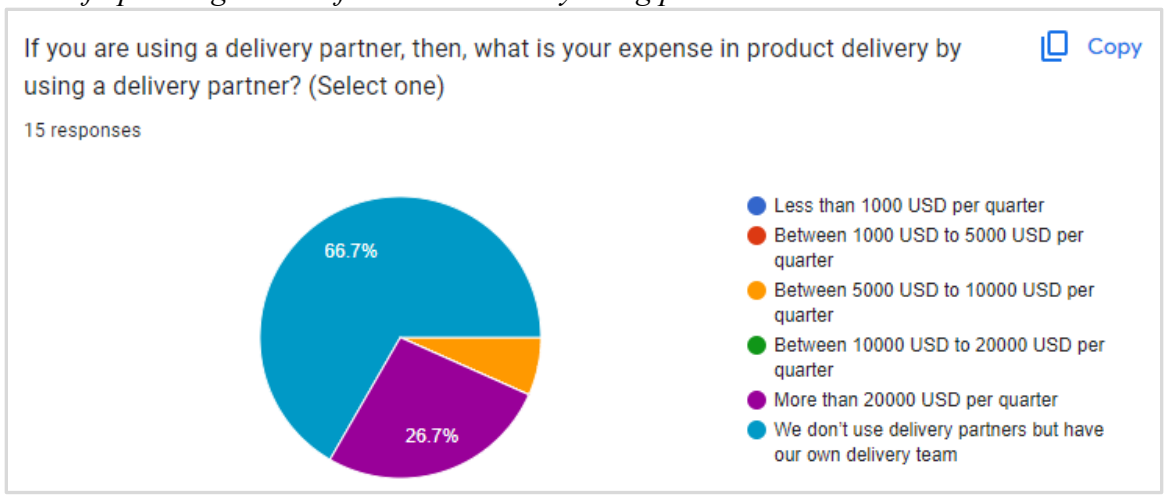
Figure-53
Ratio of cost of operating model of logistics and warehouse process

Source: Author

4.3.20 Research Question Twenty-one: If you are using a delivery partner, then, what is your expense in product delivery by using a delivery partner?

This question is complementary to the previous question where the author intends to know the cost of logistics and warehouse operations using logistics partners. As we can conclude from the responses, around 27% of the logistics team spend more than $20,000 per quarter while there are 67% of the logistics team who are owning the end to end process by themselves and have not sub-contracted to the partners.

Figure-54
Cost of operating model of last mile delivery using partners



Source: Author

4.3.21 Research Question Twenty-two: Are you interested in co-ownership or co-shared logistics and delivery model in e-commerce supply chain for better business and revenue model?

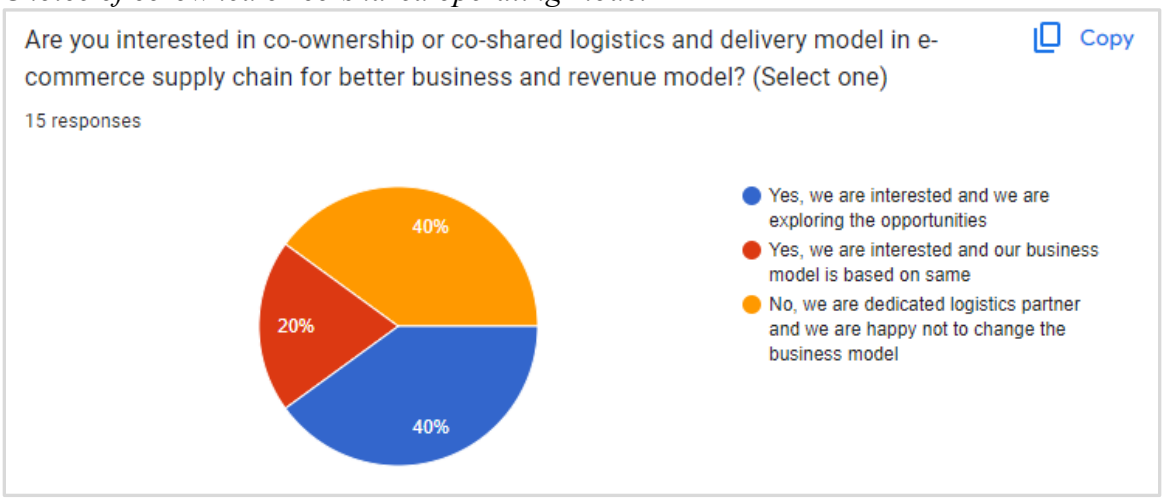
This is a very important question from the research perspective as the author wants to gauge the level of maturity related to co-ownership and co-sharing of logistics and delivery model in e-commerce supply chain. Hence, author provides following options to the respondents for their selection:

a. Yes we are interested and we are exploring the opportunities
b. Yes, we are interested and our business model is based on the same
c. No, we are dedicated logistics partner and we are happy not to change the business model

The assessment of the response indicates that around 60% of the logistics team are interested while 40% are not willing to change their model as they are dedicated logistics partner to e-commerce vendors. Out of these 60%, around 20% of the logistics team claim that their business model already incorporates the co-sharing and co-owning model.

Figure-55

Choice of co-owned or co-shared operating model



Source: Author

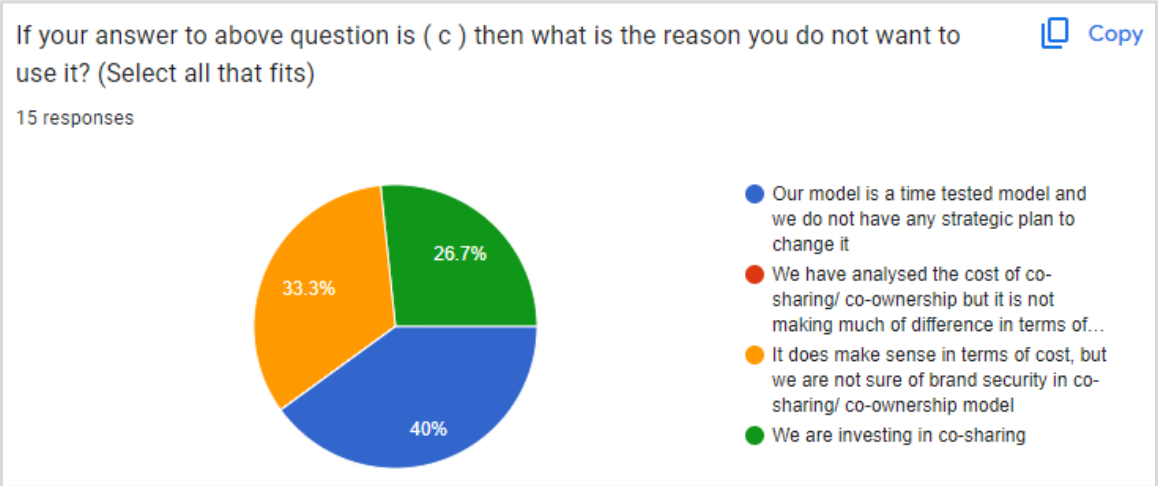
4.3.22 Research Question Twenty-three: If your answer to above question is (c) then what is the reason you do not want to use it?

In the last question, out of various options, if the respondent choses to not use the co-sharing and co-ownership model even though they are aware of process methodology, actually arises the interest for next level question which tries to understand the reason behind it. The various options given to respondent are:

a. Our model is time tested model and we do not have any strategic plan to change it.
b. We have analyzed the cost of co-sharing/ co-ownership, but it is not making much of difference in cost.
c. It does make sense in terms of cost, but we are not sure of brand security in co-sharing/ co-ownership model
d. We are investing in co-sharing

From the responses received by respondents we find that 40% of logistics partners believe that they have a time tested model and they have no strategy to change the already working model while 33% of the logistics partners believe that it does make sense to use the model but they are not sure of the security of the brand during co-sharing and co-owning of the logistics and last mile delivery process. At the same time, interesting fact is that there are 27% of the logistics partners who are already co-sharing.

Figure-56
Reason of not opting for co-owned or co-shared operating model



Source: Author

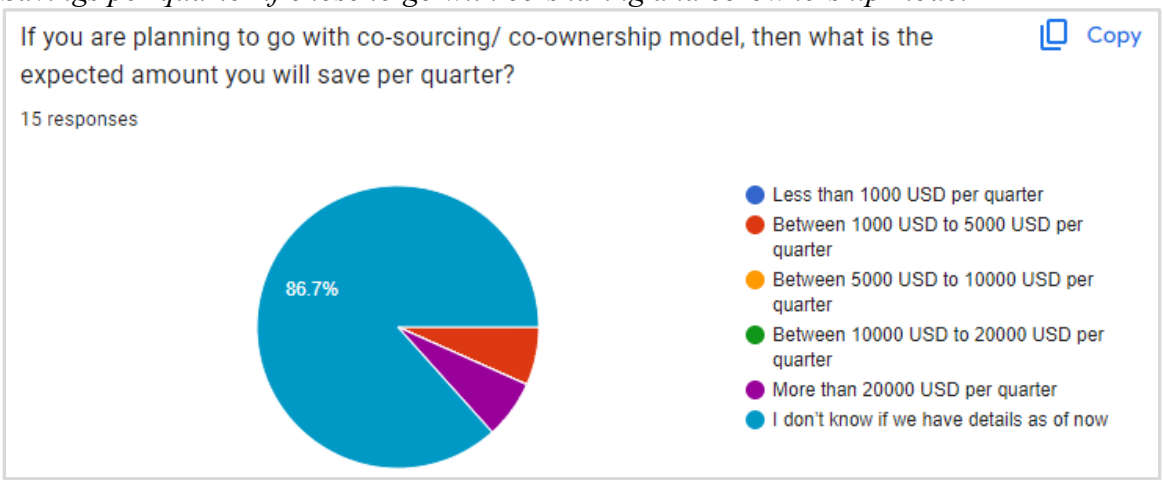
4.3.23 Research Question Twenty-four: If you are planning to go with co-sourcing/ co-ownership model, then what is the expected amount you will save per quarter?

This final question for e-commerce vendor is to understand if they have developed any costing model to calculate the expected amount of saving per quarter. Author gave following options:

a. Less than $1000 per quarter
b. Between $1000 to $5000 per quarter
c. Between $5000 to 10,000 per quarter
d. Between $10,000 to $20,000 per quarter
e. More than $20,000 per quarter
f. I don't know if we have details as of now

From the responses given 87% of logistics partners have indicated that they do not have any details as of now. On the other hand there are 7% of logistics partners who are investing around $20,000 per quarter and equal 7% of logistics partners are investing between $1000 to $5000 per quarter on co-sharing and co-owning.

Figure-57
Savings per quarter if chose to go with co-sharing and co-ownership model



Source: Author

4.4 Research questions for delivery partner

There were thirteen (13) e-commerce vendors who were selected from the responses given by the online users, and from the responses provided by e-commerce vendors fifteen (15) delivery partners have been identified for further research on this subject which are as below:

a. Gati
b. Aramex
c. India Post
d. India Rails
e. Ecom Xpress
f. BlueDart
g. FedEX
h. Delhivery
i. ShadowFax
j. Mahindra Logistics
k. E-Kart

l. XpressBees

m. Rapido

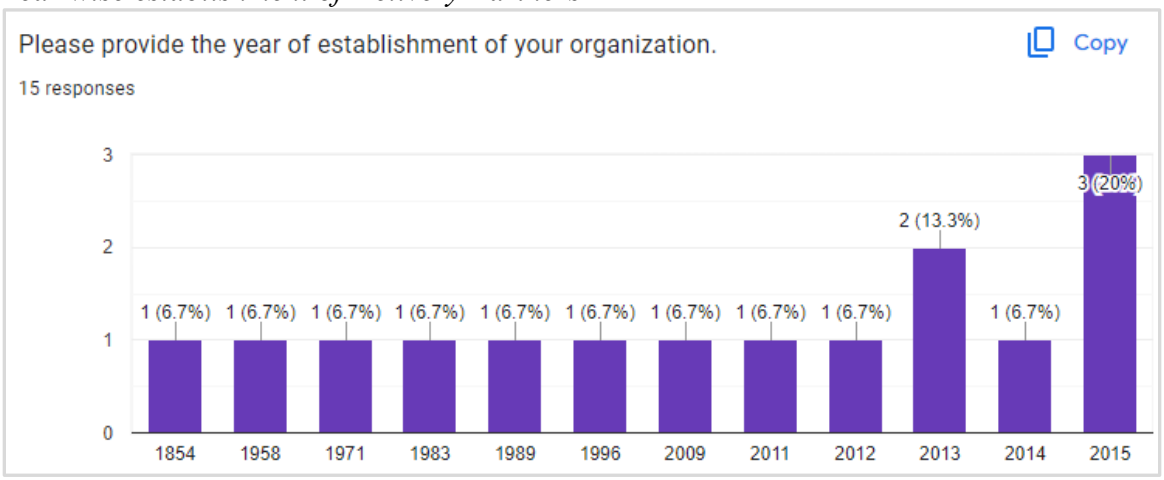
n. Porter

o. TCI

4.4.1 Research Question One and Two: Year of Establishment and registered office

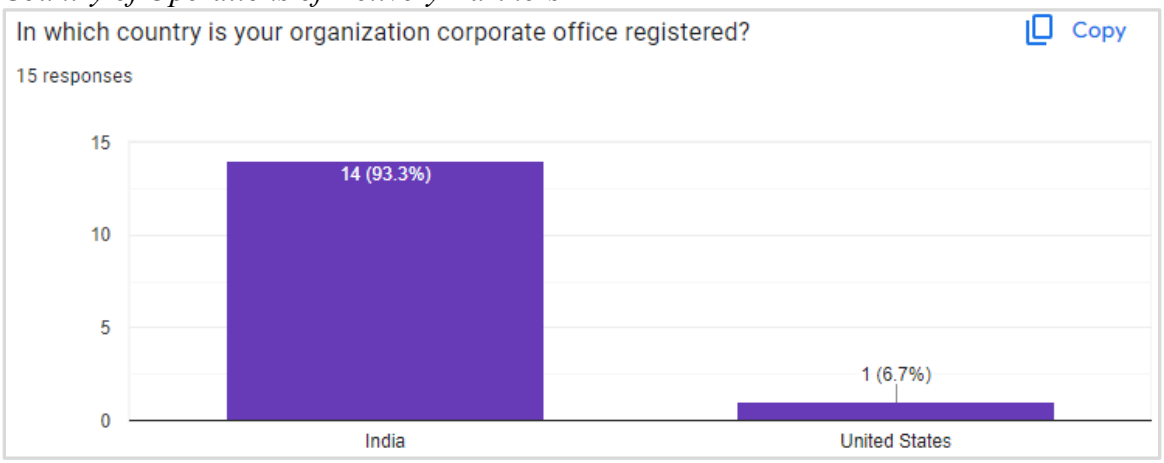
The intent of the first two questions is to understand the experience of identified e-commerce players, respective to Indian geography and market, also, if they are registered owners of business following the law of lands. From the charts below, we come to know that the operating experience is huge as couple of organizations are operating in Indian environment and economy since 1854, and the inceptions has been increasing year on year witnessing the addition of logistics and warehouse playing in Indian markets for its share of business in e-commerce and quick delivery for last mile.

Figure-58
Year wise establishment of Delivery Partners



Source: Author

Figure-59
Country of Operations of Delivery Partners



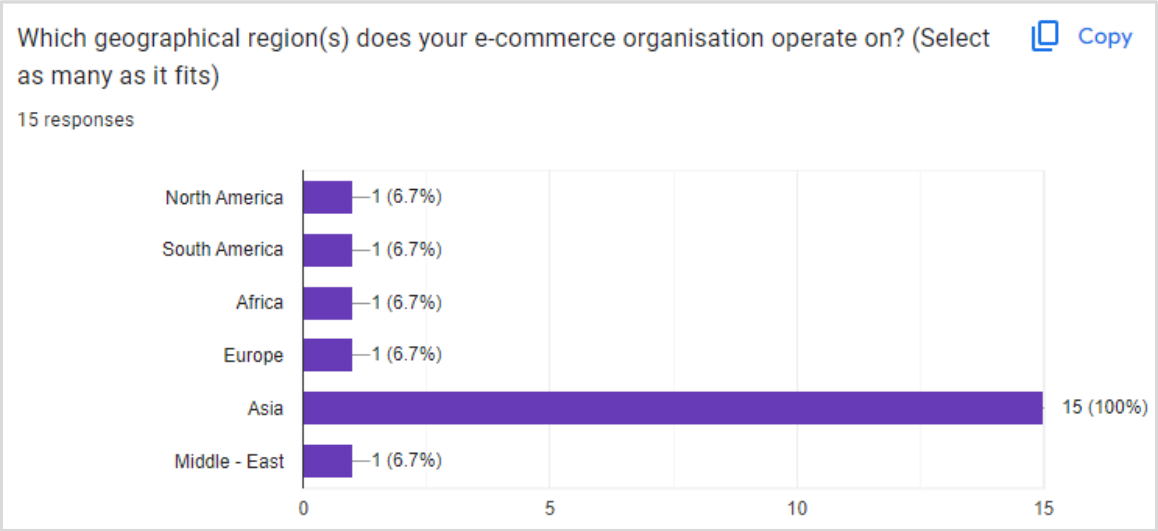
Source: Author

4.4.2 Research Question Three: Geographical area of operations

Through this question, researcher intends to gauze the location of primary operations of the identified last mile delivery partners. This question helps the researcher to understand the expertise of delivery operations globally and whether the partners have access to the best practices which are followed across the globe.

The responses received from the delivery partners clearly highlights in the chart below that the primary geographical location of operations is India and have thin presence in North America, South America, Africa, Europe and Middle East. Hence if we corroborate the two charts of years of operations and geographical regions presence, it is safe to assume that, the experience is majorly in Indian Market, hence the responses will be more attuned towards Indian geography and the results derivation will represent India market predominantly.

Figure-60
Geographical area of operations.

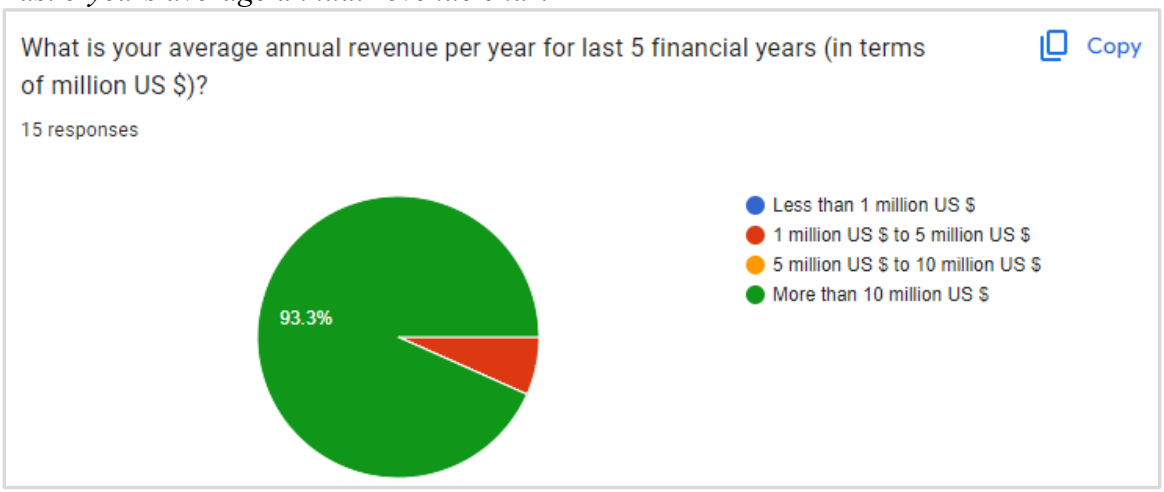


Source: Author

4.4.3 Research Question Four: What is your average annual revenue per year for last 5 financial years?

Through this question, researcher intends to understand the financial position of the delivery team of e-commerce vendors or their partners. The understanding of financial status assists the researcher to analyze the potential of delivery partners capability to adopt to technology innovations, co-own and/ or co-source with other last mile delivery partners. From the response of this question we find that 93% of the delivery partners were having a revenue of more than $10 million while 7% of the team or partners had a revenue between $1 million and $5 million. Hence it is safe to assume that most of last mile delivery teams and partners are financially stable to support adoption of technology as well as promote the model of co-ownership and/ or co-sharing of logistics and warehouse premises and processes.

