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Examining the Emergence of Information Technology and its Impact on Third Party Logistics in Nepal

by

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The undersigned certify that they have read, and recommended to the Institute of Engineering for acceptance, a thesis entitled "**Examining the Emergence of Information Technology and its Impact on Third Party Logistics in Nepal**" submitted by Pravat Shrestha in partial fulfilment of the requirements for the degree of Master of Science in Technology, Innovation and Management.

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ABSTRACT

The thesis titled “Examining the emergence of information technology and its impact on third-party logistics in Nepal” explores the integration and influence of information technology (IT) in the context of the third-party logistics (3PL) sector in Nepal.

This study explores the increasing significance of IT in enhancing the overall performance, customer service, and operational efficiency of 3PL services in Nepal's logistics industry. It aims to shed light on how IT is transforming logistics and customer experience within Nepal's unique infrastructure and socio-economic context. This will be achieved through a detailed examination of technology adoption, system integration, and industry practices.

This study tries to highlight status of third-party logistics in Nepal, IT tools currently they have adopted in their daily operations. This research provides information about current major IT tools required for 3pls and how these 3pls are chosen by clients and customers and what IT tools and other criteria to focus on for competitive advantage. Additionally, this study showcases the challenges the 3pls are facing while integrating tools and the opportunities that exists in this logistics market in Nepal.

In addition to these findings, this study highlights the impact of IT tools in 3pls, how it helps them to keep track of the logistics process, improve customer experience and increase customer retention and provides competitive advantage over other 3pls.

These findings enhance our knowledge of the 3PL industry's changes brought about by IT and offer insightful advice to stakeholders on how to best utilize technology to their advantage and achieve long-term growth in Nepal's changing logistics landscape.

***Keywords*:** logistics, third-party logistics, Information technology, IT tools, 3pl industry, Impact of IT tools, third-party logistics in Nepal

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ABBREVIATIONS

3pl: Third party logistics

IT: Information Technology

LSP: Logistic Service Provider

USD: United States Dollar

WMS: Warehouse Management System

TMS: Transport Management System

EDI: Electronic Data Interchange

AI: Artificial Intelligence

LPI: Logistic Performance Index

LIST OF TABLES

CHAPTER ONE: INTRODUCTION

1.1 Background

Logistics is described as the movement or transportations of goods and services from one location to another. It is the process of managing resources to manage how goods are transported or stored and delivered effectively and efficiently. It the most crucial and complex operations for any organizations that require movement of goods in order to reduce costs, maintain efficiency along with customer satisfaction. Currently, with exponential growth of ecommerce and online shopping, logistics has become integral part of global supply chain process that involves function from inbound, outbound, warehousing, inventory management to demand planning. (McClure, 2023)

Information technology is the solution that use computing resources to facilitate the handling of information by organising, storing and classifying in an easier way for the user so that they can make intelligent use of this information. A huge advancement has already been happening in all types of industries and logistics and supply chain is no exception. Recently, the logistics and supply chain industry has seen a massive revolution with the emergence of Information Technology. This integration of technologies in logistics has made greater impact in making processes dynamic, agile and generating real time data for efficient and transparent operations enhancing customer experience.

When an organization or a company uses external partner to manage and perform the logistics operations, that external partner is referred as third-party logistics or 3PL. These operations may include movement of parcels or packages, warehouse and inventory management that helps the providers in reducing cost and increasing efficiency for better customer experience. Due to rise in ecommerce and globalization, 3pls have seen substantial growth and with advancement of technology has smoothen the logistics processes of these third-party logistics. (Gordon, 2021)

Logistics and supply chain management in Nepal, have also been significantly impacted by this digital revolution. Nepal's logistics sector is crucial for facilitating trade and business by connecting the country to its neighbours and the global market. As Nepal strives to increase its economic growth and trade competitiveness, it is crucial to examine the implications of information technology on the Third-Party Logistics (3PL)

1.2 Statement of a Problem

The quick development of information technology (IT) has significantly altered several businesses, including the logistics sector. Understanding the amount of IT adoption and the subsequent effects it has on various aspects of logistics operations and customer satisfaction is crucial in the context of Nepal's Third-Party Logistics (3PL) industry. It is crucial to thoroughly investigate the difficulties, possibilities, and results connected with the integration of IT solutions inside the 3PL framework as Nepal's logistics landscape continues to change. By examining the advent of IT in Nepalese 3PL, its impact on logistics procedures, customer satisfaction, and the overall implications for the industry's growth and competitiveness, this thesis seeks to close the knowledge gap.

1.3 Research Objectives

1.3.1 Main Objectives

To examine the emergence of Information Technology and its impact on Third party logistics(3PL) in Nepal.

1.3.2 Specific Objectives

- To assess current situation of Information technology in Third party logistics of Nepal
- To identify opportunities and challenges faced by logistics company of Nepal in adopting and implementing the technology
- To investigate and evaluate the impact of IT in logistic services on customer satisfaction, real-time tracking.

1.4 Significance of Study

This paper offers several important implications for various stakeholders involved in Nepal’s logistics system. It provides information of opportunities and challenges associated with adoption and integration of technologies and enable them to streamline the operations and improve the existing services.

Also, this study can contribute to impart knowledge regarding impact of information technology in logistics organization in developing countries. It can be a representative study to discuss transformation of logistics and supply chain through information technology in economically emerging and developing nations.

1.5 Scope and Limitations of the study

The Third-Party Logistics sector in Nepal and the use of information technology in its operations will be the major agendas of this thesis. The study will examine how IT affects customer satisfaction, supply chain effectiveness, and overall business performance.

Other areas of logistics, such as first-party logistics and in-house logistics operations, will not be covered by the study. Additionally, due to resource limitations, it may not have been possible for the research to examine the perspectives of all 3PL businesses in Nepal so only logistics service providers (LSPs) working for e-commerce are eligible for this study thus the results may not be entirely generalizable to other areas or nations.

This study intends to offer useful insights that can open the door for sustainable growth, increased competitiveness, and improved customer experiences by evaluating the rise of Information Technology in Nepal's Third-Party Logistics sector.

CHAPTER TWO: LITERATURE REVIEW

2.1 Evolution of Information Technology in Global Logistics

With the advancement of digitization and information technology, integration of these technologies in logistics and supply chain is in rising. As industry 2.0 paced towards industry 4.0, it impacted logistics operation and services as well and added advanced approach to logistics management (Askın Özdağoğlu, 2022). Initially, logistics or logistics 1.0 was related to military application only, but in 1960s when industry 2.0 opted for mass production, it required cargo handling. This automation and evolution in logistics field was then referred as logistics 2.0. Mohammad Ezzat and colleague also pointed out that during that time companies and businesses started to manage and coordinate physical flow inside and outside of organization which involved procurement, sourcing that includes coordination with vendors, suppliers. They also confirm that after fourth industrial revolution introduced new scope in logistics. It primarily focused on digitalization and adopt information technology to provide real time tracking and transparency in process of all functions, data-backed decision making and convert traditional logistics process to smart logistics process (Ezzat & Sally S Kassem, 2019). In this global market, adopting technologies has become competitive advantage in terms of reducing cost, improve customer experience and increase efficiency (Aeologictech, 2022). The integration and needs of digitization triggered more in covid pandemic period where e-commerce boomed, and people were looking for online delivery for all kinds of products and services. Thus, to survive need of these technologies is inevitable.

The world bank developed a useful tool to measure the country's performance in logistics. They have set certain criteria and KPIs to benchmark the logistics performance of different country. These indicators include:

1. Efficiency of clearance procedure by border control including customs
2. Quality of infrastructure for trade and transport availability
3. International shipments competitive pricing capability
4. Competent and quality logistic services
5. Tracking and tracing system
6. Delivery of shipments on promise time

Logistic Performance index (LPI) is calculated on these six dimensions via weighted average of each score of each dimension. (The Worldbank, 2023)

Table 2.1 Top 30 Global logistics Performance Index (LPI) (Source: lpi.worldbank.org)

Country	Year	LPI score	Ranks
Singapore	2023	4.3	1
Finland	2023	4.2	2
Denmark	2023	4.1	3
Germany	2023	4.1	4
Netherlands	2023	4.1	5
Switzerland	2023	4.1	6
Austria	2023	4	7
Belgium	2023	4	8
Canada	2023	4	9
Hong Kong SAR, China	2023	4	10
Sweden	2023	4	11
United Arab Emirates	2023	4	12
France	2023	3.9	13
Japan	2023	3.9	14
Spain	2023	3.9	15
Taiwan, China	2023	3.9	16
Korea, Rep.	2023	3.8	17
United States	2023	3.8	18
Australia	2023	3.7	19
China	2023	3.7	20
Greece	2023	3.7	21
Italy	2023	3.7	22
Norway	2023	3.7	23
South Africa	2023	3.7	24
United Kingdom	2023	3.7	25
Estonia	2023	3.6	26
Iceland	2023	3.6	27
Ireland	2023	3.6	28
Israel	2023	3.6	29
Luxembourg	2023	3.6	30

The main aim of this index is to assist countries to identify their status in global market, challenges and opportunities they are facing in this global trade logistics and areas of improvement to improve this index. Nepal has not made into the list of 160 countries as we have complicated customs procedure and not very competitive logistics infrastructure.

With growing time, the level of knowledge of logistics has developed as well. Weber (Weber,2002) has identified four maturity stages which was examined empirically by Weber and Dehel and by Wallenburg. First maturity stage implies the transportation, handling and storage services for the movement of goods and materials efficiently and effectively. This stage was observed first in 1950's when the market shift from suppliers to buyers which demanded improvement in materials flow to be competitive (Cahill, 2006). Second stage matured when the world was facing inflation and stagnation of economy of companies which seek competitive initiative and thinking to stay in the market. They realised that with improved coordination of material flow from inbound to outbound to distributor, efficiency can be elevated. Coordination of lot and batch sizes, just in time concept can be some of the examples during this stage. (Cahill, 2006). Third stage maturity was required due to change in market environment from globalization, short product life cycle, quality focus of customer demands which trigger the necessity of logistics to change from functional concept to strategic management concept to reduce complexity to succeed in this changing environment. With market pressure for optimization of potentials, fourth stage of maturity arose. This stage focuses on the concept to include upstream and downstream partners in supply chain and was the reason to realise the importance of logistics outsourcing in business. (Cahill, 2006)

Logistics outsourcing has been seen as very important concept in business practice for developing competitive advantage. The concept of logistics outsourcing is when a company outsource the logistics processes to other firms to carry out its logistic activities effectively and efficiently.

The advantages of logistics outsourcing can be but not limited to following points:

- Reduction of logistics cost
- Improvement of logistics performance
- Reduce complexities of business process of a company
- Optimised asset use
- Logistics flexibility
- Reduce investment in manpower for better logistic skill (Deepen, 2007)

There are currently five types of logistic service provider that can be distinguished. They are carriers, couriers & express & parcel(postal)(CEP), freight forwarders, third party LSPs(3PLs) and fourth-party LSPs(4pls). A carrier is a business or individual who has the legal authority to move products by land, water, and air. In most cases, the carrier collaborates with shippers to move products from one location to another. CEP refers to postal and logistical firms that specialise in moving products that are relatively light in both weight and volume, like letters, small packages, paperwork, or small objects. Freight forwarders are the mediators between suppliers and buyers of transportation services. Mostly they carry out transportation planning and management of information system. Contrary to aforementioned LSPs, 3PLs are contractual LSPs that provide logistics services to customers from order handling to fleet management. Globally, third-party logistics market was estimated to be USD 1.10 trillion in 2022, and it is estimated to reach USD 2.43 trillion by 2032, growing at a projected compound annual growth rate (CAGR) of 8.25% from 2023 to 2032. In 2022, the U.S. third-party logistics market was estimated to be worth USD 219.4 billion (Precedence research, 2023). With the rise of e-commerce and trade activities, 3pl market attained USD 1.10 trillion in 2022. Covid-19 pandemic also played major role in uplifting e-commerce where it called for innovation in technology and logistics. This rapid advancement in technology is expected to assist further in increase the market in coming years (expert market research, 2023)

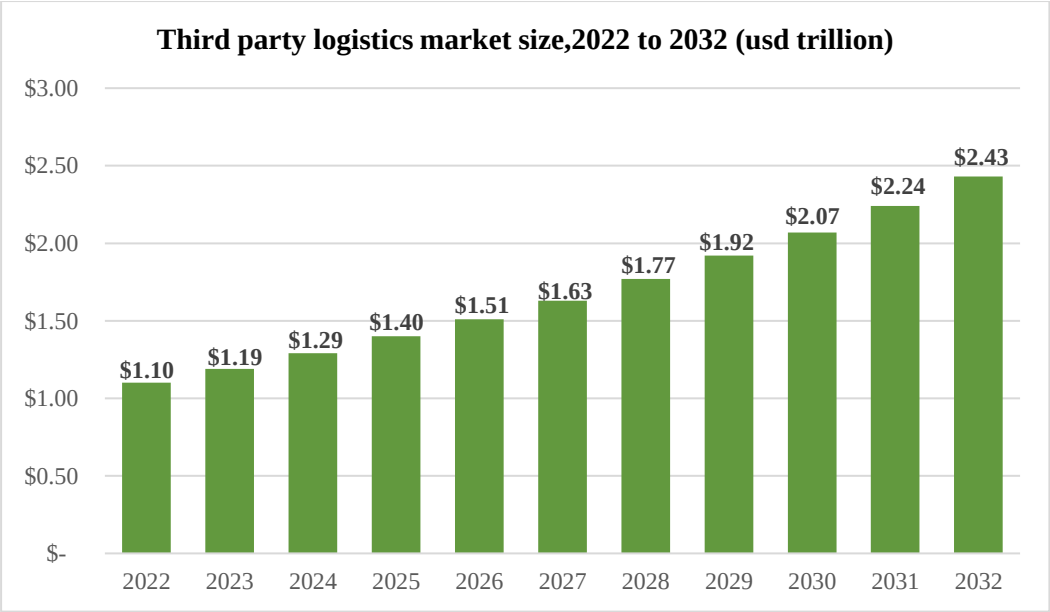


Figure 2.1 3PL market size trends and estimation (Source: www.precedenceresearch.com)

This shows that 3PLs should be treated as a distinct business due to its magnitude and the demands placed on logistics that are different from those of more basic services like public warehousing or transportation. (Berglund, Laarhoven, Sharman, & Wandel, 1999)

2.2 Different types of Logistics model

There are various types of 'party logistics operating worldwide from 1PL (First party logistics to 6PL (and beyond) (Reid, 2024).

1PL: 1PL or First party logistics refers to the logistics model where a company itself manages its own logistics operations from transportation, warehousing and distribution. The company has full control over its supply chain and logistics process.

2PL: 2PL or Second party logistics refers to a logistics service that only is responsible for transportation function and does not provide other logistics solutions. They are the subcontractors often called forwarder as their main business is transportation.

3PL: 3PL or third-party logistics includes outsourcing part of supply chain. These include warehousing, storing, transporting and distribution. These are the most outsourced elements of the supply chain. They help to make the operation smooth, simpler and cost effective.

4PL: 4PL or Fourth party logistics is a higher version of 3pls that will optimize supply chain by leveraging technology and data analytics. There may not be much difference between 3pl and 4pl but 4pl provides better optimization and coordination of the logistics process with single point of contact and better analysis.

5PL: 5PL or Fifth party logistics involves controlling the entire supply chain from beginning to end with the focus on technology. They try to maximize efficiency by implementing IT solutions and ensure real time visibility, route optimization and other solutions.

6PL: 6PL or Sixth party logistics concept is to fully integrate and automate supply chain solutions with artificial intelligence. With the application of AI, it is expected to give huge technological advancements to logistics solutions. As of now there are not many companies offering this solution (Manoj, 2023).

2.3 First mile, Middle mile and Last mile in Logistics

Figure 2.2 First mile, middle mile and last mile logistic process flow (Narayan, 2020)

Normally, the first mile is the first stage of logistic process flow. It is the initial stage of logistic process where materials and goods are transported from suppliers or manufacturers to the carrier's warehouse or distribution center. It is a major part of logistics process as it defines the timeline for delivery process and delivery experience. This stage consists of pickup scheduling, goods consolidation (Innovative Logistics University, 2023).

Middle mile is the stage where goods and materials consolidated from first mile are stored in the warehouse or distribution center where they are sorted and ready for the last mile terminal.

Last mile is the final stage of the delivery process, which is the buyers or customers. This is the stage where goods and materials transported from middle mile are distributed among last mile distribution center or last mile hubs which are then ultimately reached to the customers or buyers' location. It is the most crucial and challenging stage of logistics process as it involves navigation to complex location of buyers, delivering to multiple location with proper delivery route plan optimization (Innovative Logistics University, 2023). This is the main stage where logistics come in contact with buyer and impacts customer experience directly and realize customer demands and expectations. Thus, improving customer experience and logistic competence depends

majorly on the last mile services and experience provided by logistics service provider. As it is the most expensive stage of logistic process, this while stage is often outsourced to other LSPs, or certain portion is outsourced, and others are performed by inhouse logistic service provider.

2.4 Estimated delivery time and its calculation

Estimated delivery time is the projected time assuring customers or recipients that their parcels and items will get delivered or attempted for delivery before or during that time. For instance, customers may be told that their parcels will be delivered 2 days after they place the order, and this 2 day is the estimated delivery time. It is a crucial aspect for any 3pls as it helps customers plan and manage their packages better and improves 3pls delivery success.

The survey showed that compared to delayed deliveries without an estimated delivery time, delayed deliveries with estimated delivery time has 76% fewer contacts meaning it makes customer aware of their expectations and improve customer experience (Australian Post, 2021). Another survey on ecommerce also showed that 22% of carts get abandoned due to long estimated delivery time (Hotjar, 2024). Hence calculating estimated delivery is crucial.

Estimated delivery time normally is affected by the nature of shipping methods, origin and destination regions, and the time it takes to cover the logistics process from package collection from source to the delivery at the destinations (TrackingMore, 2024). The logistics process is broken down and each stage lead time is calculated. How long it takes for package to be collected from the source or manufacture, how long it will be on transit, how long it will take for 3pls to pick from their clients or stakeholders and can be send to their distribution center and how long it will take for the packages to be attempted to the customer for delivery. All these stages lead time is calculated and certain delivery time is estimated for the customers.

2.5 IT Trends in Logistics industry in Nepal

There has been a digital transformation in global logistics trend by adopting various technologies like Artificial Intelligence (AI), Robotic process automation, blockchain, fleet management system and finding effective solutions and improving customer satisfaction worldwide. (Shevchuk, 2023)

Logistics around the world is embracing digitization and adopting various information technologies to automate and improve their logistics operations at all stages of the logistics processes, from order fulfilling to tracking to final delivery to customer. In today's context, many logistics companies are inclined to digitization because of following advantages:

- Aids efficiency.
- Better visibility.
- Reduce logistic cost and waste.
- Elevate customer experience.
- Enhance sustainability. (Cejudo, 2023)

The use of digitalization in logistics further enhances the functionality of solutions, enables real-time administration of massive volumes of data through Internet of Things applications, and makes use of simulation techniques to make decisions in real-time. Naturally, these adjustments will have a big impact on how the labor market, the economy, and competitive conditions all work. (Illés, Varga, & Czap, 2018).

The aftermath of evolving global supply chain has reached Nepal too with international trade being one of the main aspects of global supply chain. With international logistics company like Aramex, DHL operating, Nepal's logistic sector has seen adoption of IT for logistics operations by international and local logistics company. According to Nepal Trade Information, Ministry of Industry, Nepal has moved to one-stop window to provide transparency and information of import, export and in transit through Nepal by integrating trade procedures between Department of customs and other stakeholders involved in international trade. (Ministry of Industry, Commerce and Supplies, 2023).

2.6 Challenges and Opportunities in IT Adoption for 3PL in Nepal

The booming of ecommerce and online shopping business has demanded growth in logistics in Nepal. Internet penetration in Nepal is at around 51.6 percent while 41 percent is in social media (Ministry of Communication and Information technology;Frost & Sullivan, 2019) and 9% shop online (Redseer, 2021) which will continue to rise. This consequently impact positively the growth of conversion to ecommerce, it is estimated that revenue of e-commerce will be at US$1,012.6 million by 2023. (ecommerceDB, 2023). Thus, there lies opportunities for the adoption in

logistics to provide transparency and give better services to customers. But there also are challenges associated with adoption of IT. Though digital literacy is in increasing trend, lack of proper and economical IT infrastructure as well as digitally sound professional scarcity brings reluctance from logistics company.

2.7 Impact of IT on Logistics Operations Efficiency and Performance

The integration of Information technology is to bring improvement in efficiency and performance of logistics operations. Achman Wildan and Mahendrawathi on their study validates that the information technology has a positive impact on customer sensitivity through information sharing and supply chain integration (Nabila & Mahendrawathi ER, 2021). Mahshid Mashregi and his colleague shows that there is positive effect of information technology in the effectiveness of supply chain performance and the operation is effective with better flexibility (Mashregi, et al., 2018). Kalkan also showed the relationship between IT use by logistic firms, business firms and customer satisfaction and found them to be positively related (Kalkan, 2018).

King Lun Choy, Hoi Yan Lam and colleagues suggested from their findings that IT implementation enhances quality of service of logistics service provider directly and improves existing quality consequently creating competitive advantage in this global market (Choy, et al., 2014). The objectives of any logistics service provider is to provide services that include on-time service delivery, prompt response to inquiries, correct information storage and delivery, capacity for problem-solving, fulfilment of commitments (Stank, Goldsby, Vickery, & Savitskie, 2003). Accuracy, timeliness, information quality, customer focus, order quality fulfilment of promises, and order discrepancy handling responsiveness are all critical components of the job of IT and this competitive advantage ensures customers happiness and increases customer retention.

2.8 Customer Expectations in the Digital Age

Due to the globalization of the market, many businesses find it difficult to maintain customer expectations in today's unstable business environment. Customers can choose from a wide range of options and information readily available to them in the digital age. Consumers anticipate smooth, customized, and effective business encounters. Customers' requests for digital technology to improve, expedite, or mediate their in-person shopping experiences are becoming more and more prevalent (Digital4Business,

2023). Customer satisfaction is the degree at which organizations can meet the expectation of customers from their goods and services.

Customers now prefer not just convenience and speed but also a personalised shopping experience (AJOT, 2023). Customers frequently demand high-quality logistical services throughout the entire purchasing process, from information search to order placement to delivery to pick-up and return. On-time delivery, adaptability, tracking deliveries in real-time, dependability, addressing order discrepancies, having enough pick-up locations, and return management are common examples of quality traits (Cheah, Lim, H. Ting, & Quach, 2020).

With customers demanding thorough customer services, businesses need to make every possible effort to provide a top-notch experience (issuetrak, 2017). Logistics company must step up more than ever with the digital revolution globally, flourish of ecommerce, significant change in customer shopping experience This has compelled logistics company to adopt digitization and information technologies.

In Nepal, where the logistics sector is rapidly growing, there is strong potential for adoption and integration of information technology in third party logistics company. Although there exist problems in digital literacy and IT infrastructure, the sector's growing use of electronic platforms (Ministry of Communication and Information technology;Frost & Sullivan, 2019) shows a readiness to accept IT-driven services.