Figure-61
Last 5 years average annual revenue chart

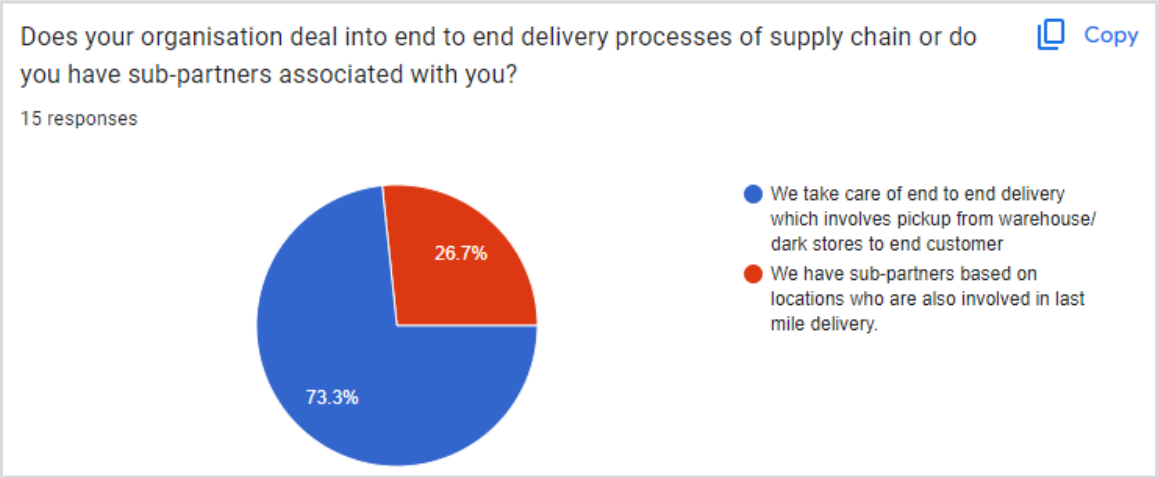


Source: Author

4.4.4 Research Question Five: Does your organization deal with end-to-end delivery process of supply chain, or do you have sub-partners associated with you?

This question gauges on the perspective if the last mile delivery teams take care of end-to-end process of last mile delivery for the e-commerce vendors or they have employed sub-partners to carry out final delivery process of supply chain. From the response we find that around 73% of the delivery teams take care of end to end logistics and warehouse process while 27% of the delivery team have also involved sub-partners to take care of the load of last mile delivery at rural areas.

Figure-62
Ratio of involvement of partners with last mile delivery team



Source: Author

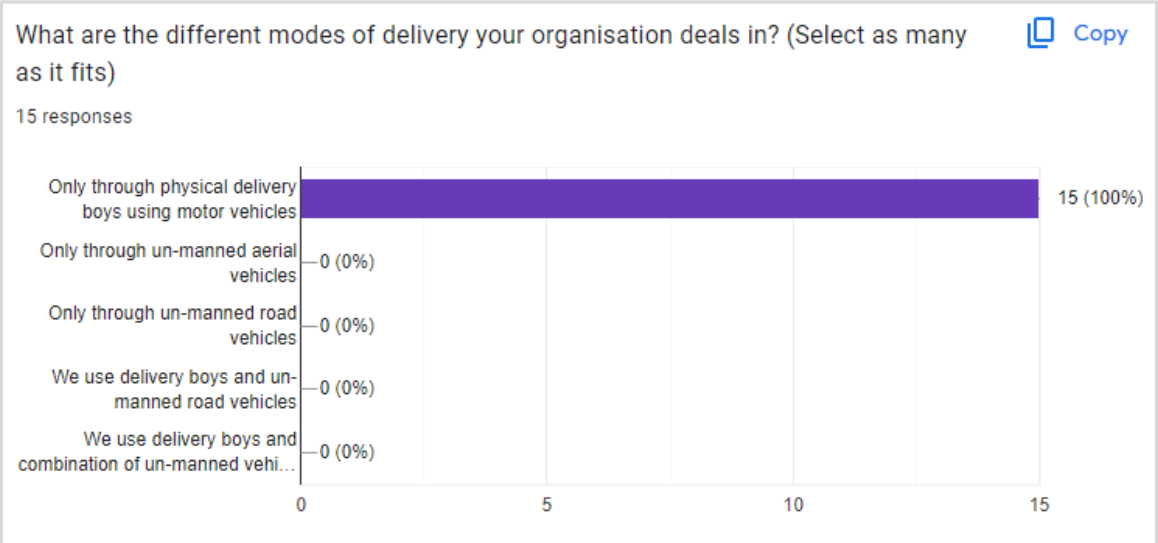
4.4.5 Research Question Six: What are the different modes of delivery your organization deal in?

In the last question, we analyzed the ratio of last mile delivery operations model w.r.t sub-contracting the process to next level of contractors. In this question, we take a deeper dive to understand the various delivery processes the team operates on. The options provided were:

a. Only through physical delivery boys using motor vehicles
b. Only through un-manned aerial vehicles
c. Only through un-manned road vehicles
d. We use delivery boys and un-manned road vehicles
e. We use delivery boys and combination of un-manned vehicles

It is very clear from the response that 100% of the last mile delivery team are using delivery boys using motor-vehicles to ensure physical delivery. There is no mention of any un-manned vehicle (aerial or road) for last mile delivery.

Figure-63
Various delivery modes used by last mile delivery team.

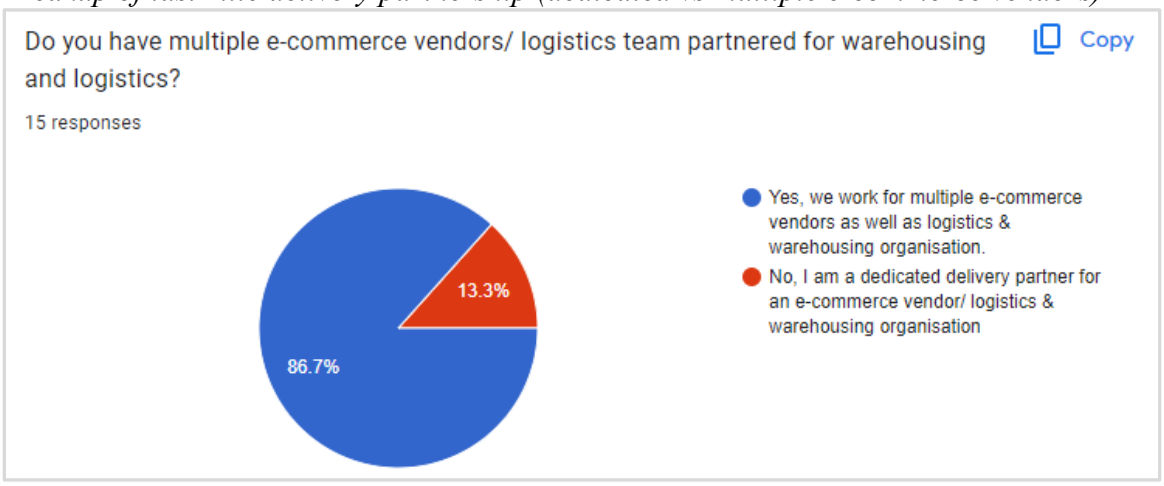


Source: Author

4.4.6 Research Question Seven: Do you have multiple e-commerce vendors/ logistics team partnered for warehousing and logistics?

Through this question, researcher wants to know if a delivery team is a dedicated partner for an e-commerce vendor/ logistics partner or it is a partner for multiple e-commerce vendors/ logistics team. Through the response from the delivery team, we find that 87% of the delivery team have multiple e-commerce vendors for whom they act as last mile delivery partners while there are 13% logistics team who are dedicated to one single e-commerce vendor or logistics team.

Figure-64
Breakup of last mile delivery partnership (dedicated vs multiple e-commerce vendors)



Source: Author

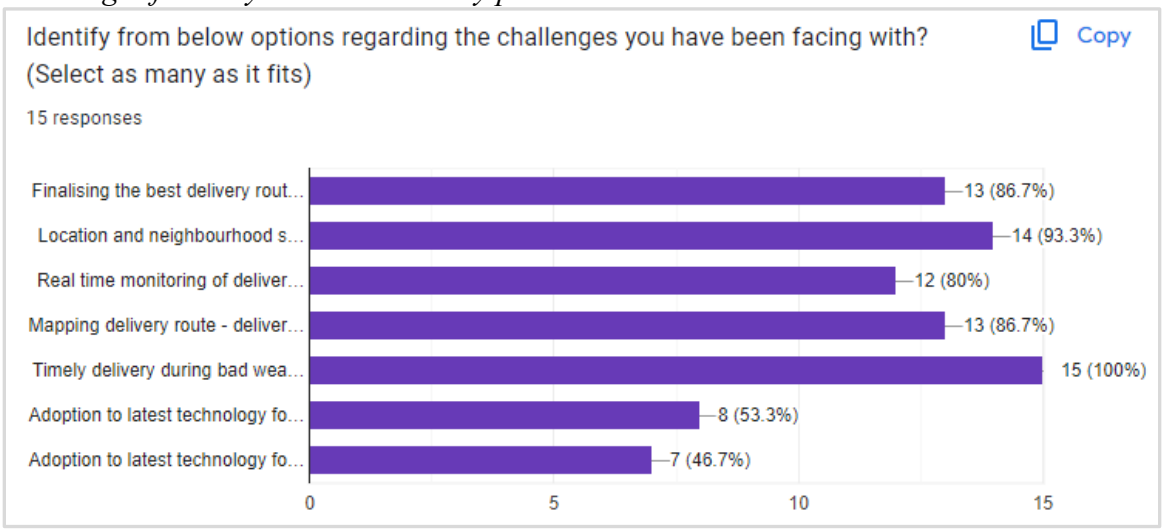
4.4.7 Research Question Eight: Identify from below options regarding the challenges you have been facing with?

Delivery team has their own set of challenges to take care of, and, researcher here is interested to understand the challenges the team faces. The intent is not only to understand the challenges but also to see if the research can provide a set of solution(s) or framework(s) to solve these challenges via the research output. The options have been curated to keep in mind that they serve the purpose to provide a response to the research. The options provided to the team were:

a. Finalizing the best delivery route to ensure dynamic pickup and drop
b. Location and neighborhood search
c. Real time monitoring of delivery boys
d. Mapping delivery route – delivery boys against delivery schedules
e. Timely delivery during bad weathers
f. Adoption to latest technology for faster and safe delivery fulfilment
g. Adoption to latest technology for real time insights for intelligent decision making and analysis to reduce operating cost

As per the response from the various delivery teams we find that 100% of the partners and team face challenges in 'Timely delivery during bad weather' and it clearly means that technology adoption can play a greater role to solve this problem. If we take a look at the next sets of problematic situation, we find that managing 'location and neighborhood search' and 'optimizing delivery route and mapping delivery boys' is a big challenge, followed by 'real time monitoring'. All these challenges clearly depict that with technology adoption these problems can be removed and it serves the purpose of the research.

Figure-65
Challenges faced by last mile delivery partners



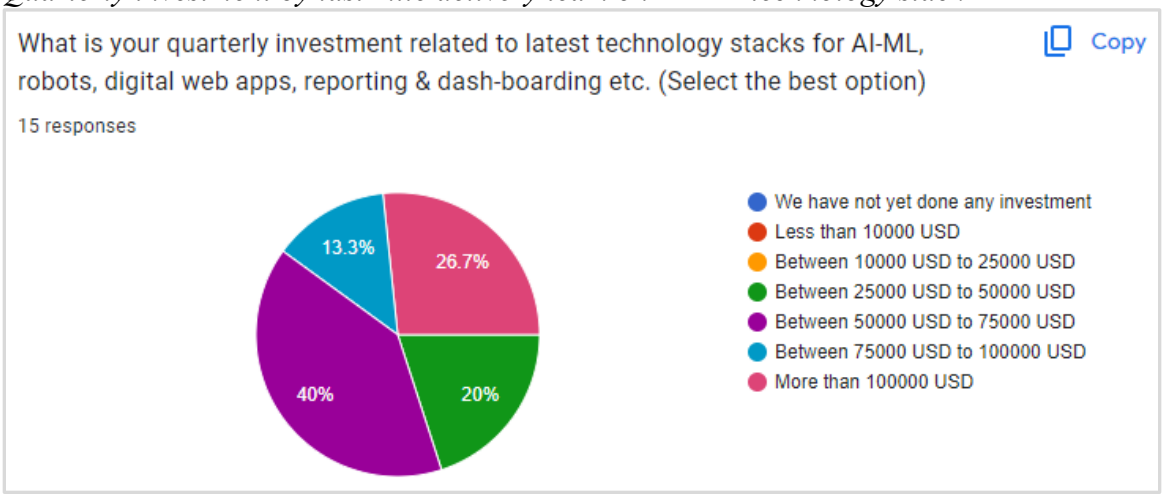
Source: Author

4.4.8 Research Question Nine: What is your quarterly investment related to latest technology stacks for AI-ML, robots, digital web apps, reporting & dashboarding etc?

From the last question, researcher gauged the readiness or acceptance of the robots/ cobots within various delivery team. In this question, researcher tries to understand the quarterly investment a last mile delivery team had made to adopt technology related to AI-ML, robots/ cobots, digital apps, intelligent dashboarding etc. From the responses, it is

evident that 27% of the delivery team have been investing heavily to a tune of more than $100,000 per quarter equally followed by 13% of delivery team having spent between $75,000 and $100,000 and so on. It is interesting to note that 40% of the delivery team spend between $50,000 to $75,000 per quarter and there are no last mile delivery partners who have not spent any budget on above mentioned technology stacks.

Figure-66
Quarterly investment by last mile delivery team on AI-ML technology stack



Source: Author

4.4.9 Research Question Ten: Which of the following technology stack is already in place within your organization?

This question is complementary to the previous question, where-in after establishing the quarterly budgetary spent by the last mile delivery partners in previous question, researcher wants to understand the technology landscape already adopted by the delivery partners via this question. The questions have been curated by researcher to observe the response of technology adoption using Artificial Intelligence & Machine Learning (AI-ML) for logistics & warehousing, delivery & routing optimizations, mapping location wise customer interest, robotics & autonomous driving's. There are question

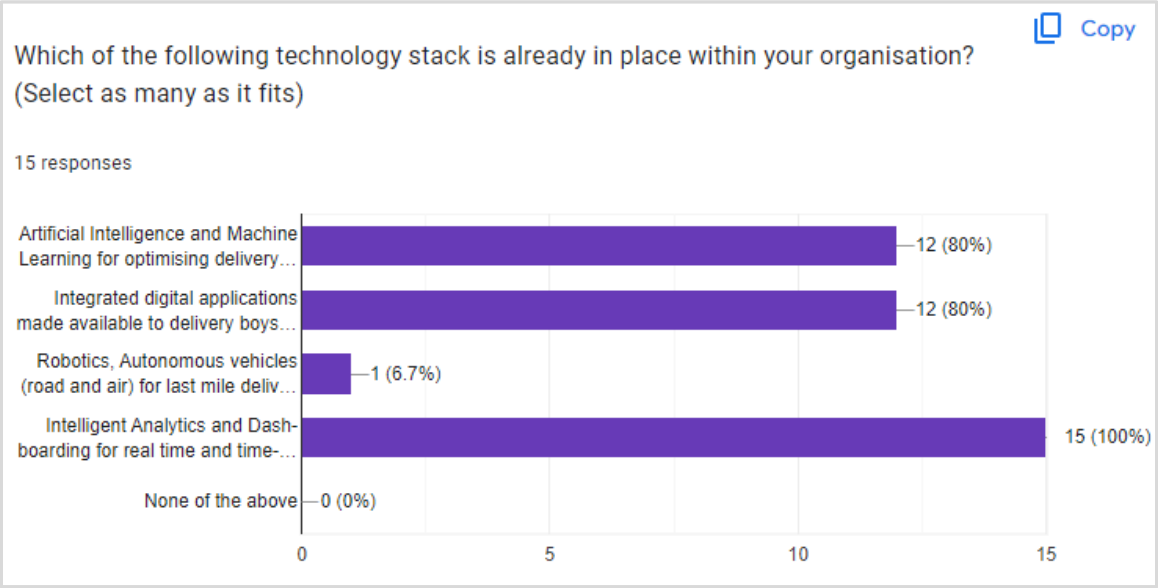
options to also understand if e-commerce vendors have technology stack for intelligent analytics & dash-boarding as well as real time notifications.

From the graph below, it is evident that all logistics have one or more technology stacks in their organization. The detailed analysis represents that most of them have real time monitoring & dash-boarding technology stacks available within their organization which is followed by AI-ML based technology stacks for logistics, warehousing, delivery & routing optimizations.

Researcher intends to understand the technology stacks being employed by the last mile delivery partners as below:

a. Implementation of Artificial Intelligence and Machine Learning for optimizing delivery schedule with availability of delivery boys
b. Integrated digital apps made available to delivery boys and managers to see the delivery pickup points.
c. Implementation of Robotics and autonomous vehicles (air and road) for last mile delivery
d. Implementation of Intelligent Analytics and Dashboarding for real time status
e. None of the above

Figure-67
Technology stack adopted by last mile delivery partners.



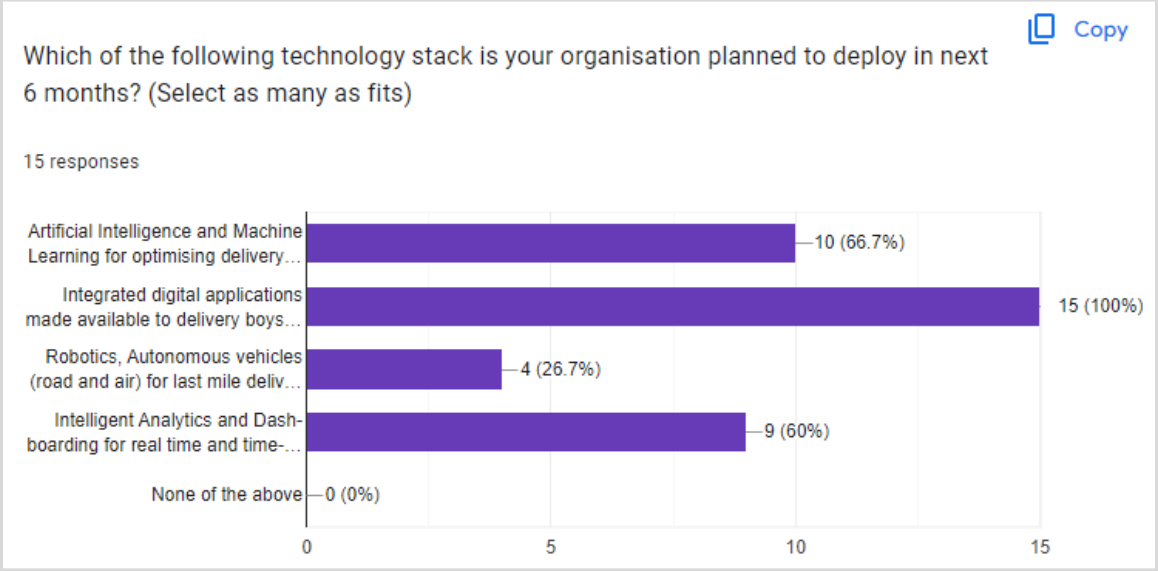
Source: Author

4.4.10 Research Question Eleven: Which of the following stack is your organization planning to deploy in the next 6 months?

From the last question, researcher will come to know about the technology landscape, which is present in the delivery partner ecosystem, while from this question, researcher intends to gauge if there are any deployments planned in next six months using the technology landscape identified in previous question.

As we can see, there is an inclination to setup efficiency in operations by adopting to technology for seamless delivery operations & routing optimizations as well as managing efficiency in last mile delivery operations. The response also indicates that the delivery partners have already deployed some technology solutions for getting real-time insights for intelligent analytics and real time status updates. The questions asked for responses are same as of last question.

Figure-68
Technology stacks planned to be deployed in 6 months.

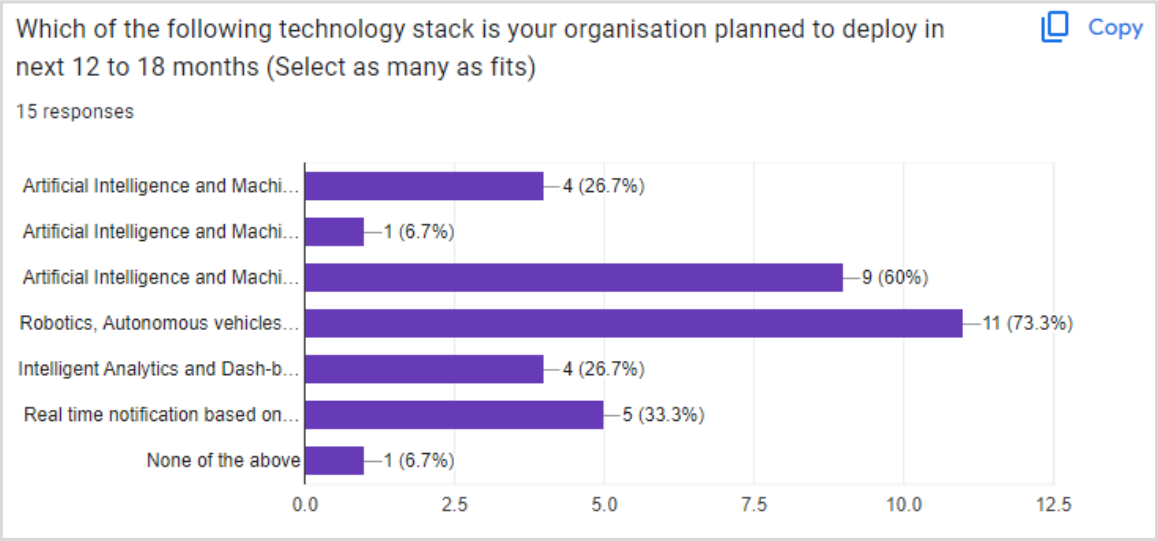


Source: Author

4.4.11 Research Question Twelve: Which of the following stack is your organization planning to deploy in the next 12 to 18 months?

While in the last question, intent was to understand the technology stacks which were planned for deployment in next 6 months, this question intends to gauge more on the technology stacks planned for deployment in next 12 to 18 months. From the responses it is evident that the focus is being shifted towards implementing robotics and autonomous driving vehicles for logistics and warehouse process. The questions remain the same as of the last question.

Figure-69
Technology stacks planned to be deployed in the next 18 months.



Source: Author

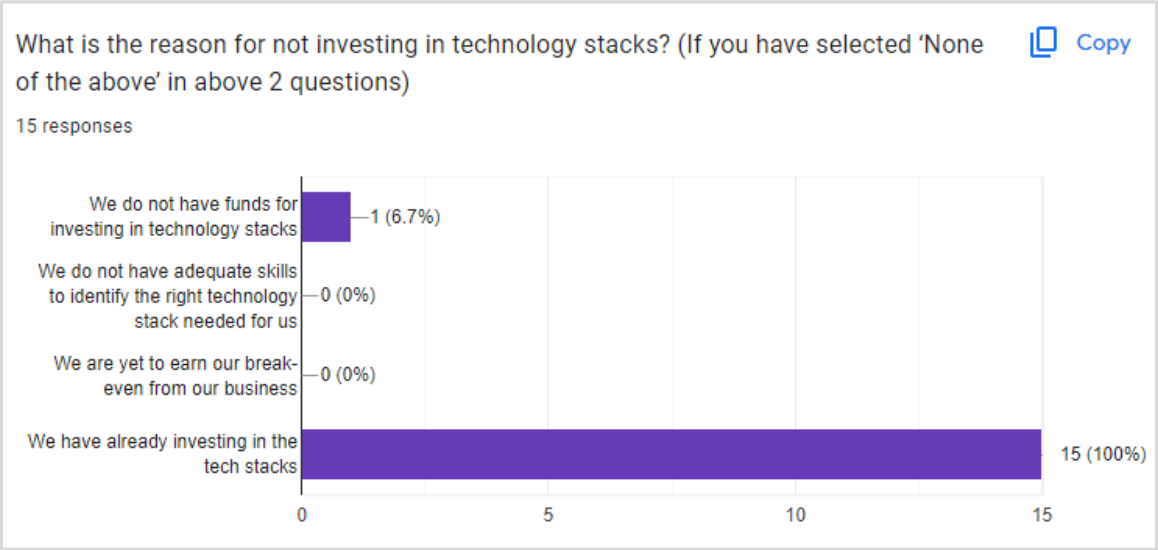
4.4.12 Research Question Thirteen: What is the reason for not investing in technology stacks?

This question is important from the perspective to understand reasons due to which an logistics and warehouse partner would not invest much in technology and innovations or efficiency. The questions asked were:

a. 'We do not have funds for investing in technology stacks'.
b. 'We do not have adequate skills to identify right technology stack needed'
c. 'We are yet to earn our break even from our business'
d. 'We are already investing in the technology stacks'

As we can see from the responses captured, all of the delivery partners claim that they are already investing to adopt the technology to ensure seamless and efficient operations for last mile delivery process. On the other hand there are 7% of the delivery partner who claim that they do not have funds to invest in the technology adoption.

Figure-70
Reasons for not investing in technology adoption.



Source: Author

4.4.13 Research Question Fourteen: What are your expenses in product delivery by self?

This question is to understand the expenses made by delivery partners and teams for operating using own last mile delivery team. From the responses we observe that 100% of the delivery team spend more than $20,000 per quarter.

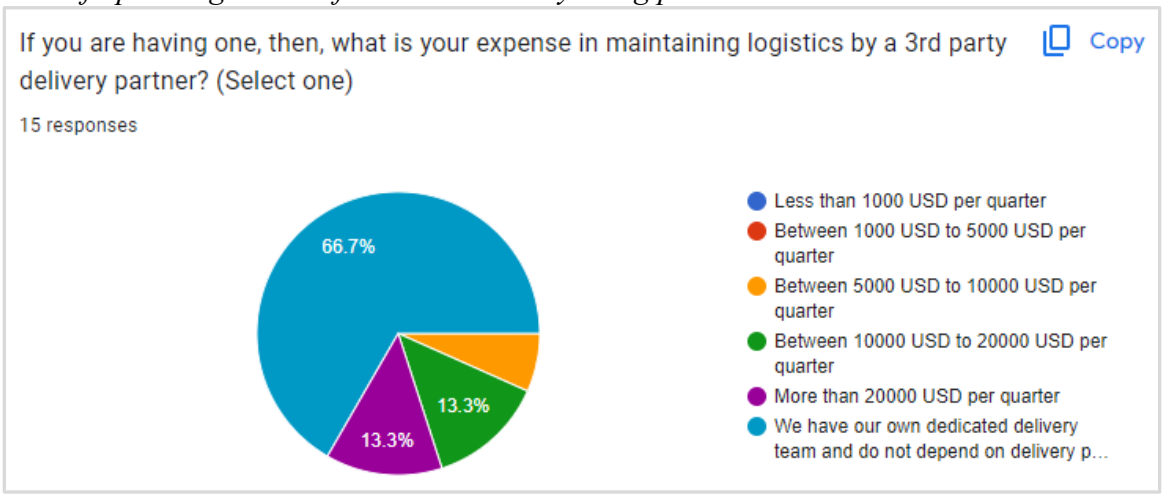
Figure-71
Expenses ratio breakup of managing self-delivery to last mile

Source: Author

4.4.14 Research Question Fifteen: If you have one, then what is your expense in managing the logistics by a 3rd party delivery partner?

This question is complementary to the previous question where the author intends to know the cost of last mile delivery operations using delivery partners. As we can conclude from the responses, around 13% of the delivery team spend more than $20,000 per quarter and equally 13% spend between $10,000 to $20,000 per quarter while there are 67% of the logistics team who are owning the end to end process by themselves and have not sub-contracted to the partners.

Figure-72
Cost of operating model of last mile delivery using partners



Source: Author

4.4.15 Research Question Sixteen: Are you interested in co-ownership or co-shared logistics and delivery model in e-commerce supply chain for better business & revenue model?

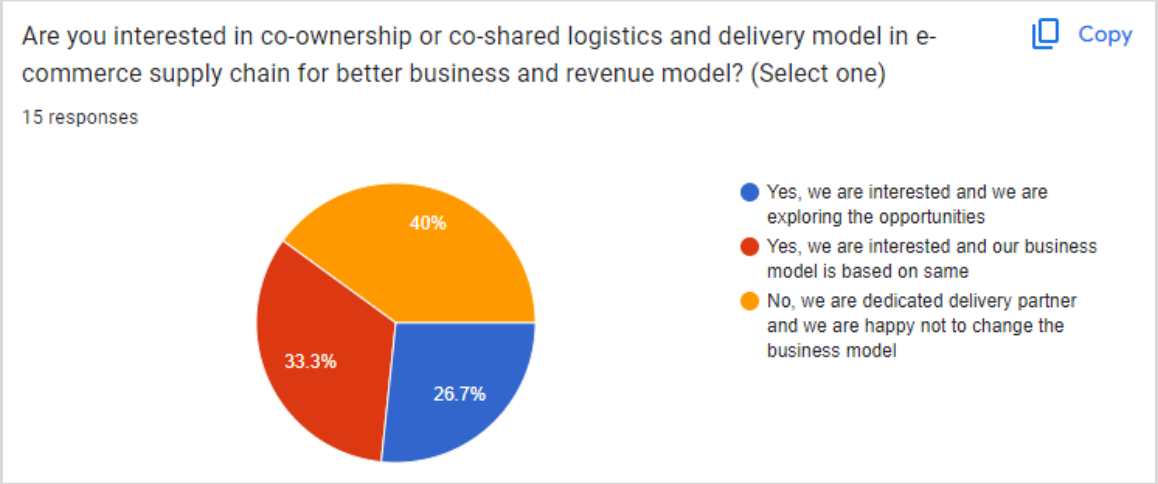
This is a very important question from the research perspective as the author wants to gauge the level of maturity related to co-ownership and co-sharing of logistics and

delivery model in e-commerce supply chain. Hence, author provides following options to the respondents for their selection:

a. Yes we are interested and we are exploring the opportunities
b. Yes, we are interested and our business model is based on the same
c. No, we are dedicated delivery partner and we are happy not to change the business model

The assessment of the response indicates that around 60% of the delivery team are interested while 40% are not willing to change their model as they are dedicated delivery partner to e-commerce vendors. Out of these 60%, around 26% of the logistics team claim that their business model already incorporates the co-sharing and co-owning model.

Figure-73
Choice of co-owned or co-shared operating model



Source: Author

4.4.16 Research Question Seventeen: If your answer to above question is (c) then what is the reason you do not want to use it?

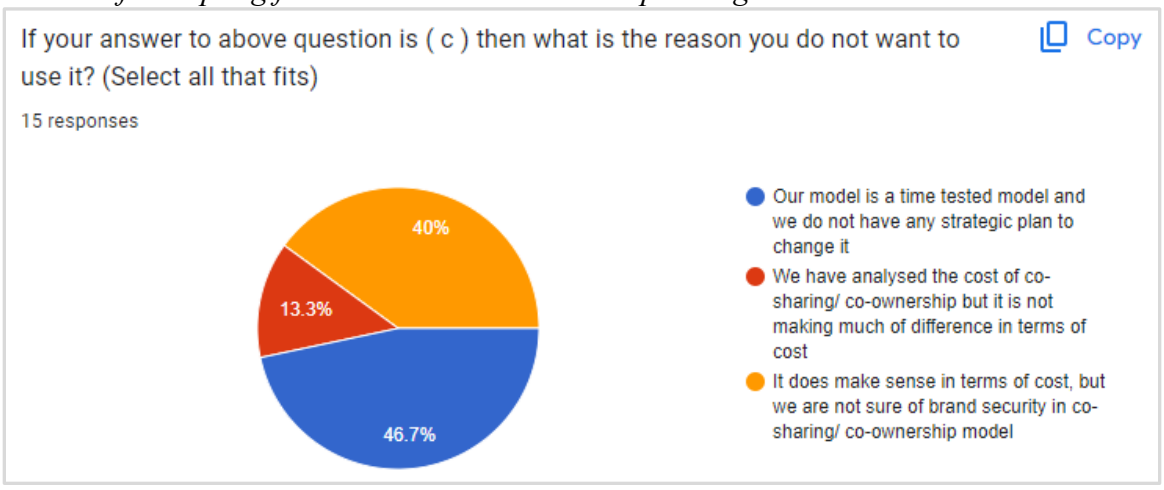
In the last question, out of various options, if the respondent choses to not use the co-sharing and co-ownership model even though they are aware of process methodology,

actually arises the interest for next level question which tries to understand the reason behind it. The various options given to respondent are:

a. Our model is time tested model and we do not have any strategic plan to change it.
b. We have analyzed the cost of co-sharing/ co-ownership, but it is not making much of difference in cost.
c. It does make sense in terms of cost, but we are not sure of brand security in co-sharing/ co-ownership model

From the responses received by respondents we find that 47% of delivery partners believe that they have a time tested model and they have no strategy to change the already working model while 40% of the logistics partners believe that it does make sense to use the model but they are not sure of the security of the brand during co-sharing and co-owning of the logistics and last mile delivery process. At the same time, interesting fact is that there are 13% of the delivery partners who claim that they have done their studies but they do not find a cost benefit out of this model.

Figure-74
Reason of not opting for co-owned or co-shared operating model



Source: Author

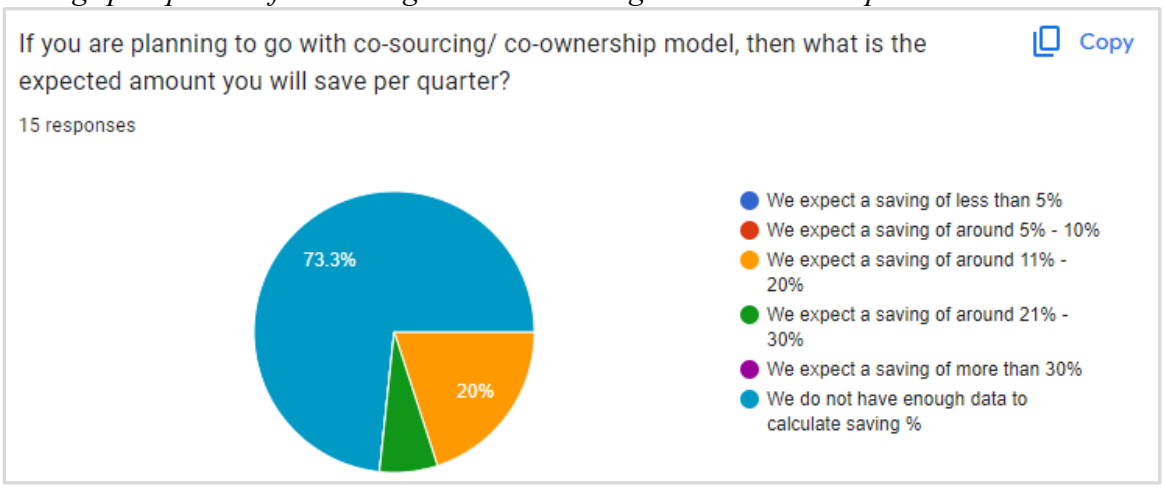
4.4.17 Research Question Eighteen: If you are planning to go with co-sourcing/ co-ownership model, then what is the expected amount you will save per quarter?

This final question for delivery partner is to understand if they have developed any costing model to calculate the expected amount of saving per quarter. Author gave following options:

a. We expect a saving of less than 5%
b. We expect a saving of around 5% - 10%
c. We expect a saving of around 11% - 20%
d. We expect a saving of around 21% - 30%
e. We expect a saving of more than 30%
f. We do not have enough data to calculate saving%

From the responses given 73% of delivery partners have indicated that they do not have any details as of now. On the other hand there are 7% of delivery partners who are expecting benefits between 21% - 30% per quarter and 20% of delivery partners believe that they could make a saving of 11% - 20% per quarter on co-sharing and co-owning.

Figure-75
Savings per quarter if chose to go with co-sharing and co-ownership model



Source: Author

4.5 Summary of Findings

This research has four (4) stakeholders and each stakeholder's findings are as below:

a. Online Buyers: As discussed earlier, they are critical to this research as they are the ones who define the demand part of this research. If there is no demand from this user group the entire research goes in vain. From the responses received by this user group based on the questionnaires, they have established a very great credibility to the demand of quick and quality delivery. The summary of findings for online buyer are as below:

   i. Most of the participants were from age group 21 to 40 years old comprising of 68% of the participation user base. It was also interesting to find out that 21% of the respondents were from 41 to 50 years of age group.

   ii. It is also clear from the respondents group that 79% of them are Indian residents while rest 11% are from various countries like Australia, US, Europe etc.

   iii. Amazon is one of the preferred online e-commerce vendor but there are many other local e-commerce vendors playing substantial role to promote online quick commerce. Major purchases are clothes (contributing to 83%), medicines (contributing to 73%), groceries (contributing to 67%) apart from other items.

   iv. Very important finding is that the online buyer is not concerned about how the deliveries are done whether they are physical delivery boys or un-manned vehicles, however they are (contributing to 64%) willing to pay extra for quick and quality delivery. This is supporting the research idea as it generates the demand of this research.

b. E-commerce vendors: They are second level stakeholders of this research, and the responses received from them assist the researcher to take a decision whether the proposed theory for co-ownership and technology adoption is on the right track or not. The summary of the findings from the responses are as follows:

i. All the e-commerce companies who participated in the responses are registered in India and have a high extensive experience starting from 2007 onwards. This means that the e-commerce vendors have great experience in Indian market and they understand the law of land very well.

ii. Average annual revenue of the responding e-commerce vendors is greater than $10 million and hence it is safe to assume that these e-commerce vendors have enough potential for IT spend and adopt to technology advancements.

iii. On analyzing the responses it has been found that, around 47% of the e-commerce vendors are spending more than $100,000 per quarter while around 38% of the e-commerce vendors are spending in the range of $50,000 to $100,000 per quarter. The data indicates that e-commerce vendors are curently investing and have apetite to invest for adopting innovative technologies for better operations and gaining market edge.

iv. In continuation to the previous point, it has been analyzed from the responses, that, in next 6 months the e-commerce vendors intends to optimize delivery & routing efficiency along with intelligent analytics. At the same time, it is also found that, in next 18 months e-commerce vendors intends to innovate and deploy autonomous vehicles for last mile delivery.

v. While analyzing operating model of the e-commerce vendors, it is realized that around 47% of ecommerce vendors have hybrid operating model where they are

involved in end to end supply chain and they have partners to manage logistics, warehouse and last mile delivery.

vi. Coming to important question, on analysis of the responses it is found that 92% of the e-commerce vendors are aware of co-souring/ co-ownership model but they do not have full operating model defined as of yet and it will take time.

c. Logistics and Warehouse partners: An important party in this research responsible for managing logistcs and warehouse for e-commerce supply chain. The responses from the logistics and warehouse partners plays an important role to understand adoption acceptance of the the theory for this dissertation. Summary of findings are as below:

i. All logistics and warehouse partners are registered in India and having inception since 1853. This clearly means that they have a wide range of experience and business expertise within India, at the same time they too have operational experience in Europe, Middle-East, North America, South America.