2.9 Different 3pls active in Nepal

With the advancement in technologies and growth of social ecommerce as well as other ecommerce platform in Nepal, it has elevated high demand for development and founding of different logistics partners. Various international and domestic logistics industry has seen scope in Nepal and thus has been competing to make the logistics industry better for the country. Some of the active and popular domestic logistics company currently operating in Nepal are Nepal Can Move, Pick and Drop, Total Logistics, Everest Logistics, Upaya, Dash Logistics etc. **Nepal Can Move** x1is a national logistics and courier company operating across Nepal. It is backed by the Australian technology conglomerate “The Can Brand.” Nepal Can Move aim to provide fast, secure and reliable logistics services by infusing global best practices and innovative technology in operations (Nepal Can Move, 2024). **Pick and Drop** logistics company, launched in April 2020 during Covid period, is one of the rapidly growing

logistics companies that offers delivery services throughout the country using their own branches and partner courier networks. They provide efficient delivery services with technology platform that enables clients to track their packages (Pick N Drop, 2024). **Upaya Logistics** is a technology-driven logistics service provider operating in Nepal that offer comprehensive logistics service including inter-city and intra-city deliveries. They aim to optimise logistics industry through wide range of technologies like real-time messaging and tracking, mobile technologies, data analytics and so on and plans to improve operational efficiency, reduce costs and enhance customer satisfaction (Upaya, 2024). **Dash Logistics** is a domestic logistics company that wants to enhance logistics operations across country. They provide real-time tracking system that utilizes GPS to monitor delivery process and unlike other logistics companies that start rates from 1 kg, Dash offers charges from half a kilogram which is beneficial for businesses with light-weight parcels. Dash Logistics targets for the fastest delivery and improve customer satisfaction (Dash Logistics, 2024). There are other various 3pls which have not been discussed here but actively contributing to the logistics sector of Nepal. These local logistics companies may or may not have necessary technologies and tools to provide logistics services but these all 3pls wants to have their own competitive advantage and realises or should realise technology and infrastructure as a crucial key in providing them these advantages. This literature study offers the base for the other chapters of this thesis and provides the framework for examining how Information Technology is affecting Nepal's logistics scenarios.

CHAPTER THREE: RESEARCH METHODOLOGY

This chapter describes research design, data collection methods, sample selection and data analysis techniques used to examine the emergence of Information Technology (IT) and its impact on Third party Logistics(3PL) in Nepal.

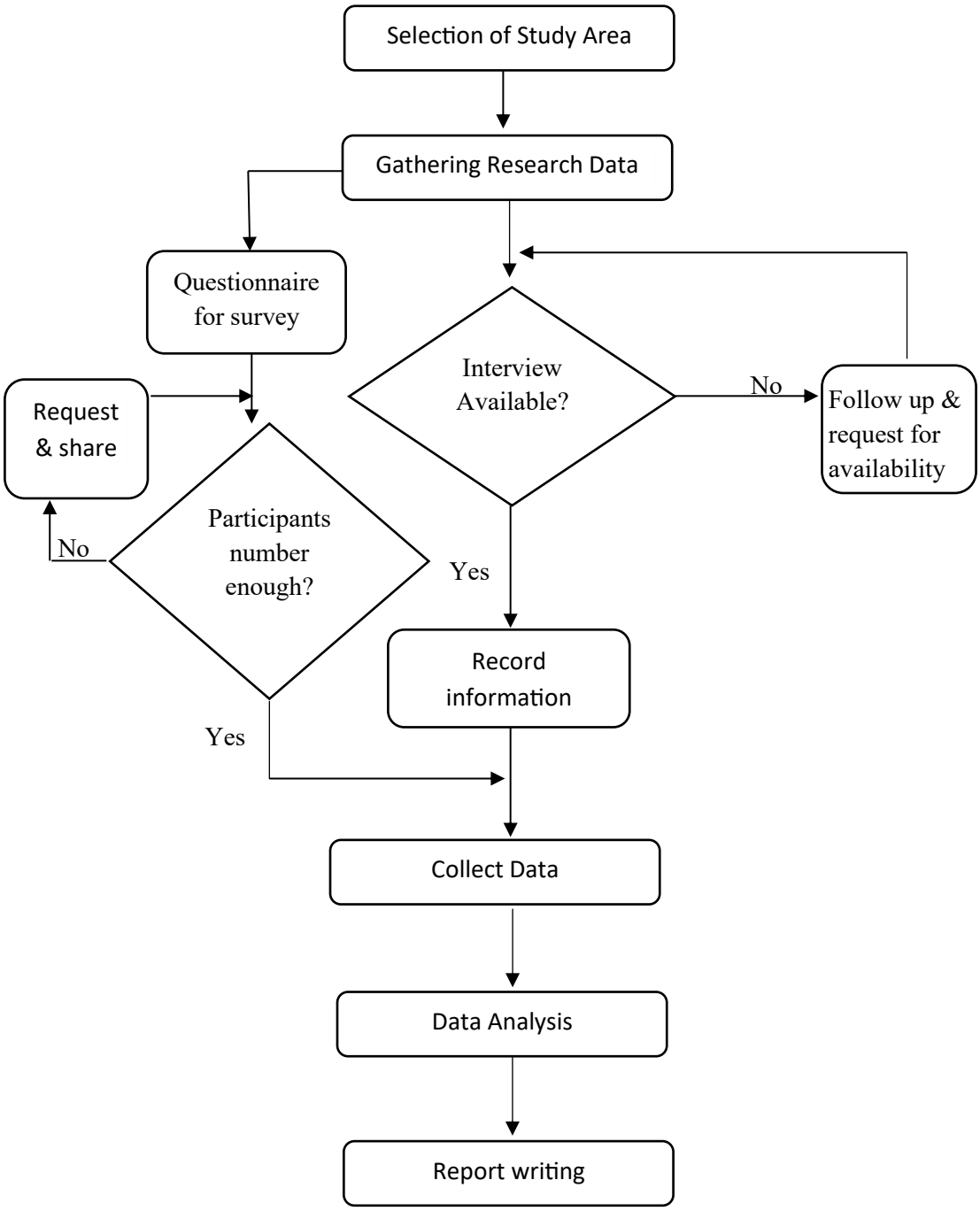


Figure 3.1 Research Design

3.1 Selection of Study Area

This research major topic of study was logistics in Nepal and the third-party logistics that are active in this market. This study main objective was to understand the current state of third-party logistics in Nepal, the challenges they are facing and the opportunities they want to grab for their growth and the information technology they currently have and how it has impacted their day-to-day operations.

This study focuses on some of the popular and active third-party logistics provided from the survey by the customers/clients that are involved with ecommerce and social commerce business. This study will explore their status, IT tools they have integrated and challenges they are facing in their logistics processes.

3.2 Gathering research data

This research adopts both qualitative and quantitate methods to enable comprehensive understanding of IT adoption trends, challenges and impact on Nepal's third-party logistics. Qualitative data is collected through interviews and discussions with key industry stakeholders, while quantitative data is gathered through surveys distributed among logistics companies.

3.3 Data collection Methods

The study will be conducted for third party logistics operating Nepal and prioritising those 3pl that are involved in last mile delivery for e-commerce and online business where they have huge customer database and data visibility is easy to obtain and analyse.

3.3.1 Qualitative Data Collection

Interview and discussion with key industry stakeholders, questionnaire with logistics partners to know about their perceptions, experiences and challenges related to IT integration in logistics operations.

3.3.2 Quantitative Data Collection

Survey will be shared with logistics companies with questions about the extent of IT adoption, types of technologies implemented and its impact on supply chain and customer satisfaction.

3.4 Data Analysis Techniques

For this study, purposive non-random sampling is used. Purposive sampling is a subjective sampling where researcher with their own judgment select participants for the survey as a part of a population. Normally, researcher have prior knowledge about the purpose of a study so they can properly choose the eligible participants (Nikolopoulou, 2022). Since it is cost-effective and faster, so this method was used for this study.

Approximate sample size for the population of 500000 (based on the internet penetration and percentage of people that shop online) (Redseer, 2021) was calculated for this study using following formula:

$s = X^2 NP(1-P) / (d^2 (N-1) + X^2 P(1-P))$ (Krejcie & Morgan, 1970)

s = required sample size and d = the degree of accuracy expressed as a proportion (0.05)

X^2 = the table value of chi-square for 1 degree of freedom at the confidence level of 95% i.e., 3.841

N = the population, P = the population proportion (assumed 0.50 for max sample size).

$s = 383.806$, $s \approx 384$

This study will be based on primary source of data. Two types of questionnaires have been prepared: one for third party logistics stakeholders and another for customers survey. First one shared with the 3pl stakeholders will be compiled and analysed using thematic analysis to identify recurring patterns regarding IT adoption, challenges and its impact on their performance. While another will be surveyed with customers for their feedback of using IT tools and systems while taking the service from the logistics service providers. The feedback of customers will be measured on Likert scale which is a 5-point scale normally used in a survey that includes 1= strongly disagree, 2= disagree, 3= neutral, 4= agree, 5= strongly agree levels of agreements and disagreements IT tools. This feedback then will be analyzed using statistical tools like python and excel to show the relationship of customer satisfaction with IT tools used by the 3pls.

Two hypothesis was formulated to provide evidence and to evaluate the impact of IT integration in third party logistics in Nepal.

3.4.1 Hypothesis development

To understand the relationship between IT adoption by third party logistics in Nepal, two hypothesis was developed.

Hypothesis 1:

Null hypothesis (Ho): The implementation of real-time tracking system in third party logistics in Nepal has no effect on accuracy of delivery time estimates.

Alternate hypothesis (H1): The implementation of real-time tracking system in third party logistics in Nepal has significant impact on accuracy of delivery time estimates.

Hypothesis 2:

Null hypothesis (Ho): The implementation of real-time tracking system in third party logistics in Nepal has no effect on customer satisfaction.

Alternate hypothesis (H1): The implementation of real-time tracking system in third party logistics in Nepal improves customer satisfaction.

For hypothesis 1, different 3pls currently available for customers were grouped in two groups based on the availability of real time tracking system and from the data of estimated delivery timeline and actual delivery time, accuracy of on time delivery was calculated. These data are provided by various 3pls and with the data available, mean and standard deviation for two groups were calculated from total sample size of 191 each. From these means and standard deviation, independent samples t-test was performed to calculate t-static which is then compared with critical t-value for significance level (alpha) of 0.05 and degrees of freedom. Additionally, p-value was also calculated, and decision was made by following criteria:

- If the value of t-statistic > critical value, reject null hypothesis (Ho)
- If the p-value < alpha, reject null hypothesis (Ho)

Python and excel tools were used to get the result and correct decision was accepted which is then interpreted accordingly.

For hypothesis 2, from the survey data on customer satisfaction rating was collected related to availability of real time tracking system. To assess this hypothesis, 3pls were grouped based on availability of real time tracking system and like previous hypothesis, with means and standard deviation from each group, two-sample t-test was performed. And t-static was calculated to be compared with t-value at significance level of 0.05. Like the previous hypothesis, based on two criteria, one hypothesis was rejected, and the other was accepted with correct interpretation.

CHAPTER FOUR: RESULTS AND DISCUSSIONS

4.1 Current State of Information Technology in logistics in Nepal

For the study, third party logistics associated with e-commerce were considered. Top 3pls were selected and segregated based on the integration of Information technologies they currently have. Some of the main types of information technologies adopted in logistics are:

1. **Barcoding:** A barcode is machine/computer readable codes that helps to represent data or information to identify product, packages or person (Tech Target contributor, 2022). Using barcode in logistics helps to save time and improve accuracy in package handling and eliminates manual work of entry and input of details in the system. This automatic identification technology is used to capture delivery information when packages move from one place to other or one status to other.
2. **Electronic Data Interchange (EDI):** Electronic data interchange is the electronic, computer to computer transfer of standard business documents and information between organizations. It involves organizations to the organization, computer to computer exchange of business data in a structured, machine-processable format. Its purpose is to eliminate duplicate data entry and to improve the speed and accuracy of information flow by linking computer applications between organizations, a EDI specifically replaces more traditional transmission of documents such as mail, telephone, and fax.
3. **Data management and analytics:** A database management system allows application programs to retrieve required data stored in a computer system. A database management system must store data for retrieval to be efficient. This is a critical issue in logistics because of the large volume of data generated which may require analysis later (Googlesir, 2020).
4. **GPS tracking**: GPS tracking enables the development of logistics mobility solutions to help you take control and monitor fleet vehicles and manpower. This will help to track activity to know about the real time location of vehicles or human resources so that route can be optimised or lagging in delivery can be identified (Fulache, 2023).
5. **Real-time status visibility**: This technology helps to provide update of status change during the movement of products/packages from one status to another or

one location to another for 3PL's hiring organizations as well as to the customers. This helps to track each and every step of journey and flag whenever the status becomes idle, or it is taking too much time to change status from one to another.