ii. Around 87% of the logistics partner have average annual revenue of greater than $10 million as analyzed for 5 years while rest 13% average annual revenue for 5 years ranges between $1 million to $5 million. This analysis indicates that logistics and warehouse partners have capacity to invest in technology advancements.

iii. From the operating model perspective 74% of the logistics and warehouse partners take care of end to end logistics for the e-commerce vendors. Around 20% of logistics partners have active sub-partners to take care of supply chain and around 6% have sub-partners only in case when there is a peak of logistics requirement.

iv. Regarding challenges the most important challenge is to ‘adhere quality while delivery’ and ‘defining best combination of routing & delivery’. The imporatnt

challenges are ‘managing warehousing process during peak load’ and ‘adopting to technology for better operating efficiency’.

v. It is analyzed that around 93% of logistics partner are already investing in technology stacks adoption. Within 6 months logistics partners intend to adopt technology pwhich will solve ‘delivery poperations & routing combination’ problems and ‘providing real time insights for intelligent analysis & decision’. On the othe had in next 18 months, logistics partners intend to invest in autonomous vehicles for last mile delivery.

vi. Responses also reveal that 73% of logistics team take care of the entire logistics process by self while 27% have employed third-party logistics (3PL) as their partners. Out of these 73% logistics partners there are 87% partners who spend more than $20,000 per quarter in managing logistics process.

vii. Regarding co-ownership data analysis we find that 60% of logistics team are interested to explore co-sourcing and/or c-ownership model while 40% are not interested as they are dedicated logistics partner, and are not willing to change the already time tested model. Further analysis, indicates the main reason of not changing the existing model is that they are not sure of security of data and/ or brand and also have not defined strategy towards co-ownership model.

viii. However, on the other hand ouy og 60% logistics partners who are interested to explore, 27% partners are already have analyzed and around 14% of the partner believe that they will have a saving between $5,000 and $20,000 per quarter, while 87% do not have any data on savings.

d. Last mile delivery partners: An important party in this research responsible for managing last mile delivery for e-commerce supply chain. The responses from the

delivery partners plays an important role to understand adoption acceptance of the the theory for this dissertation. Summary of findings are as below:

i. All delivery partners are registered in India and having inception since 1854. This clearly means that they have a wide range of experience and business expertise within India, at the same time they too have operational experience in Europe, Middle-East, North America, South America.

ii. Around 93% of the last mile delivery partner have 5 years average annual revenue of greater than $10 million while rest 7% have 5 years average annual revenue ranging between $1 million to $5 million. This analysis indicates that delivery partners have capacity to invest in technology advancements.

iii. Analysis of the operating model depicts that 73% of the delivery partner takes care of end to end delivey which means pickup from warehouse/ fulfillment center/ dark stores and delivering to end customer. On the other hand 27% of the delivery partners have sub-partners for assisting last mile delivery. All these 100% partners deliver only through delivery boys phycisally using motor vehicles. It is also noted that 87% of the delivery partners are associated with multiple e-commerce vendors.

iv. On analyzing the challenges, all delivery partners face challenge in ‘maintaining time during bad weather’. Also, there are other challenges like ‘Neighbourhood & area search’, ‘finding best delivery route’, and ‘real time monitoring’. It is to be noted that delivery partners believe that 'Adoption to the technolog’ is not a major challenge in their line of business.

v. Technology adoption analysis states that 27% of delivery partners has quarterly investment of more than $100,000, while 53% of delivery partners have quarterly investment between the range of $50,000 and $100,000 and rest 20% delivery partners have quarterly investment between the range of $25,000 and $50,000.

Hence it is a safe assumption that every delivery partner is in a position to invest and adopt technology enhancements. Continuing on the same topic, delivery partners, in next 6 months, intend to invest on integrated digital applications for delivery boys to view delivery pick-up points. On the other hand, delivery partners in next 18 months intends to implement autonomous vehicles for last mile delivery.

vi. In terms of co-sourcing/ co-ownership model, it is found that 60% of the delivery partrners are interested and in-fact 33% among them have their model adapted to co-sourcing. The rest 40% delivery partners are not willing to go for co-sourcing model and they have their own reasons like 'operating model is time-tested and do not intend to change', 'not sure of brand security', 'have not checked the benefits in terms of monetary'. It is interesting to note that 73% of delivery partners have not done any analysis and hence have no data on savings but 27% of the delivery partners have indicated that they foresee a saving between 11% to 30% in operating cost which is a big saving.

4.6 Conclusion

From the analysis it is very evident that there is a dmenad of quick delivery and aournd 64% of the online buyers are willing to pay extra. Hence it is a great start for the research and it obviously means that research has a potential to develop a framework to support this demand. At the same time, the other stakeholders like e-commerce vendors, logistics & warehouse partners and last mile delivery partners have displayed great interest in investing for latest technology adoption. They also have a 6-18 months plan for adopting various technology stack in order to solve their business problems or complex scenarios. It is also clear that there is a dire need for co-sourcing & co-ownership as well as adoption to technology to share the cost of operations, recuce the entry cost in the market, horizontal

acceptance of the technology stack as all stakeholders might not have high investing capability.

With all the above points in front of us, it is now the right time to develop the framework as an output of the research.

CHAPTER V:

DISCUSSION

5.1 Discussion of Results

This section for discssion of results is sub-divided into four sections (a) Online Buyer (b) E-commerce vendors (c) Logistics and Warehouse Partners (d) Delivery Partners. In each section, author would interpret and describe about the results obtained from the online survey as well as interviews conducted.

This research subject is applicable to entire world involving all the countries on earth, however the researcher does not have capacity and capability to cover the entire user base of earth, hence the stakeholdes has been selected keeping in mind the capacity and the capability of the researcher. For 'Online Buyers', researcher has used its social group and invited around 400 acquaintances using neighbours, relatives, friends, colleagues and via social media like 'LinkedIn'. Responses were seeked using an online survey which was posted in LinkedIn and couple of users were invited personally by sending link to their WhatsApp. There were responses from 317 from the online buyers which were analyzed and out of those responses top 15 e-commerce vendors (with having at least 3% of market) were shortlisted for research. These 15 e-commerce vendors provided the list of logistics and delivery partners in their surveys which were then taken up for research subsequently.

The next sections discusses the results of every questions in the questionnaire which was given to various stakeholders. However, this comes with an underlying statement that the study is mainly focused on India market and the other external markets should be taken up for forthcoming research.

5.2 Discussion of Research Results for Online Buyers

In this section we will discuss the responses received from the online buyers. These are the stakeholders who are consumers of the online commerce and they define the real requirements of the online commerce.

5.2.1 Research Question One: What is your age group?

On the basis of data collected from the online survey responses, we find that most of the respondent population is from the age group 31 to 40 years (participation rate 37.7%), which is followed by 21 to 30 years (participation rate 31%), and then followed by respondent age group of 41 to 50 years (participation rate 20.3%). Hence it is safe to say that respondents from the age group 21 to 50 years collectively form participation rate of 89%. Actually, the result corroborates with the fact that the researcher had used his social groups like 'Office colleagues', 'Neighbors', 'Relatives' and 'LinkedIn social media'. The respondent age group less than 21 years and greater than 50 comprises 11% of the respondent's sample population.

One important derivation from respondents is that e-commerce and online shopping is widely accepted by all age-groups, and this is really good data for discussion of research results and supports the hypothesis proposed by researcher.

5.2.2 Research Question Two and Three: Where do you live (Country, State and City)?

The intent of researcher is also to understand the demography from where the respondents of the questionnaire come from. This is important from various aspects as below:

a. Based on the majority of respondents' location, it will be safely assumed that the dynamics of research will be based for that geographical location.
b. On comparing with the previous age group question, researcher will get an idea about the age group of respondents vis-à-vis location spread.

The results clearly indicate that around 84% of the respondents are from India, and hence, it is safe to assume that the research will primarily be tilted towards India market. The rest 16% are varied across geography and are belonging to primarily Germany (4.4%), followed by USA (4.1%), followed by U.K. (3.4%) and then Australia (2.5%). There are other countries like Dubai, Croatia etc. which comprises of less than 1.5%. This data actually makes sense because the researcher currently is living in India and so most of his acquaintance is from India. Researcher works for a German Automotive giant and so the German office colleagues have responded, and so is the participation from colleagues operating out of U.S, U.K. and Australia.

If we drill to the next question, we get a fair understanding of regional breakup of states and cities via the data collected from the responses. We find that respondents are majorly from Maharashtra state with a whopping share of 67% followed by Karnataka at 12% and New Delhi trailing at 5% while other states with share of 1% or 2% or 3% participation (table reference below).

Table-15

Table depicting participation % age-wise and state wise

Row Labels	16 to 20 years	21 to 30 years	31 to 40 years	41 to 50 years	Greater than 50 years	Grand Total	Participation % (state wise)
Andhra Pradesh		2				**2**	**1%**
Bihar	1	2		1		**4**	**2%**
Gujarat			2			**2**	**1%**
Haryana		1	2	1	2	**6**	**2%**
karnataka		8	4	12	8	**32**	**12%**
Kerala				2		**2**	**1%**
Madhya Pradesh		1		1		**2**	**1%**
Maharashtra		71	84	16	6	**177**	**67%**
Mangalore			1			**1**	**0%**
New Delhi		6	1	4	3	**14**	**5%**
Punjab			2			**2**	**1%**
Rajasthan		1	1			**2**	**1%**
Tamilnadu			1	4		**5**	**2%**
Telengana		1		1	1	**3**	**1%**
Uttar Pradesh	1	2	2	2	1	**8**	**3%**
West Bengal		2		1		**3**	**1%**
Grand Total	**2**	**97**	**100**	**45**	**21**	**265**	
Participation % (age group)	**1%**	**37%**	**38%**	**17%**	**8%**		

Source: Author

5.2.3 Research Question Four: What is your job sector?

This question is to understand which job sectors are primarily the users of online commerce, and we find that around 90% of the respondents are from 'Private Organization' while the other sectors are very small contributors to the entire response. It can also be seen that in private organization sector the age group is variate starting from 21 years and going beyond 50 years. The primary contribution from age perspective is in between 31 to 40 years of respondents.

Table-16
Table depicting job sector contribution % vs participation % age-wise

Job Sector	16 to 20 yrs	21 to 30 yrs	31 to 40 yrs	41 to 50 yrs	> 50 years	Grand Total	Contribution %
Government Organization				2	8	10	3%
House Maker			5			5	2%
Private Organization	1	93	112	61	19	286	**90%**
Public taking Organization		2	2	1	4	9	3%
Student	3	3				6	2%
Un-employed				1		1	0%
Grand Total	**4**	**98**	**119**	**65**	**31**	**317**	**100%**

Source: Author

5.2.4 Research Question Five and Six: What are your average online purchases and which e-commerce platform(s) do you use?

On assessing the responses from the respondents, it is very evident that around 37% of the respondents make more than 3 online purchases per week while 63% of the respondents make less than 2 online purchases in a week. Hence, it is safe to assume that there is a strong acceptance of online purchases and there is no longer a need to prove this point. We also understand that the first choice of respondents for making online purchases is Amazon as 95% of respondents are using Amazon for their online purchases followed by Flipkart, Zomato etc. We see that there are many e-commerce players based out of regions which means that there are small local e-commerce vendors who are also playing an important role in e-commerce. This is a great area of interest for the researcher to understand if these local/ regional e-commerce vendors are well budgeted to counter the

force which bigger players like Amazon, Flipkart, Myntra, Zomato, Swiggy etc. bring onto the table. It will also be an interesting thing to witness and conclude if the regional players would like to partner among themselves and share the resources to make an edge in the market.

5.2.5 Research Question Seven and Eight: What type of products do you purchase from online e-commerce vendors and reasons to prefer online shopping?

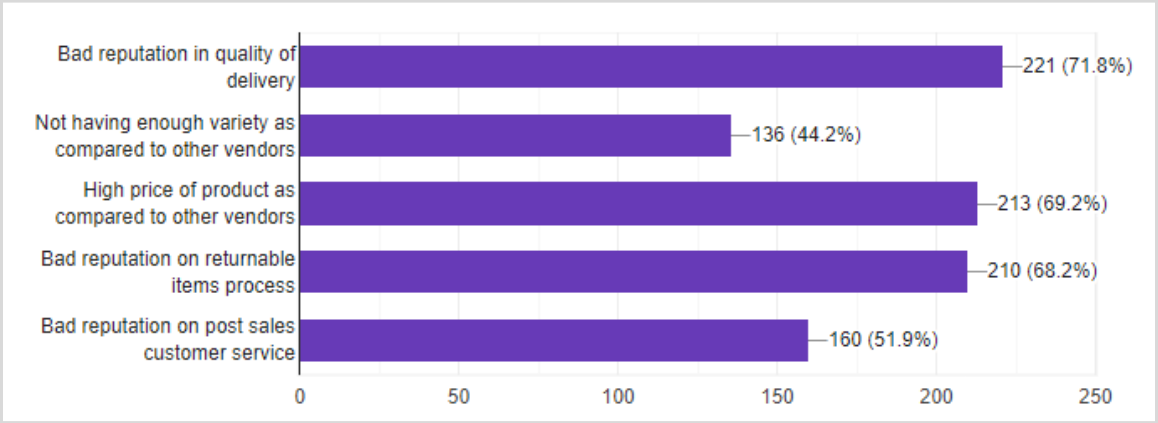
On analyzing these two questions, we can see a trend of change from window shopping to online shopping. We see that buyers are looking for convenience to shop from their place at the luxury of their time. Around 92% of the users have chosen convenience as the top factor of their motivation to do online shopping rather than windows shopping. They also give credit to discounts and offers (around 66% of respondents chose this) available in online shopping and the ease of comparing prices of the products among various e-commerce platforms. If we look at it critically, we find these reasons are very genuine as it would be difficult to obtain all these facilities in windows shopping.

The analysis takes a deeper dive and we find that online shopping is very much used for buying clothes online (around 83% of respondents chose this option) followed by electronic gadgets shopping (around 73% of respondents chose this option). Kitchen groceries (around 66% of the respondents chose this option), fresh vegetables and fruits (around 50% of the respondents chose this option), healthcare products (around 49% of the respondents chose this option) and medical products (around 38% of the respondents chose this option) are also major products to be purchased via online purchases.

5.2.6 Research Question Nine: What are the reasons you would leave an e-commerce vendor?

While we are studying the various factors of e-commerce vendors and online buyers, it is also important to draw attention to the factors which will de-motivate an online buyer to remain loyal to a specific e-commerce vendor. On analysis the graph indicates that primary reason for an online buyer to switch loyalty would be 'Bad reputation of the e-commerce vendors in terms of delivery quality' (around 72% of the respondents says so). This is important from various factors of research as this would enable researchers to develop technology frameworks to solve this problem. The other factors which decide on the loyalty of the online buyer is price factor, easy returnable process, post sales services and variety to chose from.

Figure-76
Comparison of the reasons for an online buyer to leave e-commerce vendor



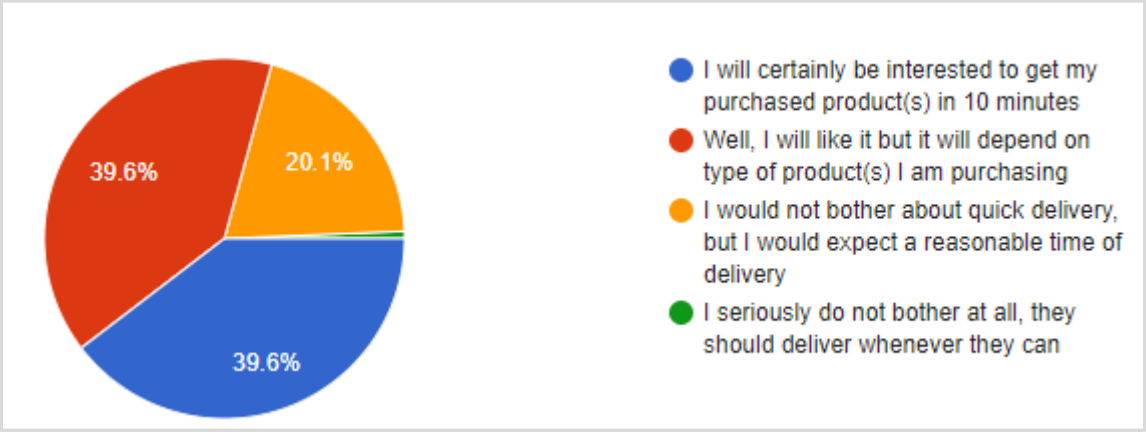
Source: Author

5.2.7 Research Question Ten and Eleven: Will you be excited for a quick delivery and what products would you prefer for quick delivery?

If we analyze the response from the respondents we find that around 80% of the online buyers are very interested for quick delivery, and there are around 20% online buyers who do not have any choice on quick delivery and they are fine with the current

state of affairs. This certainly means that there is a demand in online buyers for quick delivery and e-commerce vendors are certainly putting their best foot forward to become market leaders. The graph below provides a very clear demarcation of the requirement of quick delivery from current online buyers.

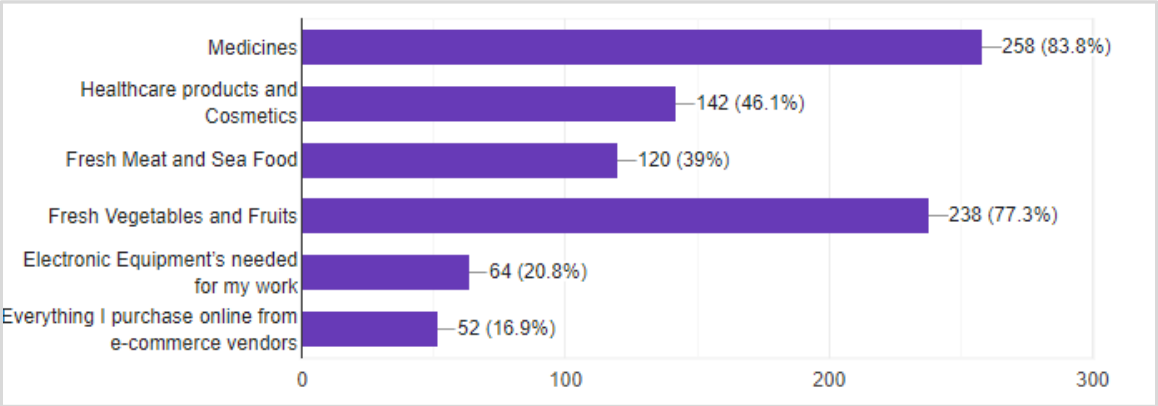
Figure-77
Ratio of online buyers for quick delivery



Source: Author

On analyzing the next question, we find products preferred by the buyers for quick delivery. The highest preference is provided to 'Medicine' (around 84%) followed by 'Fresh vegetables and fruits' (around 77%) followed by 'Healthcare products and cosmetics' (around 46%). This looks correct and correlated because medicines (because of health concerns) and fresh fruits and vegetables (because of perishable in nature) are needed on priority basis.

Figure-78
Preferences of products for quick delivery by online buyers

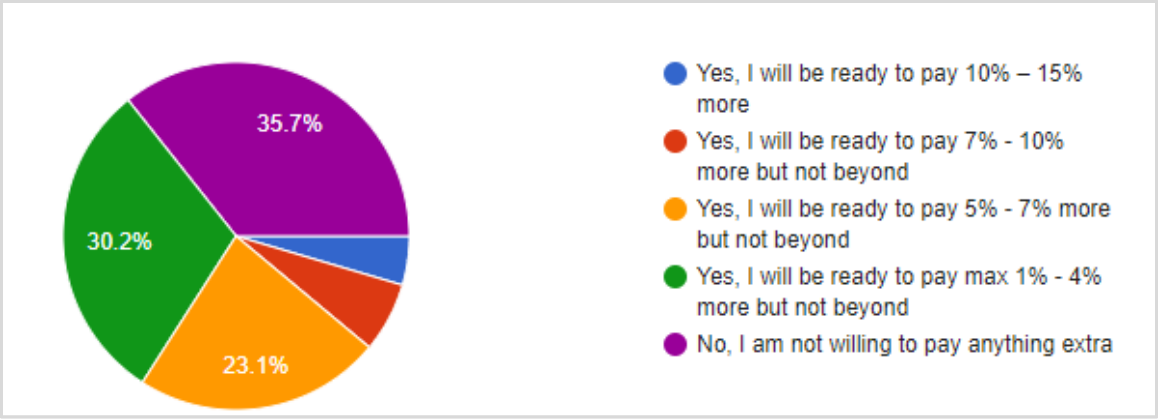


Source: Author

5.2.8 Research Question Twelve: Would you be willing to pay extra for quick delivery?

A very important question for this research and the analysis clearly shows that 65% of the respondents are willing to pay extra for quick delivery. The extra payment range differs from 1% to 15% more than the regular prices. This is a very positive news for the research as it means there is a demand for quick delivery and there are online buyers who would not mind shelling extra money to get the quick delivery facility. Since there is a demand and revenue involved hence the e-commerce vendors can develop a working model around it.

Figure-79
Depiction of willingness of online buyer to spend extra for quick delivery

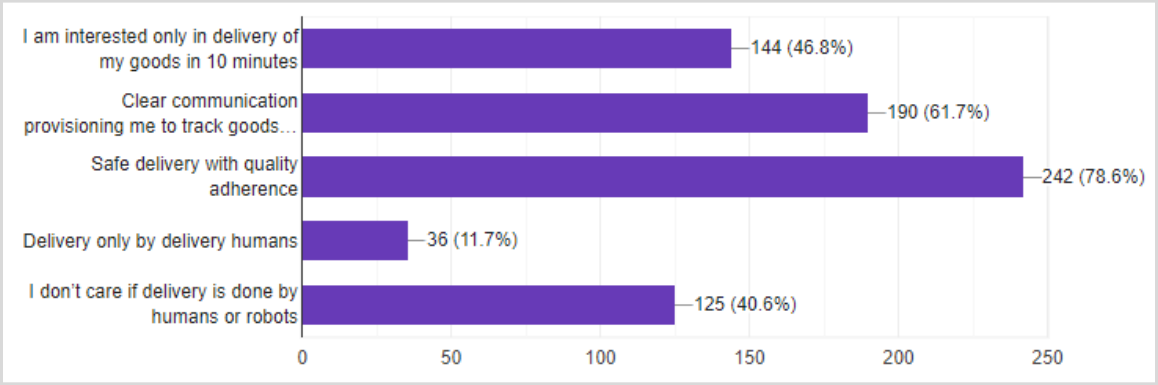


Source: Author

5.2.9 Research Question Thirteen: What facilities do you want to have during quick delivery?

Response to this question actually provisions us to analyze the facility needs of online buyers related to quick delivery. If we look closer, we find that to adhere to these needs/ requirements of the online buyers there would be a need to develop technology solutions and adopt them horizontally across e-commerce vendors. Major need is to have safe and quality delivery (around 79% of respondents say so) and around 41% of the respondents are fine if delivery is done by a physical human or an autonomous vehicle (can be drone or a car). However, there is a need for clear communication to track the status of the order as depicted by 62% of the respondents.

Figure-80
Analysis of facilities required by online buyers for quick delivery



Source: Author

5.3 Discussion of Research Results for E-commerce Vendors

In this section we will discuss the responses received from the e-commerce vendors. These are the stakeholders who provide the online platform for enabling online purhcases. However they are not restricted to online platform development but they own the entire supply chain which need to be efficient and smooth to adhere to quick delivery.

5.3.1 Research Question One and Two: Year of Establishment and Registered Country

From the responses received by the e-commerce vendors, it is very evident that they all are registered in India and have been operating from a long time. In-fact there are certain e-commerce vendors who have been operating since 2007. Hence this is very safe to assume that these e-commerce vendors do have a very rich experience in operating within India.

5.3.2 Research Question Three and Four: Geographical area of operations and Average annual revenue in USD million for last 5 financial years?

On analysis we find that operations are primarily happening in India and some of the e-commerce vendors have their presence in Middle-East and couple of them also operate out of Europe and Americas too. This means that most of e-commerce vendors have international experience and on deeper analysis we also find that all the e-commerce vendors (100% of them) have annual average revenue in past 5 years is more than $10 million, which certainly makes it clear that they have capability to invest into technology.

5.3.3 Research Question Five: Does your organization deal with end-to-end e-commerce process, or do you have partners associated with it?

Analysis of this question reveals two important information:

a. Looking into the size of the country India, how many e-commerce vendors possess the ability to run this mammoth size business (in terms of money and scale of operations)?
b. How many vendors completely believe in outsourcing the operations while what is the ratio of e-commerce vendors who have opted for a hybrid model of operations?

The questions above are important to the researcher to prove his theory, because if there is a majority of e-commerce vendors opting for option #a then the theory does not hold true and there is no point of proving it. But if the majority of the e-commerce vendors opts for #b then the theory is worth proving.

On analysis of the responses for this question, we come to know that around 92% of the e-commerce vendors have partnered in one form or another to ensure smooth operations while only 8% of the e-commerce vendors are owning end to end business of their own.

5.3.4 Research Question Six and Seven: What stage of e-commerce are you involved in and what stage of e-commerce have you partnered for?

From the responses, we analyze that there is only one e-commerce vendor (out of thirteen online respondent vendors) who do not have any partners involved and they own execution of end-to-end supply chain by itself, rest of the vendors have been developing partners at different stages to have seamless last mile delivery. It is also interesting to note that none of the e-commerce vendors have outsourced accounting & billing as well as customer care and these two processes are kept in-house. On the other hand, with a closer look it is evident that organization e-commerce strategy and branding process is mostly kept in-house but there are some e-commerce vendors who use partners for branding & strategy. It is also very clear that most of the e-commerce vendors are using hybrid operating models (self-owned as well as outsourced to partners) for sourcing materials, warehousing & logistics, and last mile delivery.

On further analysis of respondent's data, it is quite clear that e-commerce vendors are developing the local market using local partners. This analysis helps to strengthen the research case for promoting co-ownership and co-sharing of resources like technology, real estate, knowledge and data for efficient last mile delivery.

5.3.5 Research Question Eight: Identify the challenges as an organization you are facing with?

Based on the responses from the e-commerce vendors we come to some safe conclusions. One of the important conclusions is that every e-commerce vendor (100% of the e-commerce vendors) is facing one common challenge to 'optimize the operations cost' followed by other prominent challenges (around 92% of e-commerce vendors) like dynamic shift in 'customer loyalty' and 'product price'. The next type of challenge faced by e-commerce vendors are 'optimized combination of routing and delivery' and 'managing customer expectations of delivery' which contribute to around 85% between all e-commerce vendors. If we take a closer look at the challenges posed to e-commerce vendors, then we understand that e-commerce vendors need to adopt to the technological advancements like Artificial Intelligence, Machine Learning, Robotics & Autonomy. Adoption of technology will assist the e-commerce vendors to reduce the operating cost, optimize delivery routing and time, take informed decisions on various factors important to e-commerce business. At the same time, e-commerce vendors should start promoting internally to co-share and co-own resources and partners to bring optimization in cost and efficiency in operations keeping abreast local geographical sensitivity.

These assertions are important as they bring in high level of confidence to the theory proposed by the researcher and paves way for acceptance of the framework in this research document.

5.3.6 Research Question Nine: Quarterly investment related to latest technology stacks for AI-ML, robots, digital web apps, reporting & dashboarding etc?

As per data analysis, we find that around 46% of the e-commerce vendor spend more than $100,000 per quarter for adopting to latest technology related to AI-ML, robotics, digital web apps and dashboards. Following, there are around 15% of e-commerce vendors who have quarterly spent between $75,000 and $100,000 and there are around 23% of the e-commerce vendors whose quarterly spent is between $50,000 and $75,000. These are very good numbers which certainly establishes that there is great opportunity among the e-commerce vendors to adopt to technology innovations and enhancements to support enhancing operational efficiency and reducing cost of operations. These numbers are strong supporter of the research theory where-in it is evident that if there is a required technology or operational framework which can bring efficiency and cost reduction in e-commerce for last mile delivery process then these e-commerce vendors would certainly adopt it.

5.3.7 Research Question Ten: Technology stacks already present in the organization?

If we analyze the responses provided, we find that around 92% of e-commerce vendors are spending most on 'Intelligent Analytics and Dashboard Reporting for real time monitoring'. This indicates that the 92% e-commerce vendors are trying to first resolve challenges for getting real time information to take informed decisions. At the same time, if we take a closer look at the other responses, we also see that 85% of e-commerce vendors are spending on the technology stack to optimize logistics and warehouse operations. One of the other areas where-in 77% of the e-commerce vendors spend on bringing efficiency within delivery operations and routing optimizations.

5.3.8 Research Question Eleven and Twelve: Technology stacks e-commerce organization planning to deploy in period of next 6 months to 18 months?

Analysis to the responses for this part of question produces different results and we observe that around 92% of e-commerce vendors intend within 6 months to spent on technology stack for delivery and routing optimizations. Similarly, we also find that 87% of e-commerce vendors are planning to invest in the period of 6 months to 18 months for AI & ML technology stacks for logistics and warehousing operational efficiencies. We also observe that there is an increase in the spent from 77% to 100% in the period range of 6 months to 18 months related to robotics and autonomous vehicles for last mile delivery. This data is a very good data as it provides enough information of the interest of e-commerce vendors to spend in various technologies in the time period of 6 months to 18 months as it is a supportive data for this research and indicates that the research theory is worth proving.

5.3.9 Research Question Thirteen: Reason for not investing in technology stack?

The response data is unanimous and all 100% of e-commerce vendors are already geared to invest in the technology stack for supporting one or more requirements of quick commerce last mile delivery.

5.3.10 Research Question Fourteen: What is your logistics model, do you have your own logistics and warehouse team?

On carefully analyzing the response we find that there around 39% of the e-commerce vendor have their own logistics and warehouse team while 46% of the e-commerce vendors have a hybrid business model where-in the logistics team is owned by e-commerce vendors as well as partners, while on the other hand around 15% of the e-commerce vendors have outsourced it to third party partners.

5.3.11 Research Question Fifteen: What is your expense in having your own logistics warehouse set up?

From the responses we observe that 70% of the e-commerce vendors spend more than $20,000 per quarter, while 16% of the e-commerce vendors spend between $10,000 to $20,000 per quarter. It is also witnessed that around 16% of the e-commerce vendors do not have their own logistics setup but have outsourced the same to third party logistics team. Hence from these data results it is clearly evident that warehouse and logistics team has enough revenue to spent on technology stacks for bringing in efficiency in the logistics and supply chain process of e-commerce. This also corroborates with the analysis in question 5.3.8 where-in 87% of the e-commerce vendors are intending to spend on operational efficiency of warehouse and logistics.

5.3.12 Research Question Sixteen: What is your expense in having logistics warehouse set up operated by third party logistics partner?

From the response of question 5.3.11 and 5.3.12 we can clearly make out that whether an e-commerce vendor operates the business by self or commissions the business to its partners, in both cases the operating expenses are high, and as per response data around 54% of e-commerce vendors spend more than $20,000 per quarter while around 8% spend between $10,000 to $20,000 per quarter. Thus it is clear that a good amount of focus is on operating efficiency at warehouse and logistics process of supply chain.

5.3.13 Research Question Seventeen: What is your product delivery model?

Based on the responses, it is clear that around 54% e-commerce vendors are using hybrid model where they are directly involved in last mile delivery and have also partnered with the last mile delivery partners. At the same time there are 23% e-commerce vendors

who manage the last mile delivery themselves and on the other hand 23% of the e-commerce vendors have outsourced their last mile delivery to the last mile delivery partners. Hence it is evident that most of the e-commerce vendors (around 77%) are developing local partners for doing last mile delivery. This is a very good indication that e-commerce vendors are quite aware of the potential capabilities and expertise local partners can bring in the supply chain process. This result is also a great promoter of the fact that co-ownership and co-sharing of infrastructure resources and technology stack is going to benefit the entire stakeholders in the supply chain process.

5.3.14 Research Question Eighteen: What is your expense in product delivery using your own employee and team?

From the responses we find out that 77% of e-commerce vendors spend more than $20,000 per quarter irrespective of the fact if they are doing last mile delivery themselves or using partners or both. Around 8% of the e-commerce vendors are spending between $5000 to $10,000 per quarter and around 15% e-commerce vendors say they have outsourced. The response data clearly depicts that regarding last mile delivery the e-commerce vendors spend is high and they certainly have an appetite to adapt to technology innovations/ enhancements as well as develop local delivery partners for their experience of the local place.

5.3.15 Research Question Nineteen: What is your expense in product delivery using delivery partner?

The responses to this question is complementary to the responses in previous question 5.3.14 we can conclude from the responses, that, around 70% of the e-commerce vendors spend more than $20,000 per quarter while using last mile delivery partners.

5.3.16 Research Question Twenty: Are you aware of the concept of co-owned or co-shared logistics and delivery model in e-commerce supply chain?

The assessment of the response indicates that around 92% of the e-commerce vendors are not aware of how the co-ownership and co-shared operating model works and they are neither interested to go on this road, while 8% of the e-commerce vendors are of this model in question, but they are not aware of how to start the same. This provides ample opportunity for research and analysis as how these 92% of the e-commerce vendors can be boarded on the logic of adapting to shared co-owning or co-sharing of infrastructure resources and technology stack adoption.

5.3.17 Research Question Twenty-one: If your answer to above question is (c) then what is the reason you do not want to use it?

From the responses received by respondents we find that 85% of e-commerce vendors believe that they have a time-tested model and they have no strategy to change the already working model while 15% of the e-commerce vendors believe that it does make sense to use the model but they are not sure of the security of the brand during co-sharing and co-owning of the logistics and last mile delivery process.

5.3.18 Research Question Twenty-two: If you are planning to go with co-sourcing/ co-ownership model, then what is the expected amount you will save per quarter?

From the responses given all e-commerce vendors have indicated that they do not have any details as of now.

5.4 Discussion of Research Results for Logistics & Warehouse Partners

In this section we will discuss the responses received from the logistics and warehouse partners. These are the stakeholders who ensure seamless operations of logistics and warehouse process within e-commerce supply chain. There are many challenges in this process of supply chain which can disrupt the entire process and bring heavy losses or higher operating cost to the business.

5.4.1 Research Question One and Two: Year of Establishment and registered office

From the responses received by the logistics and warehouse partners, it is very evident that they all are registered in India and have been operating from a long time. In-fact there are certain logistics and warehouse partners who have been operating since 1853. Hence this is very safe to assume that these logistics and warehouse partners do have a very rich experience in operating within India.

5.4.2 Research Question Three: Which geographical region(s) does your logistics and warehouse organization operate in?

The responses received from the e-commerce vendors and their logistics and warehouse partners clearly highlight that the primary geographical location of operations is spread majorly across Asia and then followed by Europe, Middle-East and America. Hence, it would be a safe assumption that all the responses provided in the questionnaire will provide a greater insight of India market as 100% of the respondents operate in India. These responses will provide insights as how the logistics and warehouse teams operate at the fullest capacity within Indian subcontinent.

5.4.3 Research Question Four: What is your average annual revenue per year for the last 5 financial years?

From the response to this question, we find that 87% of the logistics and warehouse team were having a revenue of more than $10 million while 13% of the team or partners had a revenue between $1 million and $5 million. Hence it is safe to assume that most of logistics and warehouse teams and partners are financially stable to support adoption of technology as well as to promote the model of co-ownership and/ or co-sharing of logistics and warehouse premises and processes.

5.4.4 Research Question Five: Does your organization deal with end-to-end logistics process of supply chain, or do you have sub-partners with you?

From the response we find that around 73% of the logistics teams take care of end-to-end logistics and warehouse process while 20% of the logistics team have also involved sub-partners to take care of the load of logistics and warehouses in rural areas. It should also be noted that around 7% of the logistics team have established sub-partners for support during the main peak season like festivals, new year's etc.

The response gives enough confidence that the warehouse and logistics partners can manage supply chain from warehouse & logistics to last mile delivery perspective. For efficiency in logistics and delivery, there are multiple local partner chain which ensures that the delivery is seamless and with the right delivery parameters of time and quality.

5.4.5 Research Question Six: What warehouse and logistics processes is your organization involved with?

On deeper analysis of the responses to this question, we derive that warehouse and logistics team manages end to end logistics process within their warehouse, but when it comes to the partner warehouse, their support is around 7% and they expect the warehouse partners to resolve their challenges by themselves. It is also evident that all warehouse &

logistics partners would agree to manage transportation system for themselves as well as transportation partners to ensure timely delivery. It is also observed that 80% of the logistics partners are involved in Export & Import process, and around 93% are involved directly or indirectly in the last mile delivery process.

5.4.6 Research Question Seven: For what part of logistics process have you partnered?

Based on the response, we find that around 53% of logistics teams do not have partners involved and they are running their business of their own. Around 47% of the logistics team have partnered for last mile delivery which means they have extended their coverage, on the other hand around 27% logistics team are also involved in managing the logistics and warehouses at sub-partner's level.

5.4.7 Research Question Eight: Do you have multiple e-commerce vendors partnered for warehousing and logistics process?

Through the response from the logistics team, we find that 93% of the logistics team have multiple e-commerce vendors for whom they act as third-party logistics & warehouse partners while there are 7% logistics team who are dedicated to one single e-commerce vendor.

5.4.8 Research Question Nine: Identify challenges you face as a logistics and warehouse partner?

As per the response from the various logistics and warehousing team we find that most of the partners and team apx 93% face challenges in 'Adhering to quality delivery' and 'Setting up best combination of routing and delivery', and it clearly means that technology adoption can play a greater role to solve this problem. If we take a look at the

second set of problematic situation, we find that managing ‘dynamic warehousing for multiple e-commerce vendors’ is a big challenge, followed by ‘technology adoption for real time monitoring’ and ‘high volume management during festive seasons’. All these challenges clearly depict that with technology adoption these problems can be removed, and it serves the purpose of the research.

5.4.9 Research Question Ten: Are you using robots and cobots in your warehousing and logistics process?

The responses from the respondents clearly indicate that one third of the respondents have intention to induct robots/ cobots in their system in next 12 months. Similarly, around next one-third of the respondents have already been using cobots/ robots in their process past 12 months and there is another one-third who either have no intent or are still struggling at ROI level for inducing robots/ cobots in their process.

5.4.10 Research Question Eleven: What is your quarterly investment related to latest technology stacks for AI-ML, robots, digital web-apps, reporting & dashboarding etc?

From the responses, it is evident that 27% of the logistics team have been investing heavily to a tune of more than $100,000 per quarter equally followed by 27% of logistics team having spent between $75,000 and $100,000 and so on. It is interesting to note that around 7% of the logistics team have declared that they have not spent any budget on above mentioned technology stacks. So, it is safe to say that the investment capabilities to adopt technology enhancements is quite high.

5.4.11 Research Question Twelve: Which of the following stack is already in place within your organization?

Responses from the warehouse & logistics partners reveal that enough has been done for getting the real-time updates within warehouse & logistics process. This is evident as 80% of the responses indicate the same and is a natural choice because the first thing in warehouse and logistics would be to have an updated status of the inventory and the process to take informed decisions. It is also very evident that around 73% of warehouse & logistics partners are spending on using AI ML for optimized delivery routings and intelligent analytics. This will assist them to optimize the cost of operations and take informed decision to further optimize scale of economies.

5.4.12 Research Question Thirteen and Fourteen: Which of the following stack is your organization planning to deploy in the next 6 months to 18 months?

On analysis of the response it comes out clearly that warehouse and logistics partners are more likely to invest on routing optimizations and delivery efficiency by using AI-ML algorithms. This trend will increase from 6 months and within 18 months a good amount will be covered. On closer look we also find that Robotics, autonomous vehicles will gain a good traction of investment starting from 53% in next 6 months to 73% in next 18 months. This will mean that there would be lots of research going on in this area. Real time notifications will remain in constant demand from 6 months to 18 months range. This makes a clear assumption that technology will be heavily relied for better efficiency and optimizations thus supporting this research.