6. **Transport Management System (TMS)**: Transport Management System is the system which provides information about package statuses, success or failures, routes and manage overall logistics movement of goods. Transportation management systems allow companies to automate and streamline their transportation processes, resulting in cost savings, improved efficiency, and better visibility of their supply chains, at various stages of execution (Inbound logistics, 2023).
7. **Route optimization**: Truck routing, delivery scheduling and fleet management software solutions help hundreds of private fleet and logistics operators to cut transportation costs every day – giving a fast return on software investment (AR.Srinivasan, 2017). Some of the uses of this route optimization are:
    - Reduce total mileage for lower fuel bills
    - Fully utilize the fleet for maximum distribution efficiency
    - Cut overtime and agency bills with improved driver productivity
    - Optimize the distribution networks to reduce overall transportation costs

From the survey, popular 3PLs among customers are listed below in figure 4. Aramex is the most popular one with international system and experience and wide area of coverage for delivery. Pick and drop, Total logistics, Everest Logistics are some other popular 3pls serving in main cities. These are the main 3pls that works with ecommerce platform and perform last mile activities. The local 3pls are competing against international 3pls and based on the information technology adoption and digitization of individual system, one may have certain advantage over others in terms of delivery on time, real time visibility, and customer satisfaction. For this study, only 3pls offering last mile services are listed because last mile is the last point of contact for the customers and the services and experience provided by these 3pls will have major impact on overall customer experience. Below are the results and analysis from quantitative and thematic analysis of the survey, interviews and other sources. This will help to understand status of IT tools in third party logistics in Nepal, challenges and opportunities present and impact it has on the performance of logistics companies.

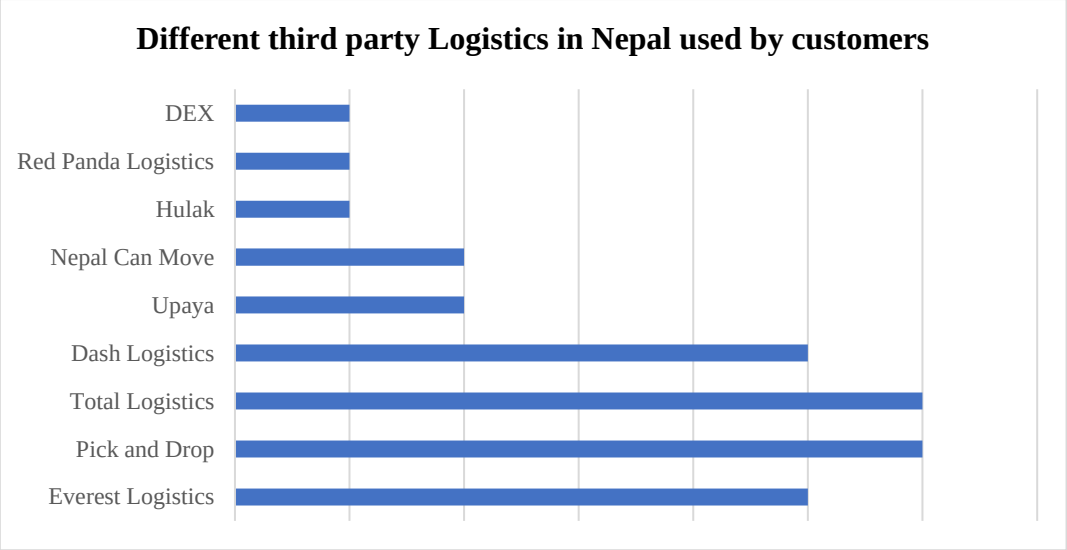


Figure 4.1 Different third-party logistics in Nepal.

From the survey and interviews from stakeholders, following were the major IT tools currently integrated with various LSPs. Still all LSPs lack some tools while some are advanced with the introduction of these tools.

Table 4.1 Current status of IT adoption in 3PL

IT type / 3pl	3pl A	3pl B	3pl C	3pl D	3pl E	3pl F	3pl G
Barcoding	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Electronic Data Interchange	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Data management	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GPS tracking	No	Yes	Yes	Yes	Yes	No	Yes
Real time status visibility	No	Yes	No	Yes	Yes	No	Yes
TMS	Yes	No	No	No	No	No	Yes
Route optimization	No	Yes	No	No	Yes	No	No

From Table 4.1 we can see that most 3pls uses barcoding or qr code to scan packages (goods or materials) to keep record in the system or in manually maintained database. This barcode has helped to provide unique identification for that goods which helps to reconcile for payments from the outsourced companies. Mostly, all the 3PLs have been aware of using EDI services, that may be status update via email or other online platform. This has made the communication effective and transparent.

Data management has become necessity in today's data driven market. Data are required to show successful delivery share, information if any issue of loss or damage occur and to ask for payments against the goods delivered. Information against those goods help 3pls for transparent negotiation and help provide for proof and validation if any unexpected issue arises.

Another tool 3pls are relying on is GPS tracking. Some of the 3PLs in Nepal are already implementing. This assist in tracking the delivery process and can even be helpful in route optimization for future delivery planning. GPS tracking is helpful for 3pls as well as customers. Customers prefer GPS tracking as it tracks the status of their orders. For instance, 3pls with GPS tracking can convey their orders journey information visually, and customers can also see for themselves what their orders status is and can estimate when the orders will arrive at their doorstep. This will provide patience to the customers and offer good customer experience.

Another service 3pls can provide is real-time status visibility. 3pls that has availability of real-time status visibility can provide as name suggest real time status update to the customers which assures them the movement of their packages is being done smoothly and they will get their packages on time. Transport Management System is system available for 3pls to update their status, manage data consolidate and make a dump for analysis and streamline the processes.

Another tool helping 3pls is route optimization. With the delivery location scattered, to deliver all goods and materials on time will require some route planning. Some 3pls perform this optimization manually while some can optimise route through the system. Segregating packages by routes helps to deliver and perform logistics operations more efficiently and this helps in optimising capacity planning of manpower, vehicle resources. Optimizing routes can help 3pls to prevent multiple runs of different delivery riders on same route, attempt delivery to the customers more efficiently, also helps

customer to familiarize with delivery riders and develop trust which will boost delivery success.

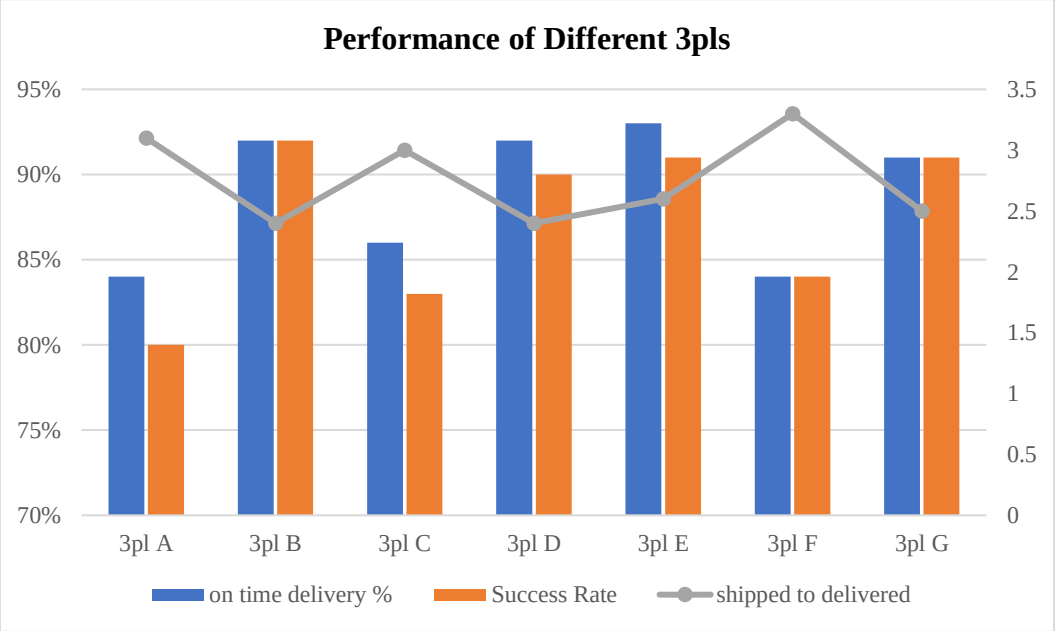


Figure 4.2 Performance of Different 3pls

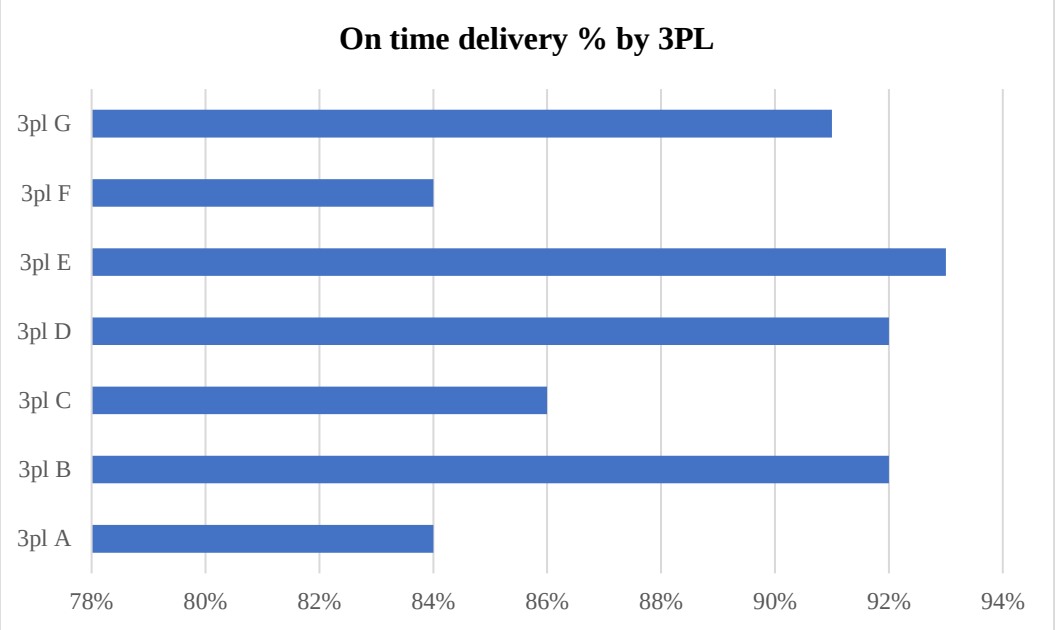


Figure 4.3 On time delivery % by 3PL

Based on the data provided, we mapped out on time delivery percentages for various 3pls in figure 4.3. 3pls that integrated IT tools most has seen most on time delivery percentages. On time delivery means if the good and materials ordered by customer reaches to them within estimated delivery time. Hypothesis was also formulated to see

the relation of IT tools and its impact on within delivery timeline. The result is interpreted in the later stages of this report. Visually it is seen that IT tools do help 3pls to achieve higher on time delivery percentage.

Success rate is defined as the total delivered packages (goods and materials) divided by total packages handled by 3pls. Figure 4.4 shows the success rate of various 3pls for a certain period. Likewise on time delivery percentages, success rate is mostly in higher side that has incorporated IT tools like GPS tracking, real time status visibility. The efficiency of any 3PLs is measured from their success rate (customer acceptance rate), on time delivery percentage, their shipped to delivery lead-time and their coverage areas of delivery. From these weighted ratios, performance index can be formulated to select the right 3pls to outsource the logistics operations by any companies.