5.4.13 Research Question Fifteen: What is the reason for not investing in technology stacks?

As we can see from the responses captured, all of the e-commerce vendors claim that they are already investing to adopt the technology to ensure seamless and efficient operations for logistics and warehouse process finally leading to last mile delivery. On the other hand there are 7% of the logistics partner who claim that they do not have adequate skills to identify the right technology stack which would be helpful for them.

5.4.14 Research Question Sixteen: What is your logistics model, do you have partners for logistics?

From the responses, we find that around 73% of the logistics and warehouse team do not have extended arm using third party logistics team while on the other hand around 27% of the logistics and warehouse partners have sub-contracted for extended support.

5.4.15 Research Question Seventeen and Eighteen: What is your expense in having your own logistics warehouse setup vs using third party logistics partners?

On comparing the responses we observe that 67% of the logistics team manage the process by themselves and rest 33% of the logistics team have partnered with third party partners for support in logistics process. Whether it is warehouse and logistics setup by the self team or using the partners the majority of the warehouse team has expenses more than $20,000 per quarter. There are fewer logistics and warehouse team who spend less than $20,000 per quarter.

5.4.16 Research Question Nineteen: What is your organization product delivery model?

Based on the responses, it is clear that around 87% logistics team are directly involved in logistics and warehousing process. At the same time there are 13% logistics team who have sub-contracted their logistics and warehouse process to third party.

5.4.17 Research Question Twenty and Twenty-one: What is your expense in product delivery by using your own employee and team vs using a delivery partner?

On comparing the responses we observe that 67% of the logistics team manage delivery process by themselves and rest 33% of the logistics team have partnered with third party delivery partners for support in last mile delivery process. Whether it is delivery process setup by the self team or using the partners the majority of the warehouse team has expenses more than $20,000 per quarter. There are fewer logistics and warehouse team who spend less than $20,000 per quarter.

5.4.18 Research Question Twenty-two: Are you interested in co-ownership or co-shared logistics and delivery model in e-commerce supply chain for better business and revenue model?

The assessment of the response indicates that around 60% of the logistics team are interested while 40% are not willing to change their model as they are dedicated logistics partner to e-commerce vendors. Out of these 60%, around 20% of the logistics team claim that their business model already incorporates the co-sharing and co-owning model.

5.4.19 Research Question Twenty-three: If your answer to above question is (c) then what is the reason you do not want to use it?

From the responses received by respondents we find that 40% of logistics partners believe that they have a time tested model and they have no strategy to change the already working model while 33% of the logistics partners believe that it does make sense to use the model but they are not sure of the security of the brand during co-sharing and co-owning

of the logistics and last mile delivery process. At the same time, interesting fact is that there are 27% of the logistics partners who are already co-sharing.

5.4.20 Research Question Twenty-four: If you are planning to go with co-sourcing/ co-ownership model, then what is the expected amount you will save per quarter?

From the responses given 87% of logistics partners have indicated that they do not have any details as of now. On the other hand there are 7% of logistics partners who are investing around $20,000 per quarter and equal 7% of logistics partners are investing between $1000 to $5000 per quarter on co-sharing and co-owning.

5.5 Discussion of Research Results for Delivery Partners

In this section we will discuss the responses received from the last mile delivery partners. These are the stakeholders who ensure seamless operations of last mile delivery process within e-commerce supply chain. There are many challenges in this process of supply chain which can create dissatisfied customers, increase in cost of operations and huge losses in terms of motor and insurances.

5.5.1 Research Question One and Two: Year of Establishment and registered office

From the responses, we come to know that the operating experience is huge as couple of organizations are operating in Indian environment and economy since 1854, and the inceptions has been increasing year on year witnessing the addition of delivery partners playing in Indian markets for its share of business in e-commerce and quick delivery for last mile.

5.5.2 Research Question Three: Geographical area of operations

The responses received from the e-commerce vendors, logistics partners and their delivery partners, clearly highlight that the primary geographical location of operations is spread majorly across Asia and then followed by Europe, Middle-East and America. Hence, it would be a safe assumption that all the responses provided in the questionnaire will provide a greater insight of India market as 100% of the respondents operate in India. These responses will provide insights as how the logistics and warehouse teams operate at the fullest capacity within Indian subcontinent.

5.5.3 Research Question Four: What is your average annual revenue per year for last 5 financial years?

From the response of this question we find that 93% of the delivery partners were having a revenue of more than $10 million while 7% of the team or partners had a revenue between $1 million and $5 million. Hence it is safe to assume that most of last mile delivery teams and partners are financially stable to support adoption of technology as well as promote the model of co-ownership and/ or co-sharing of logistics and warehouse premises and processes.

5.5.4 Research Question Five: Does your organization deal with end-to-end delivery process of supply chain, or do you have sub-partners associated with you?

From the response we find that around 73% of the delivery teams take care of end to end logistics and warehouse process while 27% of the delivery team have also involved sub-partners to take care of the load of last mile delivery at rural areas

5.5.5 Research Question Six: What are the different modes of delivery your organization deal in?

It is very clear from the response that 100% of the last mile delivery team are using delivery boys using motor-vehicles to ensure physical delivery. There is no mention of any un-manned vehicle (aerial or road) for last mile delivery

5.5.6 Research Question Seven: Do you have multiple e-commerce vendors/ logistics team partnered for warehousing and logistics?

Through the response from the delivery team, we find that 87% of the delivery team have multiple e-commerce vendors for whom they act as last mile delivery partners while there are 13% logistics team who are dedicated to one single e-commerce vendor or logistics team.

5.5.7 Research Question Eight: Identify from below options regarding the challenges you have been facing with?

As per the response from the various delivery teams we find that 100% of the partners and team face challenges in 'Timely delivery during bad weather' and it clearly means that technology adoption can play a greater role to solve this problem. If we take a look at the next sets of problematic situation, we find that managing 'location and neighborhood search' and 'optimizing delivery route and mapping delivery boys' is a big challenge, followed by 'real time monitoring'. All these challenges clearly depict that with technology adoption these problems can be removed and it serves the purpose of the research.

5.5.8 Research Question Nine: What is your quarterly investment related to latest technology stacks for AI-ML, robots, digital web apps, reporting & dashboarding etc?

From the responses, it is evident that 27% of the delivery team have been investing heavily to a tune of more than $100,000 per quarter equally followed by 13% of delivery team having spent between $75,000 and $100,000 and so on. It is interesting to note that 40% of the delivery team spend between $50,000 to $75,000 per quarter and there are no last mile delivery partners who have not spent any budget on above mentioned technology stacks.

5.5.9 Research Question Ten: Which of the following technology stack is already in place within your organization?

Responses from the Last Mile delivery partners reveal that enough has been done for getting the real-time updates within delivery process. This is evident as 100% of the responses indicate the same and is a natural choice because the first thing in the delivery process would be to have an updated status of the delivery and the delivery vehicles to take informed decisions. It is also very evident that around 80% of delivery partners are spending money on using AI ML for optimized delivery routings and integrated digital applications for pickup – delivery points and schedules. This will assist them to optimize the cost of operations and take informed decisions to further optimize scale of economies.

5.5.10 Research Question Eleven and Twelve: Which of the following stack is your organization planning to deploy in the next 6 months to 18 months?

On analysis of the responses by delivery partners, it is evident that they intend to develop and deploy solutions to assist the delivery boys to plan schedule for pickup and drops for the day. This requirement remains the top priority for 100% of delivery partners to be implemented by 18 months. We also understand that priority to optimize delivery schedule is also a recommended need for delivery partners and hence around 67% of the delivery partners are spending money to employ AI-ML routines for achieving this target.

We also find out that autonomous delivery will gain traction from 27% in 6 months to 53% in 18 months and delivery partners will spend on procuring and/ or developing such technologies within their delivery process.

5.5.11 Research Question Thirteen: What is the reason for not investing in technology stacks?

As we can see from the responses captured, all the delivery partners claim that they are already investing in adopting the technology to ensure seamless and efficient operations for the last mile delivery process. On the other hand, 7% of the delivery partners claim that they do not have funds to invest in technology adoption.

5.5.12 Research Question Fourteen: What are your expenses in product delivery by self?

From the responses we observe that 100% of the delivery team spend more than $20,000 per quarter

5.5.13 Research Question Fifteen: If you have one, then what is your expense in managing the logistics by a 3rd party delivery partner?

As we can conclude from the responses, around 13% of the delivery team spend more than $20,000 per quarter and equally 13% spend between $10,000 to $20,000 per quarter while there are 67% of the logistics team who are owning the end to end process by themselves and have not sub-contracted to the partners.

5.5.14 Research Question Sixteen: Are you interested in co-ownership or co-shared logistics and delivery model in e-commerce supply chain for better business & revenue model?

The assessment of the response indicates that around 60% of the delivery team are interested while 40% are not willing to change their model as they are dedicated delivery partner to e-commerce vendors. Out of these 60%, around 26% of the logistics team claim that their business model already incorporates the co-sharing and co-owning model.

5.5.15 Research Question Seventeen: If your answer to above question is (c) then what is the reason you do not want to use it?

From the responses received by respondents we find that 47% of delivery partners believe that they have a time-tested model and they have no strategy to change the already working model while 40% of the logistics partners believe that it does make sense to use the model but they are not sure of the security of the brand during co-sharing and co-owning of the logistics and last mile delivery process. At the same time, an interesting fact is that there are 13% of the delivery partners who claim that they have done their studies but they do not find a cost benefit out of this model.

5.5.16 Research Question Eighteen: If you are planning to go with co-sourcing/ co-ownership model, then what is the expected amount you will save per quarter?

From the responses given 73% of delivery partners have indicated that they do not have any details as of now. On the other hand there are 7% of delivery partners who are expecting benefits between 21% - 30% per quarter and 20% of delivery partners believe that they could make a saving of 11% - 20% per quarter on co-sharing and co-owning.

CHAPTER VI:

SUMMARY, IMPLICATIONS, AND RECOMMENDATIONS

6.1 Summary

The current study is focused on four important stakeholders (i) The online buyers (ii) the e-commerce vendors providing platform for online purchsaes (iii) the warehouse and logistics company which ensures seamless supply chain and finally (iv) the last mile delivery partners who ensures the delivery is done in agreed SLA timeline within agreed quality delivery parameters. The current research was conducted with majorly three objectives:

a. To identify if there is a demand for quick delivery and whether the online buyers are ready to spend more than regular price for quick delivery.
b. To identify the challenging areas, faced by e-commerce vendors, warehouse & logistics partners and last mile delivery partners, which can be solved and supported by adopting to advancements in technology like AI-ML, robotics, digital applications, and, autononmy.
c. To identify the business process which can be shared to support co-sharing and co-owning of the resources for bringing in efficiency in operating cost.

The data was collected by means of (i) responses to questionnaires (ii) interviews conducted with some partners in supply chain (iii) data availablility from the respective corporate websites. The data collected from the responses of questionnaires was analyzed for correlation to the theory proposed and to ascertain if the theory holds true based on the results of the analysis. It was very satisfying to see that there is a good demand for quick commerce in specific segments like healthcare, medicines, meat products, fresh fruits and vegetables. Hence, researcher summarises that there is a great scope in this area to develop a right framework which can be employed by different geographies.

6.2 Implications

Researcher author believes that collaboraton in between e-commerce vendors can lead to optimization of supply chain and distribution channels required for quick commerce by sharing resources and technology. This thought has led to derivation of a concept 'Collaborative Commerce' and now this is an area of research as it offers various topics for discussions. Kim S. et. al. (2005) talks in his research paper about how quick commerce can be regarded as a next evolutionary step and beyond electronic commerce (e-commerce). Some of these topics could be:

- How to manage brand security while sharing infrastructure, manpower and technology resources with other e-commerce vendors?
- How can e-commerce vendors share information regarding delivery routing, inventory & product specifictions etc.?
- How can last mile delivery partner be channeled to make multi-vendor deliveries in minimum delivery cycles?
- What is the cost benefit in collaborating with other e-commerce vendors rather than doing all by themselves?
- What would be the impact on the market share which currently an e-commerce vendor hold?
- How would languages, culture, geographical processes, time-zones etc challenges would be resolved?

As per Marshall Hargrave (2023) 'Collaborative Commerce' is a new focus for organizations and it would be a hybrid model where-in businesses will work very closely with competitors and suppliers and they would exchange information for products, market analysis, technology breakthroughs etc. for becoming profitable and highly competitive.

This research initiated with a study to support following theories:

- There is a demand of quick commerce specially for medicines and persihable items like meat products, fresh vegetables.
- The ecommerce vendors, warehouse & logistics partners and last mile delivery partners can co-share and co-own the resources to optimize the cost of operaions. As per Chernukhina et. al. (2021), dark stores can be developed in the rural areas which will be a very competitive approach for delivery of goods to the customers.
- The different stakeholders should adopt to technology advancements for better delivery operations and manging cost efficiency.

As per Blaire McClure (2023) in her post to BigCommerce website, the goal of the collaboration between different vendors is to help both parties with a creative, transparent and relational collaboration and research author believes it will yield following benefits:

- Cost effectiveness: Budget friendly partnership invoking leveraging of existing customers connection.
- High return on investment: It has been analyzed that low-maturity partnerships are yielding 18% of company revenue while highly matured partnerships programs contribute to 28% of company revenue.
- Improved brand awareness: Partners while collaborating develops trustworthy relationships hence promoting brand advocacy.
- Greater customer retention: Because of multiple benefits like reduced cost, fast delivery, increase in product catalogue etc. would motivate customers and there will be higher retention of customers.
- Bigger market share: Collaboration would provide first-mover advantage speeding up the market share.

This research has its implications on Indian society and geography as follows:

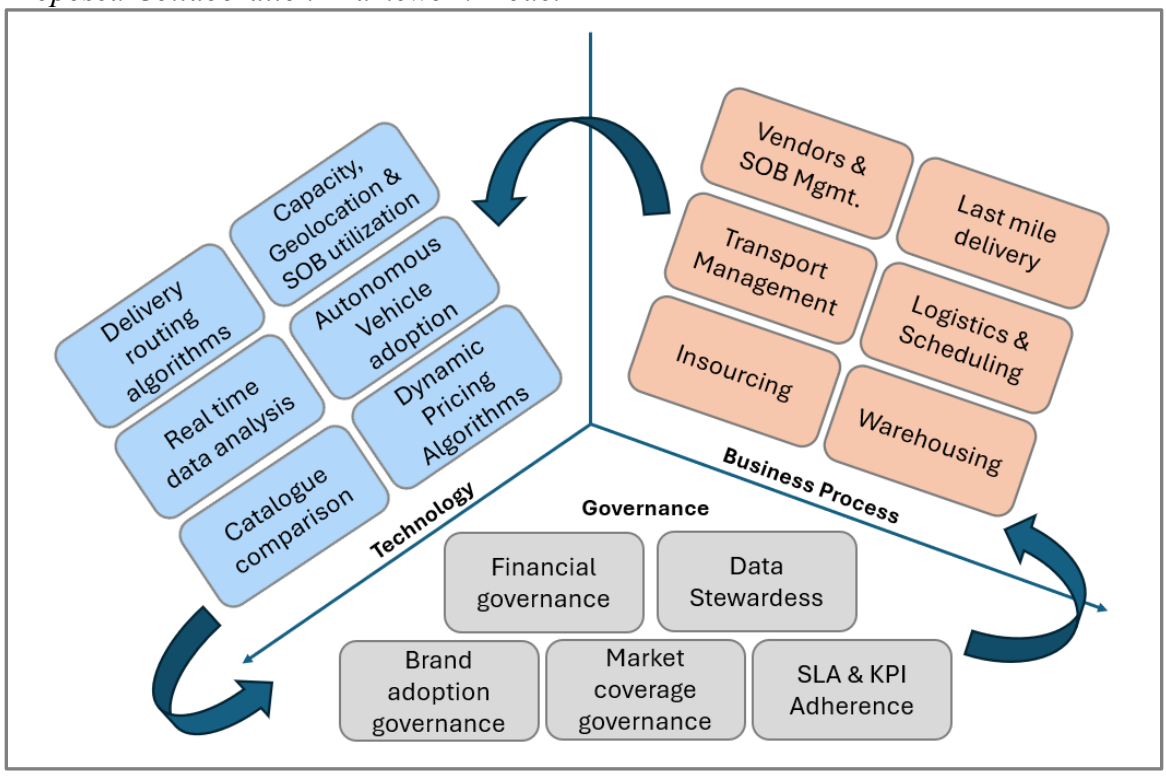
a. Reduction in traffic explosion: If the framework is established and the e-commerce vendors – warehouse & logistics partners – last mile delivery partners all work together then there will be operational efficiency and it will decrease the load over traffic conditions.
b. Reduction in traffic accidents: Looking in the reports of Indian continent, we find that the road accidents have increased with the increasing demand of quick commerce. With the framework in place and traffic conditions more controlled, there certainly would be a reduction in traffic accidents saving many lives.
c. Reduction in motor and life claims: With the reduction in accidents, there would be a reduction in insurance claims of motor accidents and human lives.
d. Change of policies and governing laws: The research would not directly affect Indian continent law, but certainly the law makers can provision law which would impact positively the society on traffic conditions, insurance procedures etc.

Collaborative Framework supporting theory of researcher for co-sharing of resources and technology.

As per Eldon Li (2004), collaborative commerce was first coined in 1999 by Gartner group as the future business model and a survey of 300 business executives by Deloitte researchers forecasted to achieve 70% rise in profitability. However, this research was done only on Information Exchange regarding collaborative engineering, collaborative decision making, collaborative financial data and human resource data using ERP products like SAP. Having cited so, researcher believes the concept to hold true even in business models as well as technology models and Chen Q. et. al. (2010) have tried to develop a framework for awareness of collaborative e-commerce in his research paper.

Researcher author proposes a collaboration framework model between stakeholders in pictorial form is as below:

Figure-81
Proposed Collaboration Framework Model



Source: Author's Work of image

The framework proposed by researcher has three important pillars:

a) Business Process: This pillar consists of all the processes which are needed by all e-commerce stakeholders starting from e-commerce vendors, warehouse & logistics partners, transportation partners and last mile delivery partners. These stakeholders would need business operations stitched in a way where the information and resources could be shared by one another based on the unification of the business processes being adhered by the stakeholders. So for example, there could be a rise in Third Party Logistics (3PL) rather than having owned logistics

program which will enable multiple e-commerce brands to store their products very near to consumer thereby supporting quick commerce.

- Insourcing: Currently, e-commerce vendors insource products from multiple sources, but this concept does not relate to co-sourcing. In co-sourcing, the researcher aims for e-commerce vendor(s) to furnish the consumer product demand as market opportunity to local e-commerce vendors (or nearest e-commerce vendors) for fulfilment. In this way the consumer/ online buyer would not need to place his orders separately via different digital apps.

  To make this insourcing collaboration process a success it is important to have an integration of data and business process where-in the products from different e-commerce platforms can be pulled depending on the location proximity and get delivered within SLA time along with agreed quality. There would be multiple challenges during the insourcing stage like 'Order complexity', 'volume fluctuations', 'order fulfilment speed' and they need to be addressed for integrated order management system, automated order processing system, automated bill reconciliation system and should protect brand value.

  To make collaborative insourcing a successful process, KPI based measurable parameters would be needed in between e-commerce vendors. Some of the KPI parameters for collaborative in-sourcing which research author proposes are as below:

Table-17
Insourcing process KPI list

KPI Name	KPI Description	Measurable Parameters
Order Processing Time	Measures the average time it takes for an order to be	○ Low order acceptance time once order is shifted from one e-commerce vendor to another.

	processed from time of order to final delivery.	○ Low order processing time by final e-commerce vendor resulting in happy customers. ○ Order fulfillment rate for shifted orders. Higher the fulfilment rate better the collaboration.
Product Data Interchange	Measures the number of products data served based on the request given for shift of consumer order from one e-commerce vendor to another	○ Low data failure rate means that the data interchange collaboration is highly successful. Data failure rate could be because of 'wrong product information', 'defective product information', 'no-product service information'

Source: Author

- Warehousing: This is a very interesting chapter for collaboration. As of the norm, it is witnessed that some major e-commerce players increase their brand value, investing a lot of money to open fulfillment centers, warehouses and dark stores. Now given that India is a large country, these e-commerce vendors are unable to reach the rural and remote locations of Indian states. Hence, the researcher intends to initiate a thought process of promoting culture of Third Party Logistics (3PL). It should be noted that 3PL is not a new concept at all, but this is being used a lot by many manufacturing OEM especially the automotive OEMs. This is a real use case where-in the fulfillment centers, dark stores, warehouses etc. can be co-shared by the different e-commerce vendors which will directly impact in reduced investment cost and being near to the consumers with an additional benefit of playing a very meaningful role in creating more local jobs.

The collaborative 3PL will have its own set of inefficiencies like 'Inaccuracy in inventory records', 'Un-optimized space utilization', 'Lack of supply chain visibility'.

However, the warehouse collaboration would need specific measurable KPIs as below:

Table-18
Warehouse collaboration KPI list

KPI Name	KPI Description	Measurable Parameters
Shrinkage Ratio	Measures the amount of inventory lost or reduced due to theft, damage, spoilage or miscounting.	○ Low shrinkage value means the products are well managed and protected.
Receiving efficiency	Measures how quickly and efficiently warehouse receives and inspects the incoming goods from suppliers.	○ High receiving efficiency means that warehouse has smooth and error-free receiving process.
Order Lead time	Measures the time required to fulfill each order, starting from order placement till it is ready to be delivered.	○ A low order lead time means better and efficient warehouse operations.
Fulfilment accuracy rate	Measures % of orders fulfilled by warehouse correctly without any defects or errors.	○ High fulfillment accuracy rate means better warehouse operations management.
On-time shipping rate	Measures the % of orders shipped before or on time from warehouse.	○ High on-time shipping rate means better warehouse operations management.

Source: Author

- Transport Management: This is a space where collaboration between the e-commerce vendors needs high level of maturity. This stage focuses on the movement of goods from producer space to large warehouses, fulfilment centers across the geography, dark stores in the remote or rural areas. This stage will have direct impact on cost, time and quality of delivery of products and the collaboration can be successful if multi-nodal transport companies of the country join hands to solve multiple business challenges like 'Space utilization of transport fleets', 'Controlled temperature based multi-compartment vehicles', 'Right guidance of the sequence of locations vis-à-vis goods delivery' etc. The most important factor here would be perishable items which will be transported using temperature-controlled fleets as these perishable items would have a shelf life for delivery.

To ensure that the collaborative transportation management is working efficiently between multiple e-commerce vendors, certain KPIs are recommended as below:

Table-19
Collaborative Transport KPI list

KPI Name	KPI Description	Measurable Parameters
Number of shipments	Measures how many loads shipped against a time period such as week/ months/ quarters/ years etc.	○ High number of shipments means high demand of transportation. ○ Correct sequence of load delivery based on the location of delivery
Transport cost	Measures the total cost of transporting goods including fuel, labour, maintenance, insurance etc.	○ Low transportation cost means process is efficient and cost effective.
Fuel efficiency	Measures quantity of fuel consumed per km by the transportation vehicles.	○ High fuel efficiency means process is environment friendly and reduces carbon footprint.
Accident Rate	Measures the work-related injuries during transportation.	○ Lower the accident rates means transportation process is safe and reliable.

Source: Author

- Vendors and SOB Management: During collaboration with various suppliers, it is important to adhere to Share of Business (SOB)%, else the e-commerce vendors will land into situation where most of the business would go to specific vendors/ partners and this will certainly bring dissatisfaction among other partners leading to failure of collaboration.

  This collaboration item has limited KPI:

  Table-20
  Vendor SOB KPI list

KPI Name	KPI Description	Measurable Parameters
Share of Business (SOB)% adherence	Measures how the SOB was adhered by the e-commerce vendors and partners	○ Low SOB% to some partners even though with established capacity means lower collaboration trust.

  Source: Author

- Last Mile Delivery: This is the final business process but the most complex one and is dependent on multiple factors like traffic conditions, weather conditions,

customer preferences, delivery routes, delivery confirmations etc. This stage directly affects the customer loyalty, satisfaction and behavior hence the collaboration at this stage should be with maximum benefits. There would be many challenges faced at this stage like 'Real time tracking of pending deliveries along with geography location', 'Real time delivery routing to maximize delivery output with minimum route deviations', 'Dynamic customer expectations', 'Perishable items', 'Customer availability leading to multiple turns' etc.

To measure efficiency of collaboration in last mile delivery, following KPIs are recommended by the researcher:

Table-21
Last mile delivery collaboration KPI list

KPI Name	KPI Description	Measurable Parameters
On-time delivery rate	Measures the number of order (in %) delivered within the agreed timelines.	○ High on-time delivery rate would translate to efficient delivery process and high customer satisfaction.
Order accuracy rate	Measures % of orders without errors, defects, damaged goods etc.	○ High order accuracy rate means efficient delivery process and high customer satisfaction.
Customer satisfaction rate	Measures the degree of satisfaction customers have with the delivery process.	○ High customer satisfaction rate means delivery process is well managed and meeting customer expectations.
Delivery cost per order	Measures the cost of every delivery attempted/ made to the customer.	○ A low delivery cost per order means the delivery process is efficient and reduces the waste and overhead.

Source: Author

b) Technology: Technology adoption requires a huge amount of time and investment and so this is the first-class candidate for sharing between stakeholders. In fact, there could be some technologies which cannot be invested by some stakeholders because of the sheer volume of research required and the facility to induct that research would be a lot difficult by small players of their own. Here is the need, when the different stakeholders can join hands and contribute to the research and

technological development as well as adoption. This could certainly mean that the technology can be shared between the business houses and with the abstracted information exchange the market could be more explored rather than leaving it to happen by chance.

- Centralized Catalogue with Comparison: E-commerce vendors can integrate data interchange among themselves to provide centralized catalogue based on the geographical location and the consumer need. This will prove to be a boon for the consumers as they would not need to switch between various e-commerce vendor apps for getting more relevant prices and delivery options as per his location.
- Dynamic Pricing: Current scenarios demand every e-commerce vendor to have their own algorithms for product dynamic pricing, which creates an unfair competition for the small e-commerce vendors and also for the consumer as they would have a higher wait period to receive the product. The dynamic pricing algorithm should be shared, and data interchange should be done to have communized dynamic pricing which would provide benefit for business and for consumers.
- Real Time Data Analysis: Technology enabling real time data analysis for informed decision should be shared as this will involve the infrastructure and resources. Not all e-commerce vendors would be in a position to invest for having an extensive recommendation engine with intelligent analytics, and hence data as well as application collaboration would help everyone here.
- Autonomous Vehicles: Some big e-commerce vendors players have a huge capacity of investment for research and development regarding autonomous vehicles including robots, cobots, drones, autonomous driving cars etc.

However, the same is not true for other ecommerce vendors who are local and do not have great investment amount as IT spent. This is a very prime candidate scenario where the autonomous vehicle technology can be shared with other e-commerce vendors and their partners with a revenue model associated with it to cover the investment cost. This certainly would benefit all the e-commerce vendors and their supply chain partners till last mile delivery partners.

- Delivery Routing Algorithm: On analysis of the responses from delivery partners, logistics partners and last mile delivery partners, we evidently find that the right mix of delivery routing with delivery boys is a challenge everyone is facing. There are algorithms which are continuously getting evolved based on the ever-ending demand of nature of business to satisfy customer needs in terms of speed and quality of delivery. The delivery routing algorithm can be shared with multiple e-commerce vendors and their stakeholders on a revenue model which will cover the cost of research and development along with service operations cost.
- Capacity, Geolocation and SOB management: Once the collaboration partnership and framework is being developed it is also important for the e-commerce vendors and their next line of stakeholder businesses to efficiently manage the Share of Business within the geography location. This will create additional capacity to serve the online buyers.

c) Governance model: In this era of interwoven business processes, abstracted information exchange and seamlessly weaved stakeholder's operations there certainly is a need to have an effective governance model. This model would be needed to ensure sanctity & correctness of data, ensuring timely flow of data, correct usage of data. The effective governance model would resolve any conflict

which can have altered brand impact, loss of market edge, loss of any financial transactions etc.

- Financial Governance: The entire collaboration backbone success would depend on how financial transparency is integrated with the collaboration process. The financial governance would include validation of monetary transactions between the collaborating stakeholders, profit and loss statements in virtue of the collaboration done against all investment cost, infrastructure cost etc. The governance team would take a call off on whether the collaboration is achieving the target objective of financial benefits between the stakeholders and whether it makes sense to continue the collaboration or call it off.

  Researchers here promote the implementation of blockchain technology for adherence to security of financial transactions and decentralization of transaction approvals.

- Data Stewardess: Data would play a very important role in governance of this collaboration from multiple perspectives. Hence seamless data stewarding process and methodology would be required so that data flow between the stakeholders, data abstraction between the interfaces and integration methods, data validation for accuracy and correctness could be ensured. Data flow and usage will support the financial governance team to ensure if the collaboration is going in the right direction and also ensure that financial transactions are valid.

  Researchers recommend having a collaborative cross functional team for defining the methodology for data creation, data usage, data flow and data governance.

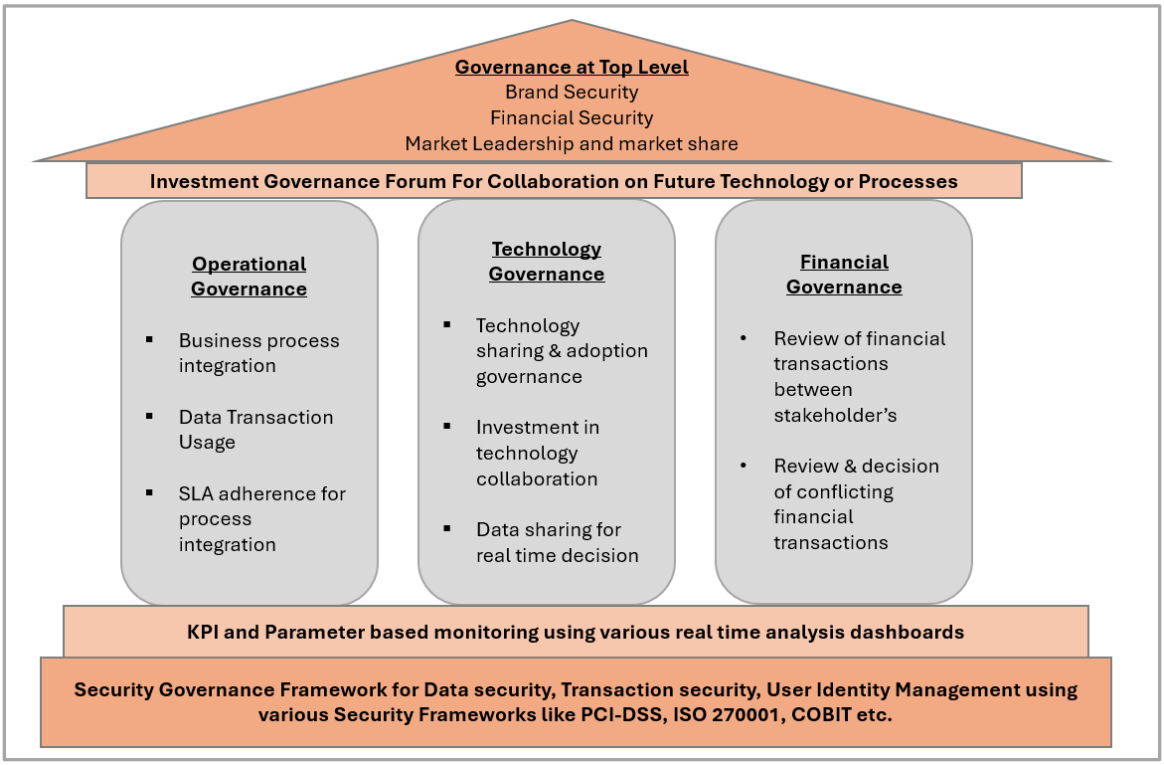
- Brand adoption governance: This would be a sensitive topic for governance as no e-commerce player would like to compromise on their brand value. Brand value will focus on aspects like customer loyalty, market outreach, product catalogue on offer and product quality etc. The e-commerce vendors or the partners would not like to come over situation where their brand value comes on stake and the customer loyalty shifts from one e-commerce vendor to another because of dissatisfaction.

  Brand governance would also be directly impacting financial governance as a decrease in the brand value would directly affect the collaboration quality and status. Hence it would be important to the stakeholders to define in the collaboration approach how brand value and brand security is protected for an organization.
- Market coverage governance: Along with brand security assurance, the e-commerce vendors and the supply chain partners will have a direct interest in the market coverage which will make them market pioneers or market leaders in their business area. There should be a governance forum which would distribute market coverage in a proper distribution ratio to all stakeholders depending on the investment contribution ratio, collaboration expenditure ratio and other tangible and/ or intangible contributions done to make the collaboration framework sustainable and successful.
- SLA & KPI governance: To ensure that the collaboration is efficient, smooth and effective, there has to be SLAs and KPIs defined and agreed. The agreed KPIs and SLA parameters should then undergo logging & monitoring, analysis, reporting and finally leading to decision making. The SLAs & KPIs would relate to business processes monitoring, technology adoptions monitoring and

would play a very meaningful role in deciding if the collaboration methodology is running smoothly or need to be made more efficient. Some of the KPIs for the business processes are defined by the research author but every collaboration organization/ stakeholder would need to define their own KPIs and SLAs to monitor, analyze and then decide for future course of actions. It should be noted that this is a very strategic step to ensure that every stakeholder is working on making the collaboration successful by adhering to the defined SLAs & KPIs.

Researcher proposes a collaboration governance model depicted as below:

Figure-82
Collaboration Governance Model



Source: Author

The above proposed collaboration governance model has three layers of governance:

- Core Base Layer Governance: This layer is the core horizontal layer of governance on which multiple governance structures will be placed. This core base layer will have two important governance playing a vital role which would be Security Governance Framework and KPI – SLA monitoring. The Security Governance framework will provide strong security practices using various frameworks like ISO270001, COBIT, PCI-DSS etc. extending security practices on Data and Business processes.

  At the same time, there would be another layer of governance structure which would deal with KPI and SLA adherence to business processes and technology adoption. There would be various dashboards which would allow the key decision makers to understand the various aspects of adherence to data and how to optimize the business process and data interoperability as well as interchange for efficiency and productivity increase.

- Vertical Tower Layer Governance: Researcher author suggests three verticals owning respective governance for Operations, Technology Adoption and Financials. The Operations governance would focus on how the business processes integration between various stakeholders is being managed and monitored. There would be SLA and KPIs dashboards to understand the success of business operations via integrated stakeholders.

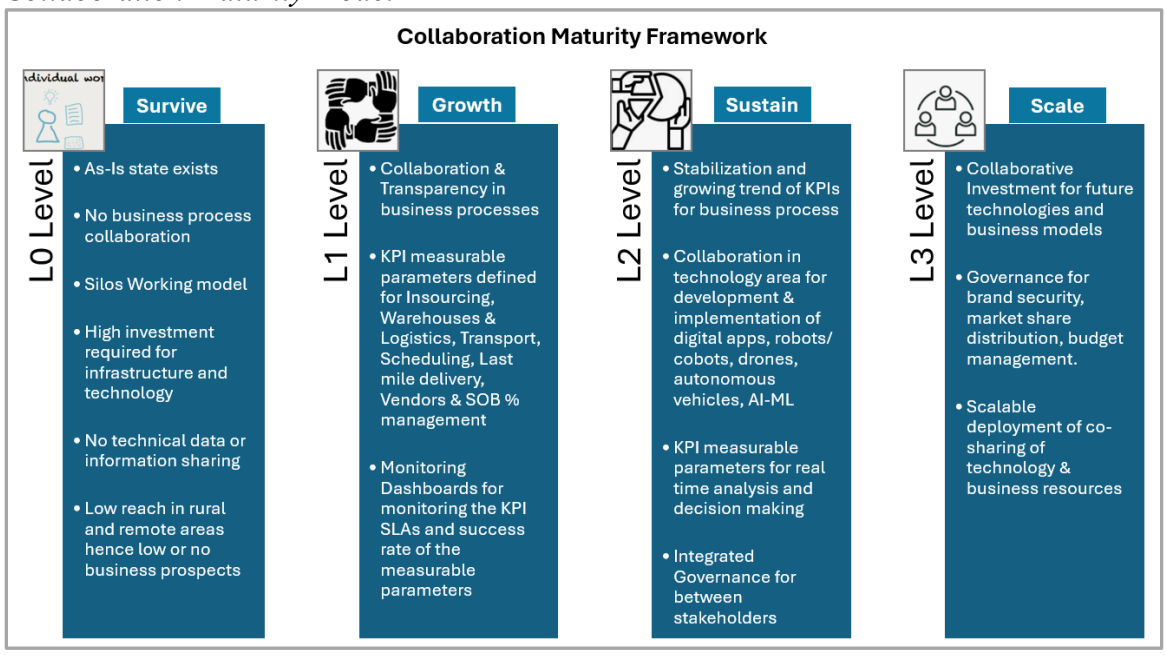
  At the same time in technology collaboration, the governance framework would like to observe how the technology adoption and sharing is done and used. This framework would levy special notice to how the data from various technology landscape are stored, reviewed and shared with other stakeholders. The technology governance also review the investment in the technology collaboration.

Lastly, there would be a financial governance model which would review the financial transactions between the shareholders & stakeholders. For any susceptive transactions this governance team would take a final call to clear it out.

- Top Layer Governance: The top layer of governance would focus on investment analysis from future technology perspective and the future collaboration within the same or different geographies. The top-level governance team would ensure that the various integrated-collaborated stakeholders do not land into brand threat and every brand is safe and secure. The top-level governance team would also ensure financial security of the stakeholders along with market share. The team would ensure that the top financial contributors in the investment or collaboration or research & development or process adherence gets the higher market share than others who are just using the services.

Researcher proposes a collaboration maturity model which emphasizes on collaboration maturity against different levels as shown in the picture below:

Figure-83
Collaboration Maturity Model



Source: Author

In this collaboration maturity model, researcher author divides the maturity levels into 4 as below:

L0 Level of Maturity: This level responds to the survival of the business stakeholders. In L0 level of maturity it is understood that the business stakeholders work in silos for as-is state. There are no collaborations, and every stakeholder is for themselves in terms of investments, research & development, challenges etc. Since there are no collaborations, the cost of operations are high, market reach is limited and technology adoption rate is low.