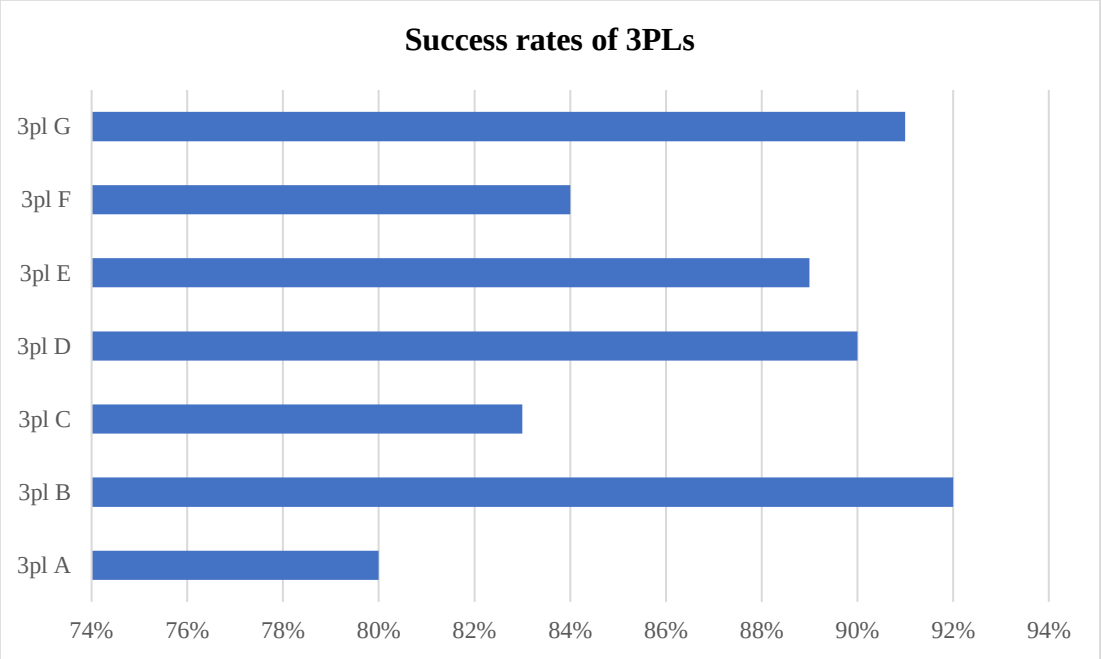


Figure 4.4 Success Rates of 3PLs

Another performance index for any 3pl is shipped to delivered lead-time. It interprets how efficient a 3pl is in its delivery processes and tools usage. This can also entail company and organization how early the materials and goods can be expected to be reached to customer. Lower the shipped to delivered lead-time, higher the performance and higher the success rate as customer expects their package to arrive as early as possible. If there is delay in packages reaching buyer location, there is high probability of the packages being canceled. This is a loss for any 3pls as most of 3pls are paid in terms of number of packages delivered and one package failed to deliver means loss of

payment while also utilizing all the resources. As other performance index, success rate, on time delivery, the shipped to delivery lead-time is affected by the IT tools incorporated by the 3pls as shipped to delivery lead-time is seen to be low which is shown in figure 4.5 for the 3pls who are adopting IT tools in their logistics operations. It is because customers are actively following their parcels' status via the logistics system to know real-time location and status which helps the customers to manage their time or be available to receive the parcels in most cases. When customers are not actively tracking the logistics with IT tools make them aware of their parcels arriving via push notifications on the phone or app. This also helps to increase the customer acceptance rate, lower delivery lead time and increase on time delivery percentage.

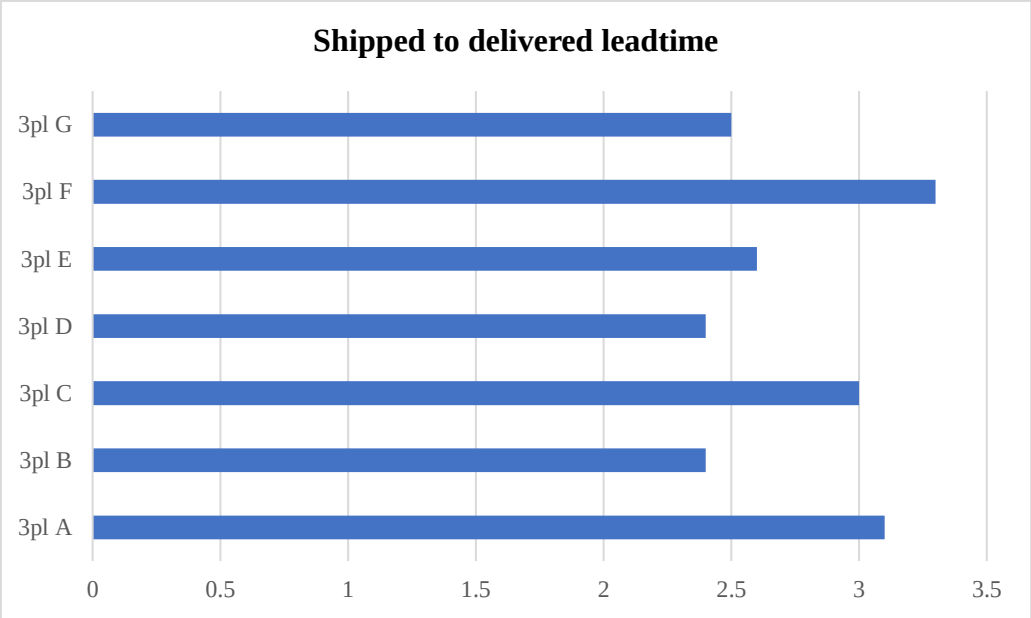


Figure 4.5 shipped to delivered lead-time of 3pl

The surveys and interviews of relevant stakeholders show that current 3PLs status and position in IT tools in their logistic process. 57.14% of 3pls have real time status visibility while all 3PLs are using barcode in their packages. Most 3pls are relying on IT tools for logistic activities but there are still some 3pls still reluctant to adopt IT tools which are visible in their performance.

Selection Criteria for 3pl by clients

As already mentioned, when an organization or a company uses an external partner to manage and perform the logistics operations, that external partner is referred to as third-party logistics or 3PL. With the growing ecommerce platform and social ecommerce

businesses, the increase in need of proper and reliable 3pl is inevitable. Consequently, this demanded more logistics company to improve and develop to meet the needs of the clients and the customers. The clients' major focuses will be always on customer satisfaction and customer retention because that will help them to increase their sales and help them sustain in the market. Thus, they want to choose their third-party logistics that will translate that vision and perform to provide great customer experience. From the interview with clients and social ecommerce entrepreneur, it was found that there are certain criteria that they look for in 3pl while selecting them. Those criteria have been summarised here using thematic analysis.

- **Operational Expertise**: The clients would prefer 3pls that have a high level of experience in terms of handling similar types of activities and packages.
- **API integration/ IT tools**: The clients that have their own system and platform would like their 3pl to have the ability to seamlessly integrate with their existing technology and system for real time updates and visibility. This is one of the crucial criteria as this would help them to have status updates in real time and follow up without a delay. Also, the clients that do not have their own system would still prefer technology-driven 3pl to track and have real-time status on 3pl systems.
- **Compliance and Certification**: The clients want their 3pls to adhere to a defined SLA (Service Level Agreement), regulatory requirements and possess necessary compliance requirements to ensure the quality of clients' products during last mile process. SLA means timeline to attempt delivery to the customer, number of attempts to be done before making delivery failed and compliance means activities to do before delivery, template for customer conversations.
- **Cost-effectiveness**: Another important factor is 3pls cost effectiveness. The client would prefer the 3pl that charges less with maximum services.
- **Coverage Areas**: The third-party logistics(3PL) provider should provide a comprehensive network that they are currently offering services or is open to expansion to facilitate the last mile services to the clients. The more service areas a 3PL covers, the better it is for clients.

4.2 Challenges and Opportunities of IT on Logistics Operations

While the majority of third-party logistics companies in Nepal have integrated IT solutions into their operations, ongoing obstacles continue to impede the optimization of their workflows. Creating adequate IT infrastructure is a significant challenge for third-party logistics firms. The local expenses involved in creating such systems are just too great. Selecting globally known systems such as Loginext has a unique set of issues because these systems might not be easily adjusted to local conditions and geographic locations. Furthermore, the complexity and expense of operating such systems are increased by the need for experienced personnel. Notwithstanding these obstacles, Nepal's e-commerce volume hasn't increased to the point where 3PLs would be justified in investing in these costly systems. Thus, locally owned small logistics provider won't be able to afford such system and implement such tools in their logistics operations. But they can provide and update information manually using available resources via mail or messages to atleast not degrade the customer experience. But there also exist opportunities in spite of the challenges.

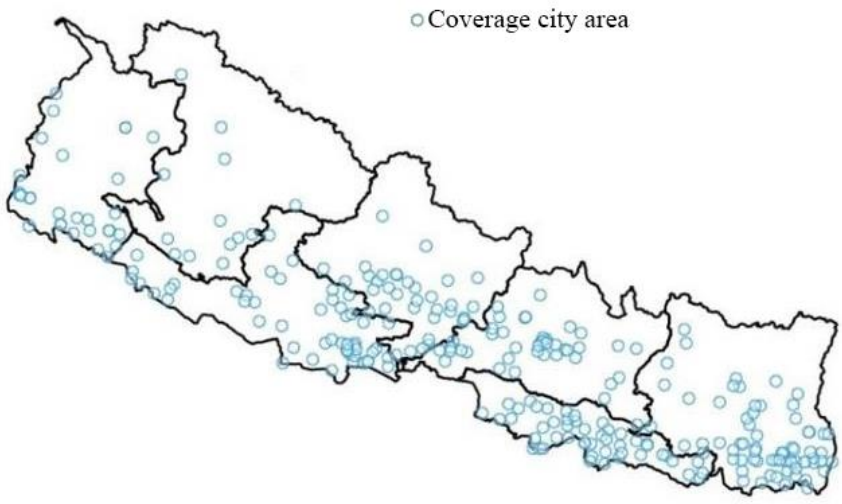


Figure 4.6 Current Coverage Areas by different 3pls (Nepal, 2024)

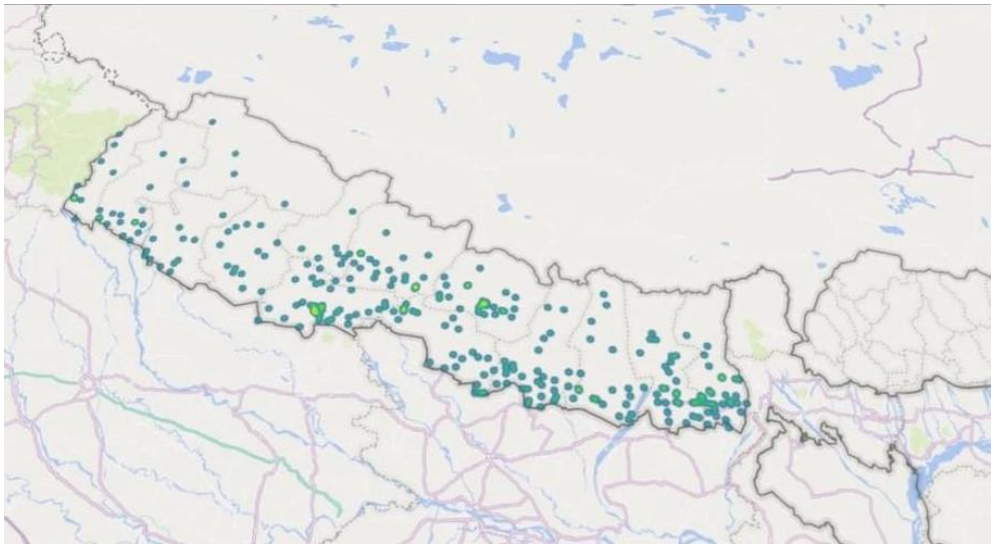


Figure 4.7 Data plot in Excel Map for the logistics coverage areas in Nepal.

The map in figure 4.6 and figure 4.7 shows the coverage areas of 3pls currently active in Nepal. The data was extracted from Nepal Can move website and other 3pls delivery locations and plotted in national geoportal and excel sheet. From the image, we can see the delivery locations are concentrated in Kathmandu valley, main cities and Terai regions that too majorly in East side of a country. With the landscape of Nepal, it has been difficult for 3pls to have the delivery in Himalayan regions. But this can be challenges as well as opportunities in disguise as the market is still not saturated and there are various prospects from untapped locations.