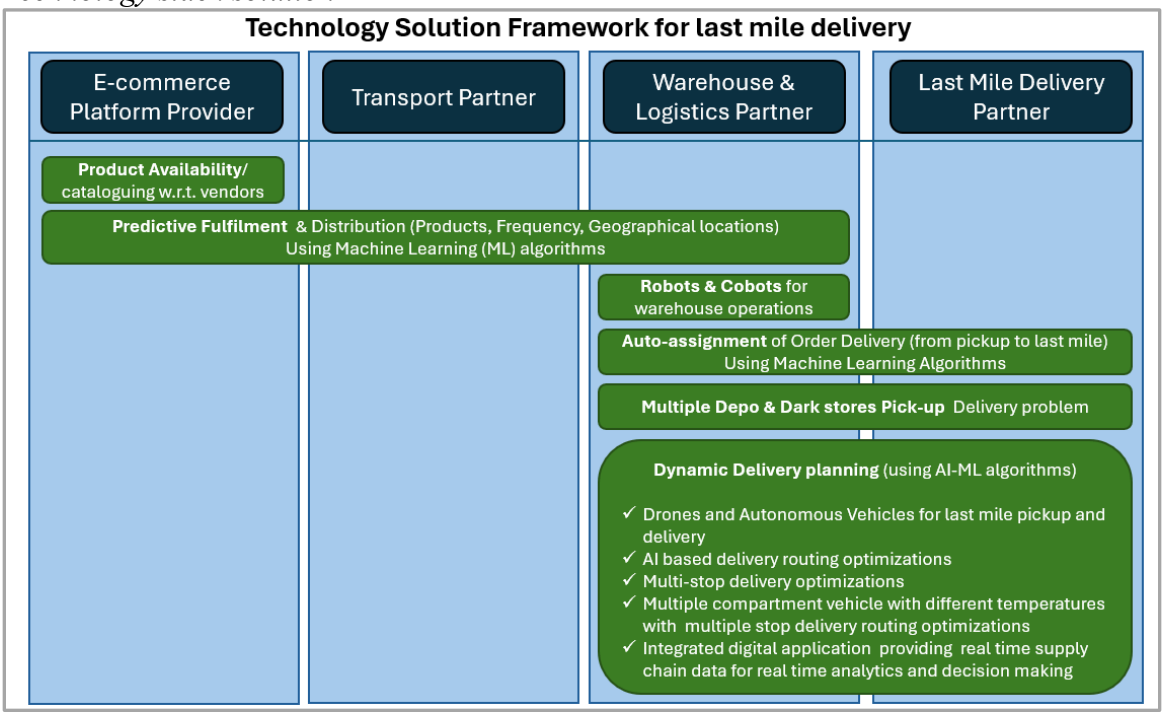
L1 Level of Maturity: This level of maturity is directed towards growth of the business collaboration. In L1 level of maturity collaboration starts forming between various supply chain stakeholders and they start easing out their pain areas by taking each other's support. The SLAs and KPIs are roughly designed, and they are monitored to make the basic needs of collaboration become a success.

L2 Level of Maturity: This level of maturity stress on sustenance of the collaboration. In L2 level of maturity, maturity scale index is high as compared to L1 level of maturity. There are more collaborations in terms of integrating business processes, data sharing between stakeholders, technology and know-how sharing between competitors & partners. There are KPI and SLAs which are more mature and have right monitoring for collaboration to reach its peak.

L3 Level of Maturity: This level of maturity takes collaboration to the next level, and it promotes the stakeholders of the collaborative governance model to scale it to other stakeholders who have not yet joined the collaboration engine wagon. At this level of maturity, the investments are planned for future visions, discussions are around how to manage brand security and market share of business (SOB). At this stage of maturity, it is taken for granted that the maturity model wheel will keep the system running clean.

To ensure that the above collaboration framework is successful, there is a need for a technology solution supporting the collaborative framework with technology stack – data sharing and best practices. The researcher proposes a framework depicting the technology to be adopted at various stakeholder's level. The proposed technology stack is as below:

Figure-84
Technology stack solution



Source: Author

Li E. et. al. (2011) introduces collaborative commerce as a means to integrate information from different integration touch points. It is very clear there would be two important technology spaces as below:

- Artificial Intelligence and Machine Learning (AI-ML) adoption for:
    - Machine learning algorithm to provide predictive analysis of products needed by online buyers and prepare to ship beforehand to nearest fulfilment center. For example: Amazon has developed a pre-shipping algorithm which can predict to a level of accuracy what can the customer demand based on his previous orders and searches.
    - Artificial intelligence and machine learning for implementing robots and cobots to assist in managing warehouse and logistics process.

- Machine learning algorithm for automated assignment of order pickup from a specific fulfillment center – assignment to a delivery resource (either a physical delivery person or an autonomous vehicle) based on best available one – optimized routing for delivery.
- AI-ML algorithms for delivery vehicle routing optimizations (VRO) as below:
  - Non-dominated sorting genetic algorithm II (NSDA-II) to find initial rider in the first stage.
  - Principal component analysis (PCA) algorithm fused with k-means to merge customer orders and generate initial delivery routing to solve vehicle routing problem (VRP)
  - Adaptive large neighborhood search (ALNS) to improve quality of initial solutions and finding optimal number of riders and final delivery routing at second stage.
  - Vehicle Routing pickup and delivery problem with time window (VRPDPTW) to optimize delivery based on three constraints: time window, capacity and coupling of pickup node of each request against delivery node in the same route.
  - Multi-compartment vehicle routing problem (MCVRP) to minimize number of trips taken by delivery vehicles in the same route.
  - Last mile delivery using drone integrated with delivery pickup from fulfilment center and delivering it at the requested address.

  Stamadianos T. et. al. (2023) has published two different papers where they talk about vehicle routing problems with drones, electric vehicles and a GRASP approach for energy minimization with electric vehicles.

- Integrated digital applications for real time data analysis based on:

- Order delivery sequence with optimized routing view
- Current location of the delivery boy(s)/ autonomous vehicle(s)
- Current weather conditions for a geographical location
- Current traffic conditions for a geographical location
- Current delivery status with optimized route information
- Dashboard stating any failure of SLAs or KPIs

6.3 Recommendations for Future Research

Researcher after doing his data analysis and documenting his views in this research paper, believes strongly, that this is a strong subject with potential to bring oprational efficiency, seamless tracking cadence, safety & security of delivey partners within quick commerce independent of any geographical location. He also believes that further researches should be carried out as below:

a. Since this research data was collected primarily from the questionnaires sent to the respective stakeholders of this research, and, all the questions were closed ended hence it did not provide any opportunity for the respondents to express their opinions on the various topics of this subject. Researcher stronly believes that there should be additional research to be done using the same category of stakeholders (not necessarily same respondents) where-in the responses should be backed by views/ opinions. In this way, a great amount of information can be extracted which will shed more light on operation challenges, technology need, business need, geography & terrain challenges etc. thereby providing a fresh view of further research to be conducted.
b. There should be research carried out on how co-sourcing and co-ownership model can be implemented between e-commerce vendors, warehouse & logistics partners, and,

last mile delivery partners so that operating model can be shared between every required stakeholder which certainly will:

- Reduce the cost of operations
- Bring higher efficiency in operations
- Develop localized vendors there-by createing more jobs in rural areas
- Adopt to technology advancements for better management and taking informed decisions

This part of research should be conducted keeping in mind to preserve the brand value and market leadership of all stakeholders who are part of the research.

c. A research from technology perspective should be carried out to deduce the effectiveness of the framework suggested by the researcher in section 6.2. Intent of this re-evaluation would be single out any sort of biasness in the framework.
d. There should be further research on 'collaboration commerce' framework and governance model (as described in Section 6.2) suiting to the current environment and legal policies and procedures as the previous ones are outdated and they do not cover the change of socio-economic behaviour of current populations.
e. Researcher recommends for more detailed research to be undertaken regarding how to implement the proposed collaboration maturity model (as displayed in section 6.2) within last mile delivery process.
f. Researcher also recommends detail research on integrating the AI-ML algorithms like NSDA-II, PCA, ALNS, VRPDPTW, MVVRP explained in section 6.2 so that an efficient vehicle routing & delivery optimization method can be derived to support the framework.

6.4 Conclusion

This research study presents the findings of online survey done with online buyers who are using various e-commerce platforms. Based on the online buyers survey analysis, the researcher concludes that:

a. There is a need of quick commerce, and it is supported by 64.5% of the respondents who not only are voting for quick commerce but also are willing to pay extra for quick delivery. This data supports the research theory of the researcher.
b. From the online buyers respondents data, there is a direct conclusion that some of the e-commerce vendors are global players while there are many small local geographical e-commerce vendors who also play an important role in last mile delivery. Apart from top 13 e-commerce vendors selected (based on share of business) there were 24 other e-commerce vendors, but with very less market share and hence they were not considered for further analysis.
c. It is observed from the e-commerce questionnaires and interviews that e-commerce vendors are owning end to end last mile delivery processes, however there are stages in the entire supply chain where-in partnership is established with the local geographical partners to serve online buyers better. However, it should be noted that at e-commerce vendor level, it is not co-sharing model but work package based revenue model.
d. From the questionnaires and interviews of warehouse & logistics, transporters and last mile delivery partners, they understand and practice the concept of co-sharing model and they have made changes in their business practices to invoke profits from such engagements. As per the responses, around 25% to 30% of the supply partners believe that they can have profit ranging from 5% to 30% while adhering co-sharing model.

e. On the technology front, it is evident that 100% of e-commerce vendors have been spending on the technology adoption and based on the need of time, they have been inducting various technology stacks in their business process for optimized way of working. It is also clear that all e-commerce vendors are high on adoption for real time data analysis and Artitificial Intelligence - Machine Learning programs.

During the research, there could not be found conclusive research to setup a complete framework supporting quick last mile delivery using co-sharing and co-ownership model, however, there were many individual research on supporting to solve individual problems like delivery routing problems with sliding time window, multiple compartment delivery routing problems, price sensitive inventory solving problems, on-demand delivery from multiple local partners etc. but no research has been done to integrate all these problems and provide a common framework.

Although the research does provide a basis of communized framework for adopting co-sharing/ co-ownership of physical resources and technology model but this research data is more inclined towards India geography and would need more research in future to make a generalized framework for the global economy and global economy supply chain.

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APPENDIX A

SURVEY COVER LETTER

For the online survey, the researcher had to send mails to the various e-commerce vendors and warehouse & logistics partners. All such mails had a cover letter requesting for audience for filling up the questionnaires. The mail content is pasted as below:

Hello <Name of the recipient>,

Through this mail I would like to introduce myself to you, as Praveen Kumar Mishra, a Doctoral Research Scholar with Swiss School Of Business Management (SSBM), Geneva, Switzerland, currently undergoing dissertation thesis preparation on the topic of bringing operational and cost efficiency in last mile delivery under e-commerce supply chain.

In this regard, I have already submitted my Research Proposal (RP) to the board and that has been accepted, provisioning me to write my thesis on the subject and submit my findings.

Having said so, I intend to explore an opportunity to integrate with you and request you to please participate in an online survey of around 25 questions which would not take more than 30 minutes of your time. The intent of the questionnaire is not to ask your personal details or opinions but to have some facts of the organisation which is public in nature and these responses will assist me to support my findings and complete my thesis.

To let you know more about me, I am an Indian professional with 25+ years of experience and currently employed with Volkswagen Group Technology Solutions India where I am heading Engineering Delivery.

I would be very thankful if you respond back to this mail or guide me to the best person who could respond to my questionnaire and I can send him the online survey link

which would allow me to complete my Global Doctor of Business Administration (GDBA) course from SSBM, Geneva, Switzerland.

Your's truly,

Praveen Kumar Mishra

Mobile: 8308824290

WhatsApp Number: 8308824290

An artifact of mail image sent is pasted below:

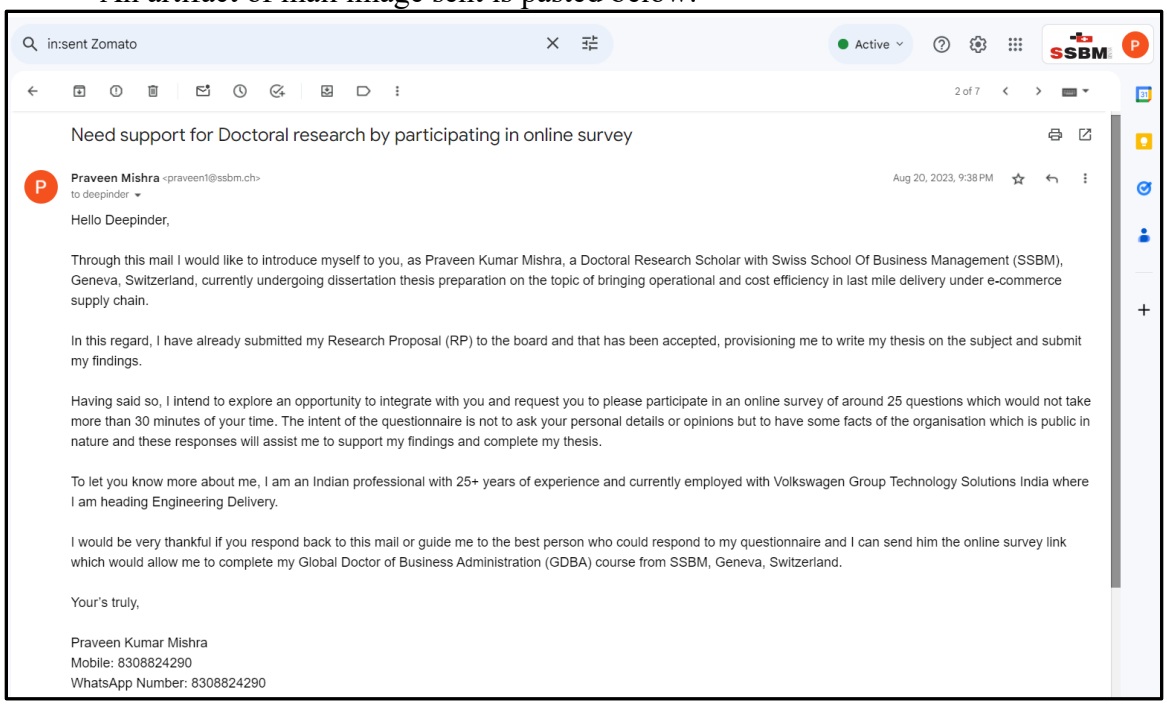

Figure-85
Mail Artifact for e-commerce supply chain players
Source: Author's Mail Image

At the same time, for the online buyer users, I had written a request on my linkedin to participate in the online survey, whose screenshot is as below:

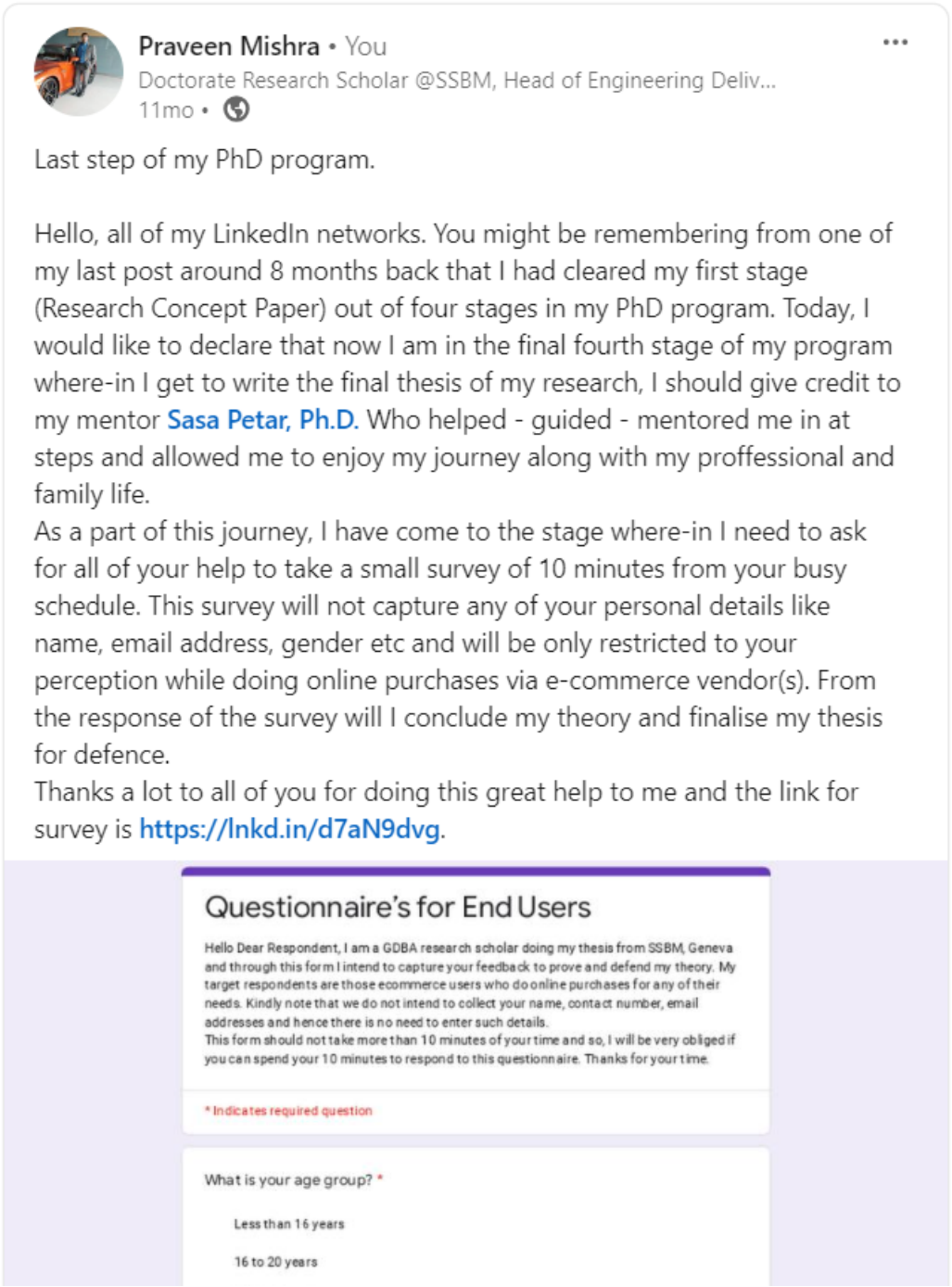

Figure-86
Invitation for online survey to online buyers
Source: Author's LinkedIn Image

APPENDIX B

INFORMED CONSENT

Researcher author, is also an employee of Volkswagen Group Technology Solutions, India (VWITS) and holding a position of Head – Engineering Delivery. Being an employee and using the organization name in the mails for various CxOs of the e-commerce vendors, warehouse & logistics partners and transport partners, it was imperative for me to take the informed consent from the Chief People Officer (CPO) and Head Delivery of the organization. Hence, researcher wrote to the CPO and Head Delivery and informed about the DBA program and the intended use of Volkswagen name, also assuring that the DBA program does not contradict or compete with the nature of our business. The consent was provided to the researcher after legally scrutinizing the DBA program, research practices and the mail content sent to various stakeholders of the research. Screenshot of the mail pasted below:

From: Mishra, Praveen (VWITS India I-GK-E) [redacted]
Sent: Monday, August 21, 2023 2:14 PM
To: [redacted]
Subject: Declaration of using Volkswagen name during my Thesis phase for my PhD (FYI)

Hello Soumi and Matthias,

As you both are aware that I am doing my Doctorate in Business Administration from Swiss School of Business Management (SSBM), Geneva, Switzerland.

I have to declare that I have come to the final stage of my PhD where-in I am writing the thesis and proving my theory. To prove my theory, I am having to host online survey to my stakeholders so that I can get data for my research. One of my stakeholders are CEOs/ CFOs/ CSOs/ CPOs of e-commerce companies and delivery partners involved in the e-commerce logistics, warehousing, fulfillment centers and last mile delivery. I have written mails to some CEOs (and I have to write more) requesting them to participate in this online survey.

Kindly note:

1. The online survey consists of one line where-in to prove my credentials I have mentioned that I have 25+ yrs of experience and I work for Volkswagen Group Technology Solutions as Engineering Delivery Head. This brings authenticity to my research and it certainly means that it is not a fake request.
2. The online survey does not mention anything about operations or data about VWITS or VW Group and my PhD is in e-commerce supply chain focused on last mile delivery which is not the operations of VWITS as an organization or part of VW group.
3. The online survey for CxOs is on-need basis survey and links are shared with only those whom the organization corporate communication allow. Hence this survey is not publicly available and is done using link which only I can provide post confirmation on mail.

This mail is just for your information so that I comply to the organization compliance.

Thanks a lot, and I am open for any queries you have.

Mit freundlichen Grüßen / With Best Regards,

Praveen Mishra
Sr. Department Head – Engineering Delivery (I-GK-E)
Volkswagen Group Technology Solutions India Pvt. Ltd.

Figure-87
Consent request from organization to use name
Source: Image from Author's mailbox

APPENDIX C

INTERVIEW GUIDE

{Sample Text Sample Text Sample Text Sample Text Sample Text Sample Text Sample Text }