It is also seen from the data collected that logistics penetration and knowledge has just touch the tip of iceberg. This can both be challenges and opportunities at the same time. With the 300+ sample data, figure 4.8 tells us that 5% of buyer has never used logistics or has no knowledge of using 3Pls while 20% of sample size rarely uses third party logistics services. 30% of sample frequently uses logistics services in a year while 45% of people are regular user of 3PLs.

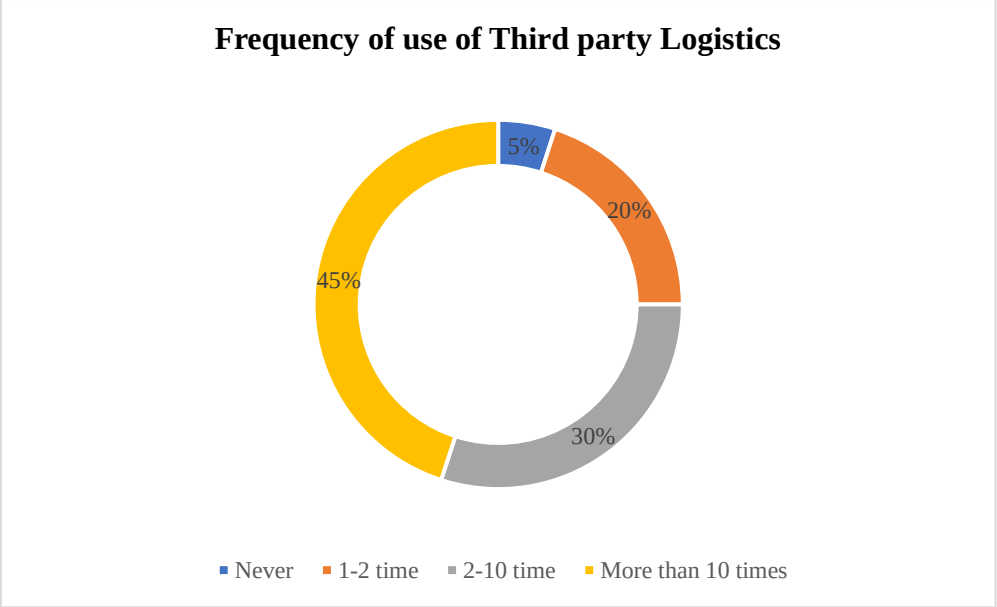


Figure 4.8 Frequency of 3PLs used in a year

IT tools though have been adopted in some 3PLs; from the survey it shows that improvement is still required to gain customer confidence.

Customers were asked to rate the Real-time status update visibility service of their 3pls from 1 to 5; 1 being worst and 5 being the best. From the visualization in Figure 4.9, it is seen that most customers are neutral while more than 25% of customers are hopeful that this tool can be improved even better. This also suggests that customers prefer real-time status updates of their packages and helps them to provide positive attitude towards the logistics by knowing where their packages are currently and when to expect that packages to be delivered to them rather than being unknown of the status of packages and doubting if those orders be delivered or not. This will create doubts and suspicion towards the logistics company as well as the client that chose that third party logistics company.

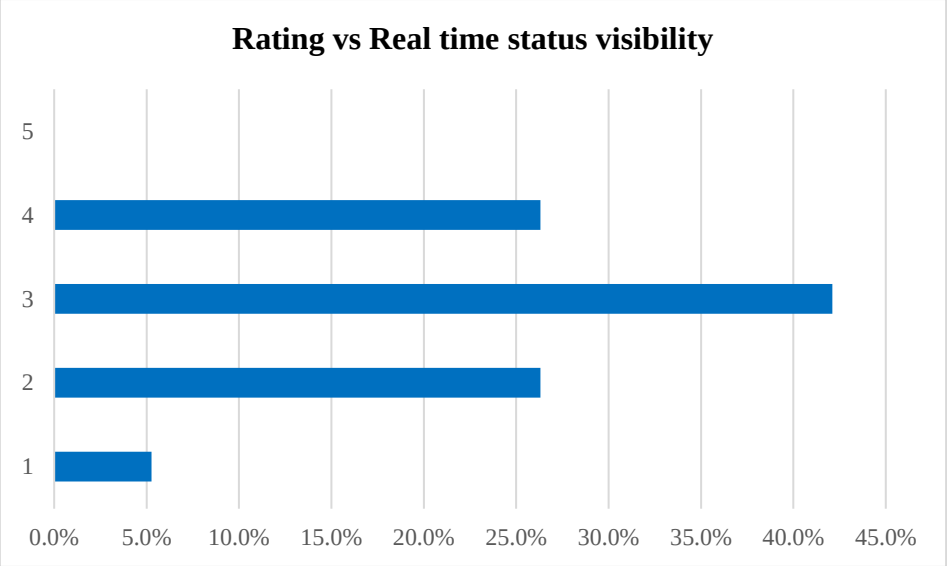


Figure 4.9 Ratings vs Real time status visibility

Logistics flexibility means how flexible any 3PLs are in terms of location change, change in delivery timeline, change in delivery customer name. Customers were asked for feedback and rate the facilities on a 1 to 5 scale (1 being worst and 5 being best). From the figure 4.10, It was observed that more than 20% of customers are unhappy about the availability of logistic flexibility.

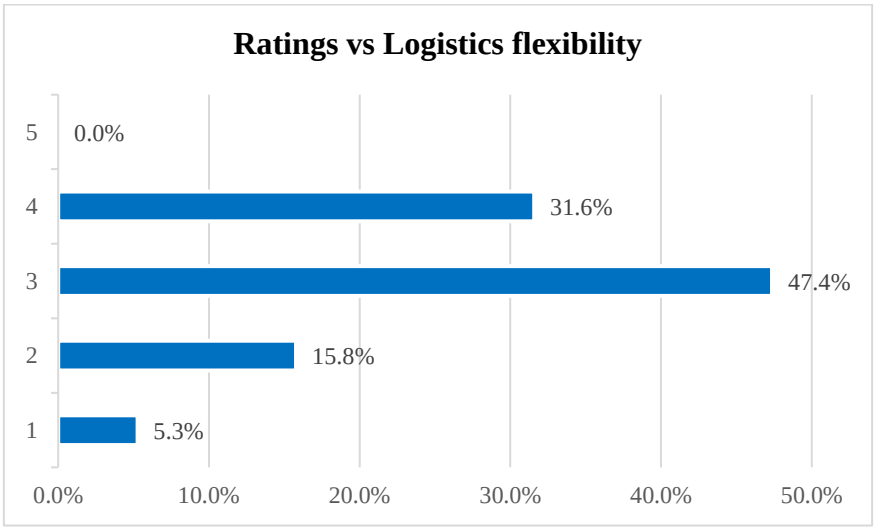


Figure 4.10 Ratings vs Logistic Flexibility

Another essential sercvice provided by 3PLs and expected by customers is Aftersales service. Aftersales service is the service provided by 3pls to pickup the packages that got delivered which was initiated for return by customer due to various reasons.

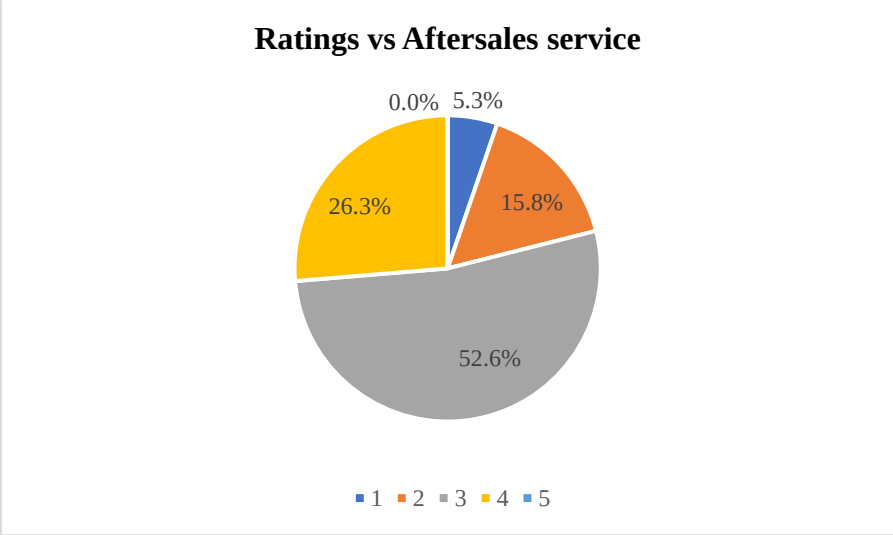


Figure 4.11 Ratings vs Aftersales service

Figure 4.11 shows that most of the customers are neutral towards aftersales services while more than 20% are expecting more from the aftersales service of 3pls.

GPS tracking tools have been used by 3pls. This has made the accuarcy of location for buyers easy to deliver. Customer were asked to rate for the location accuracy by 3PLs and it was seen in the figure 4.12 that most of the customers are happy about this service and can be said that GPS tracking tool has been working efficiently.

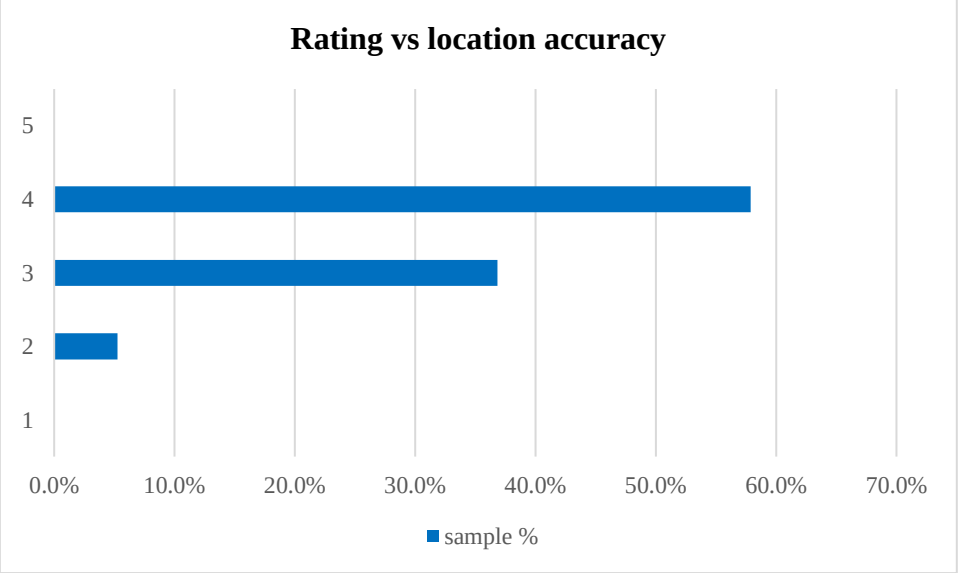


Figure 4.12 Rating vs Location accuracy

Customers were also asked for the service they think is essential in 3pls that will elevate their logistic experience and improve customer satisfaction.

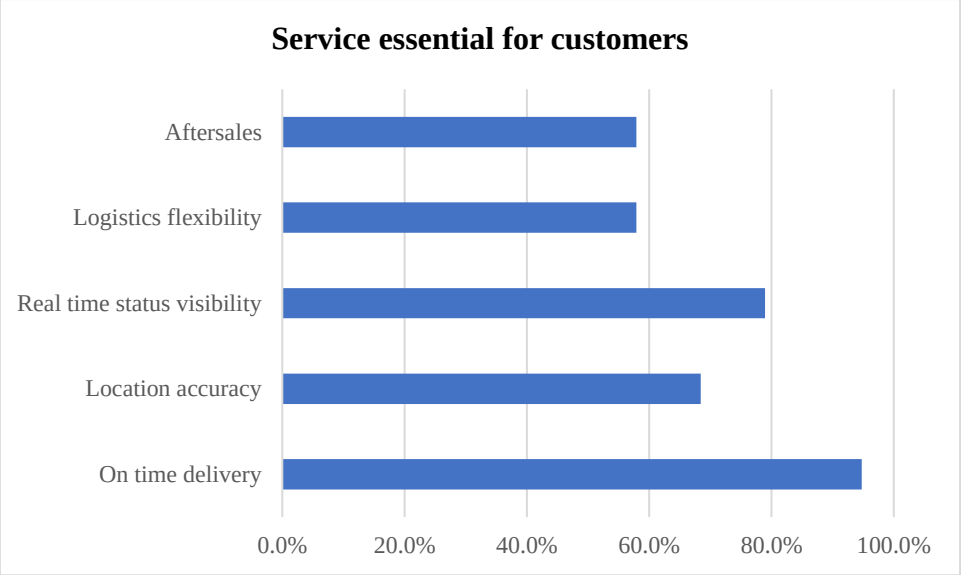


Figure 4.13 Service Essential for Customers

The survey suggested that customers prefer on time delivery and real time status visibility services in their 3PLs which can be seen on figure 4.13. This will heighten their customer experience.

From these data and current status of IT tools, it can be interpreted that there exist challenges but there is still areas of improvement and opportunity to enhance their logistic operations.

4.3 Impact of IT on Logistics Operations

IT integration has elevated the performance of 3pls and have given them competitive advantage over other in logistics market. To testify this statement, two hypotheses were formulated. Since customer said that they see real time status visibility and on time delivery as most essential service required for customer satisfaction, hypothesis was devised around it.

Hypothesis 1:

Null hypothesis (Ho): The implementation of real-time tracking system in third party logistics in Nepal has no effect on accuracy of delivery time estimates

Alternate hypothesis (H1): The implementation of real-time tracking system in third party logistics in Nepal has significant impact on accuracy of delivery time estimates

By using Python to calculate t-static, it was observed that t-static was -3.55 while t-value is +-1.96 for significance level (alpha) at 0.05. By comparing these value and p-value<alpha, null hypothesis was rejected. Mean of group A is 0.8989 while group B is 0.9050 concludes that there is a significant increase. Thus, real time status visibility indeed improves on time delivery percentage. (All the calculation and python script are attached in Annex). It signifies that when using real-time status tool, it improves their overall on time delivery percentage which impact success rate meaning it will improve their performance index. This will provide competitive advantage over other 3PLs not using this tool.

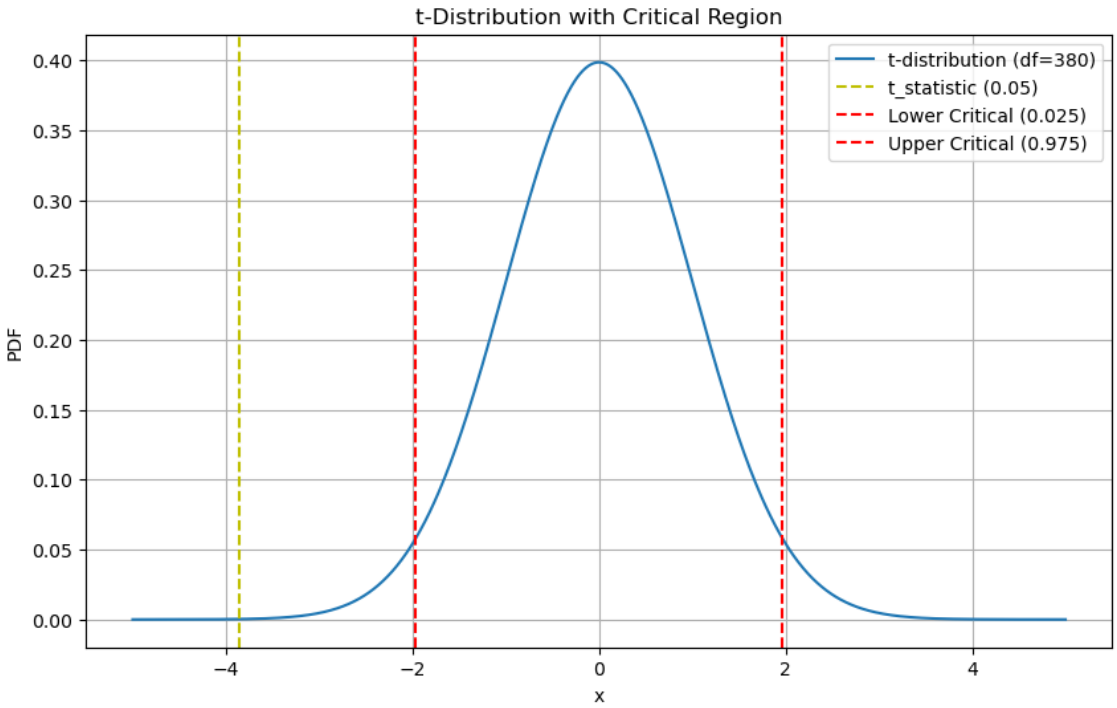


Figure 4.14 t-Distribution with critical region

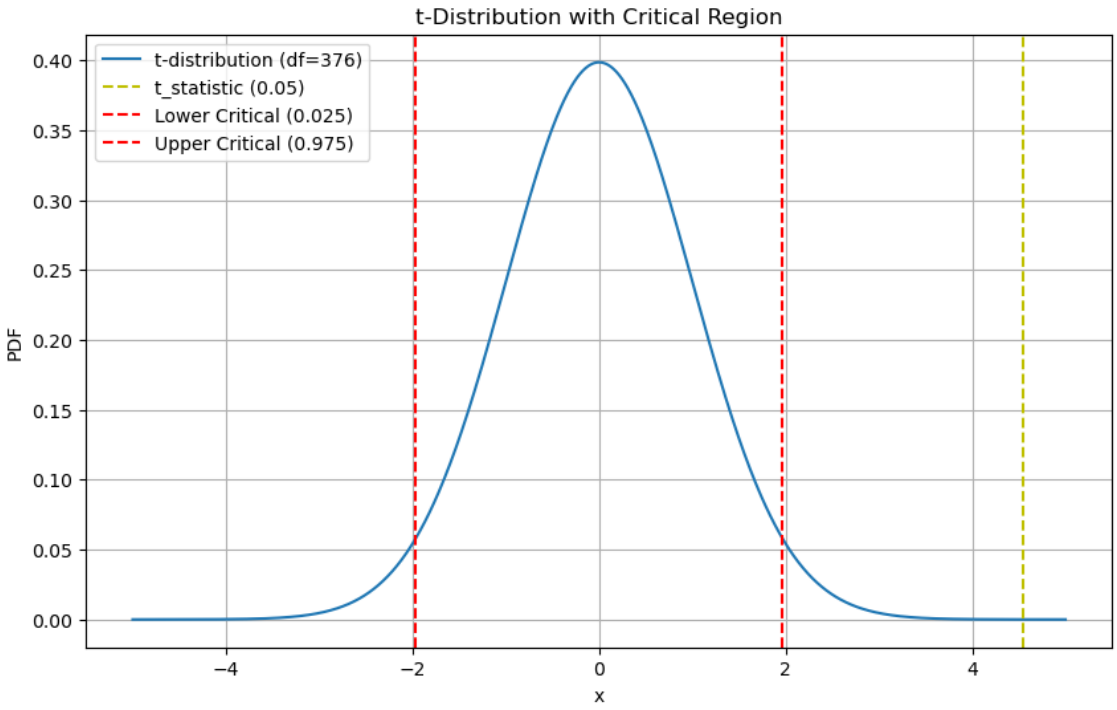
Hypothesis 2:

Null hypothesis (Ho): The implementation of real-time tracking system in third party logistics in Nepal has no effect on customer satisfaction

Alternate hypothesis (H1): The implementation of real-time tracking system in third party logistics in Nepal improves customer satisfaction

Python was used to calculate t-static value for this hypothesis. It provided t-static value of 4.649 while t-value at significance level (alpha) 0.05 is +- 1.96. By comparing t-statistic and t-value, it was observed that t-static > t-value and p-value < alpha. Hence,

null hypothesis was rejected and signifies there is significant different. Mean of group A is 3.39 and mean of group B is 2.94 which signifies that there is significant increase. It interprets that having real-time status visibility improve customer experience at a great extent.



It can be seen from two hypothesis the impact of IT tools for logistics to be competitive in logistics market. It provides advantage over others while also receiving customer acceptance along the way.

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

Examining the emergence of information technology (IT) and its impact on third-party logistics (3PL) in Nepal reveals a complex and evolving landscape. From the study and analysis following conclusions were drawn.

Globally, third party logistics is a trillion-dollar market and Nepal is no exception. With the growing ecommerce and social media commerce and customer awareness, the demand for logistics market is growing and some of the locally grown third party logistics are already thriving in the market. In Nepal, there exist some technologically driven third party logistics who focuses on customer experience and performance. But still these available technologies still need refinement and improvisation. The available technology in local third-party logistics may have real-time status visibility but no GPS tracking and so on. The direction the logistics market is heading is optimistic but still advancement is needed. The majority of 3pls present in Nepal have incorporated IT tools and the one that has not been able to integrate such tools still try to semi-automate the process and status visibility.

Since logistics market in Nepal is still on inception stage, there are huge opportunities for third party logistics. Customer is also new to this service so if can provide services to retain them then this will provide massive boost to stay competitive in this market. Though the opportunities are immense, and impact of IT is valuable, the adoption and integration have some challenges and barriers. Infrastructure development, internet penetration over the country, skilled manpower, cost of IT integration and ease of accessibility of IT tools are some of the challenges faced by 3PLs in Nepal.

Despite these challenges, this study identified the positive impact of information technology tools on third-party logistics in Nepal. It was noted that these tools enhance efficiency, accuracy, and customer experience. The integration of real-time tracking, data management, analytics, and GPS tracking has provided a competitive advantage in the logistics market.

To fully exploit the benefits of IT, stakeholders in Nepal's 3PL sector should partner with the government to invest in robust IT infrastructure. This includes expanding internet connectivity and ensuring uninterrupted power supply to support IT systems.

As usage of IT tools increases in 3pls, skilled workforce should also improve and increase similarly.

Finally, incorporating emerging technologies such as artificial intelligence (AI) and the Internet of Things (IoT) into logistics processes can offer advantages and lead to further service enhancements, ultimately improving customer experience.

To conclude, the rise of IT in Nepal's 3PL sector brings both challenges and opportunities. By tackling infrastructure limitations and staying abreast of emerging trends, Nepal can pave the way for a more efficient, competitive, and sustainable future in logistics.

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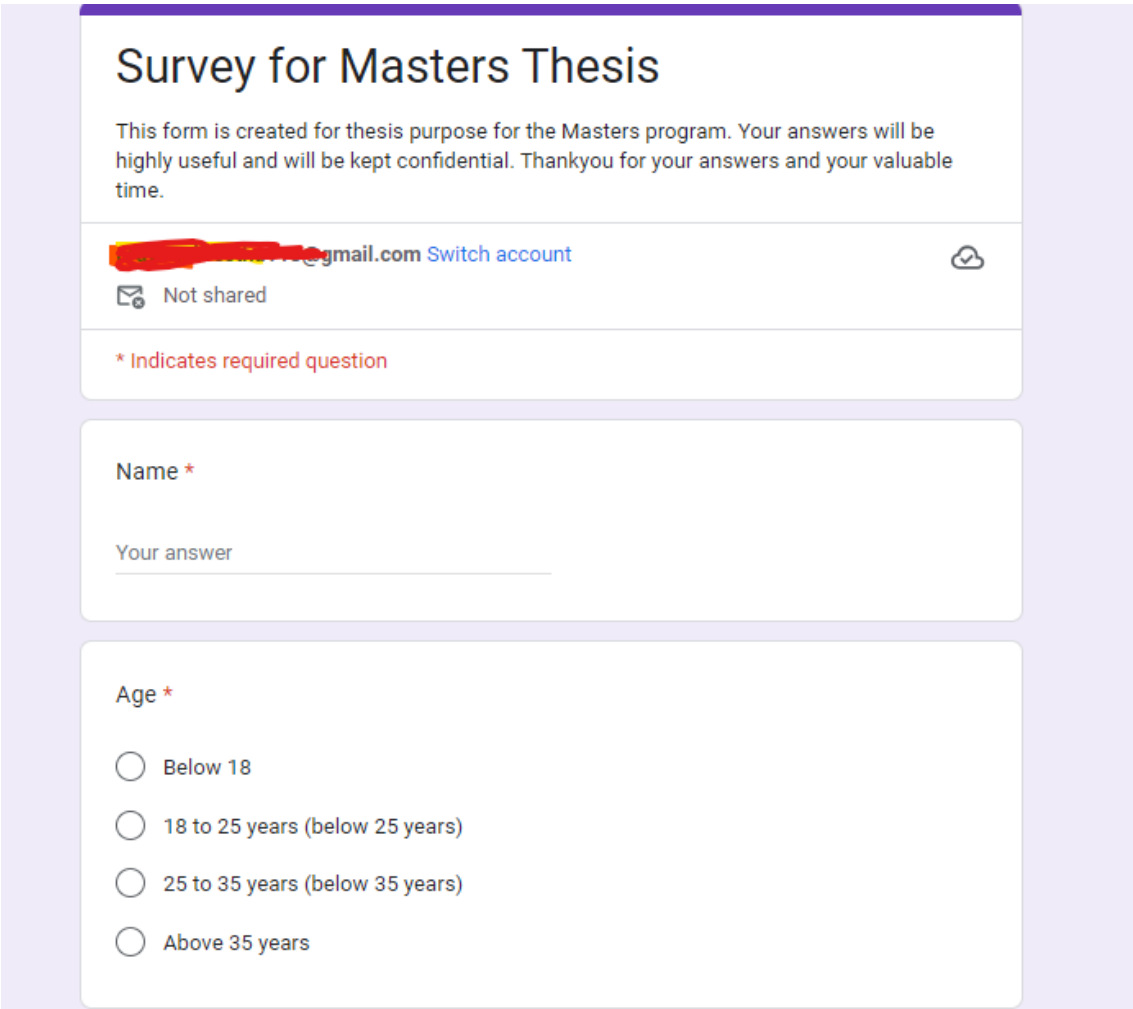
ANNEX ONE: QUESTIONNAIRE FORM

Questionnaire and survey form for customers



Survey for Masters Thesis

This form is created for thesis purpose for the Masters program. Your answers will be highly useful and will be kept confidential. Thankyou for your answers and your valuable time.

[redacted]gmail.com Switch account

Not shared

* Indicates required question

Name *

Your answer

Age *

- Below 18
- 18 to 25 years (below 25 years)
- 25 to 35 years (below 35 years)
- Above 35 years

Gender *

- ◯ Male
- ◯ Female
- ◯ Other

How often have you used logistics services in a year? *

- ◯ Never
- ◯ 1-2 time
- ◯ 2-10 times
- ◯ More than 10 times

Next Clear form

Which logistics company have you used for logistics services? (you can choose more than 1 here) *

- [ ] Aramex
- [ ] DHL
- [ ] Everest Logistics
- [ ] Pick and Drop
- [ ] Total Logistics
- [ ] Dash Logistics
- [ ] Upaya
- [ ] None
- [ ] Other: _____

How satisfied are you with "on time delivery" service by logistics service provider on a scale of 1 to 5 , 5 being the highest *

	1	2	3	4	5
Rating	◯	◯	◯	◯	◯

1.How satisfied are you with "location accuracy ,easy to navigate the address" service by logistics service provider on a scale of 1 to 5 , 5 being the highest *

	1	2	3	4	5
Rating	○	○	○	○	○

2.How satisfied are you with " Real time status visibility (visibility of status of packages or services in real time)" service by logistics service provider on a scale of 1 to 5 , 5 being the highest *

	1	2	3	4	5
Rating	○	○	○	○	○

3.How satisfied are you with " Logistics flexibility (flexibility in terms of change in delivery days, location change, delivery receiver name/number change) " service by logistics service provider on a scale of 1 to 5 , 5 being the highest *

	1	2	3	4	5
Rating	○	○	○	○	○

4.How satisfied are you with " Aftersales (pickup service if need to return) " service by logistics service provider on a scale of 1 to 5 , 5 being the highest *

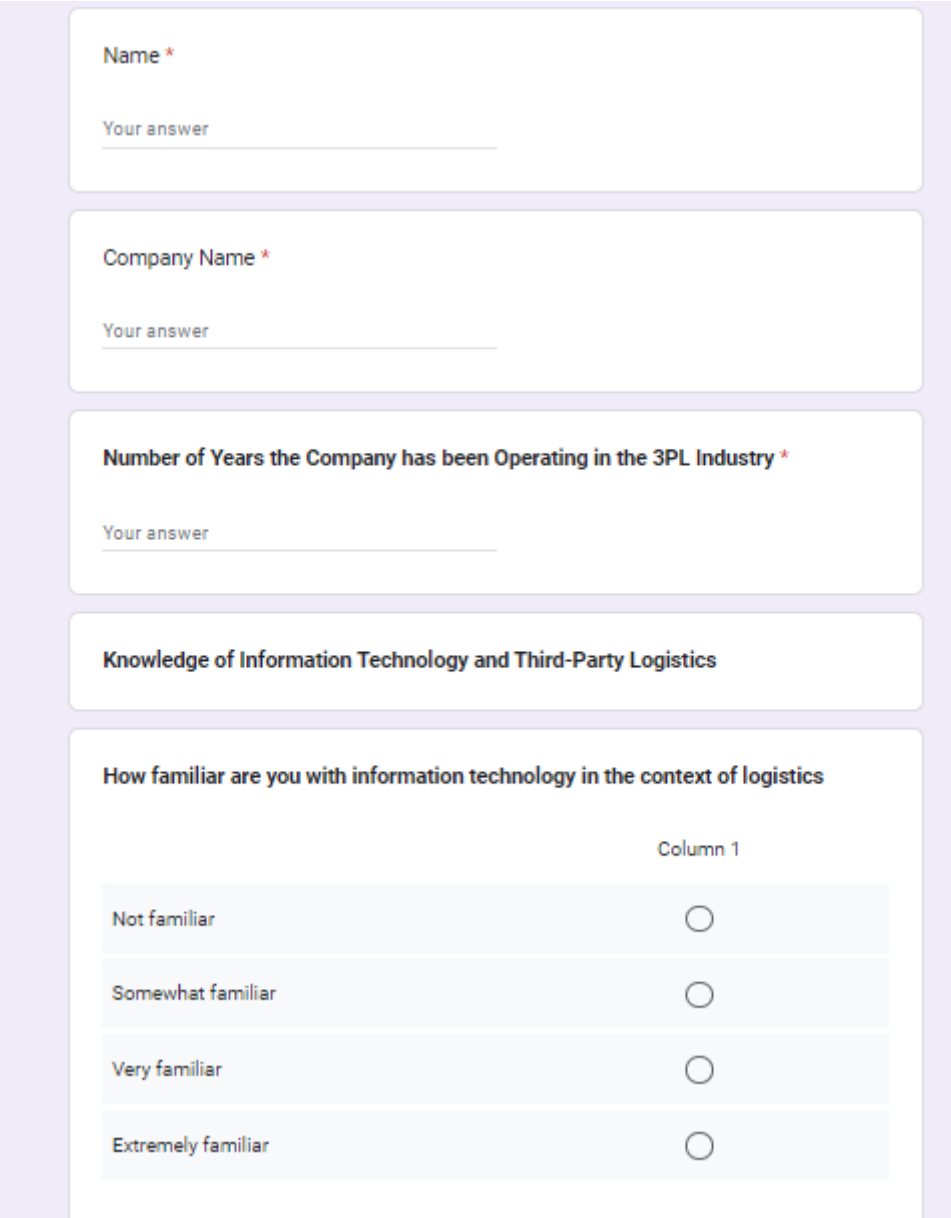
	1	2	3	4	5
Rating	○	○	○	○	○

Which service do you think is essential for logistics service provider? (you can choose more than 1 here) *

- ☐ On time delivery
- ☐ Location accuracy
- ☐ Real time status visibility
- ☐ Logistics flexibility
- ☐ Aftersales
- ☐ Other: _____

Back Submit Clear form

Questionnaire for stakeholders



Name *

Your answer

Company Name *

Your answer

Number of Years the Company has been Operating in the 3PL Industry *

Your answer

Knowledge of Information Technology and Third-Party Logistics

How familiar are you with information technology in the context of logistics

	Column 1
Not familiar	◯
Somewhat familiar	◯
Very familiar	◯
Extremely familiar	◯

How has your company utilized information technology in its logistics operations? *

- [ ] Automated order processing and tracking
- [ ] Real time tracking and monitoring
- [ ] Data analytics
- [ ] Other:

In your opinion, what benefits or advantages has your company experienced by integrating information technology into your logistics processes?

Your answer

Have you faced any challenges or obstacles in adopting information technology solutions within your logistics operations? If yes, please elaborate.

Your answer

Impact of Information Technology on Third-Party Logistics

How has the implementation of information technology positively affected the efficiency and productivity of your company's logistics services?

Your answer

In what ways has information technology contributed to better customer service and satisfaction for your clients?

Has the use of information technology improved the accuracy and reliability of your supply chain operations? If yes, how?

Your answer

How has information technology influenced the decision-making process within your company regarding logistics strategies and operations?

Your answer

Future Trends

What future trends do you foresee regarding the use of information technology in the third-party logistics industry?

Your answer

Do you plan to invest further in information technology solutions for your logistics business? If yes, which specific areas are you considering?

Your answer

Thank you for your valuable participation in this questionnaire. Your insights will contribute significantly to the research and understanding of the impact of information technology on the third-party logistics industry. If you have any additional comments or information you would like to provide, please feel free to include them below

ANNEX TWO: PYTHON MODEL

Python code for real time visibility and on time delivery

```
import numpy as np

import matplotlib.pyplot as plt

from scipy.stats import t

import math


# Parameters

degrees_of_freedom = 380

significance_level = 0.05

x = np.linspace(-5, 5, 1000)  # Range of x values

meana = 0.8989

meanb = 0.9050

na=191

nb=191

sda= 0.016904

sdb=0.013804

t_value= ((meana-meanb)/(math.sqrt(((sda**2)/na)+((sdb**2)/nb))))


# Probability density function (PDF) of the t-distribution

pdf = t.pdf(x, degrees_of_freedom)


# Plotting

plt.figure(figsize=(10, 6))

plt.plot(x, pdf, label=f't-distribution (df={degrees_of_freedom})')
```

```
# Highlighting the critical region for significance level

lower_critical = t.ppf(significance_level/2, degrees_of_freedom)

upper_critical = t.ppf(1 - significance_level/2, degrees_of_freedom)

plt.axvline(x=t_value, color='y', linestyle='--', label=f't_value ({significance_level})')

plt.axvline(x=lower_critical, color='r', linestyle='--', label=f'Lower Critical
({significance_level/2})')

plt.axvline(x=upper_critical, color='r', linestyle='--', label=f'Upper Critical ({1 -
significance_level/2})')


plt.title('t-Distribution with Critical Region')

plt.xlabel('x')

plt.ylabel('PDF')

plt.legend()

plt.grid()

plt.show()


#to get the decision

import numpy as np

import pandas as pd

from scipy import stats


# import data

df= pd.read_excel("C:/Users/Desktop/real_time_data.xlsx","Sheet1")

realtime_not_available = df['not available']

realtime_available = df['Available']


# Perform t-test

t_statistic, p_value = stats.ttest_rel(realtime_not_available, realtime_available)
```

```
# Define the significance level
alpha = 0.05


# Interpret the result
if p_value < alpha:
    print("Reject the null hypothesis. Real-time tracking systems significantly improve accuracy.")
else:
    print("Fail to reject the null hypothesis. No significant improvement observed.")


# Print t-statistic and p-value
print("t-statistic:", t_statistic)
print("p-value:", p_value)
```

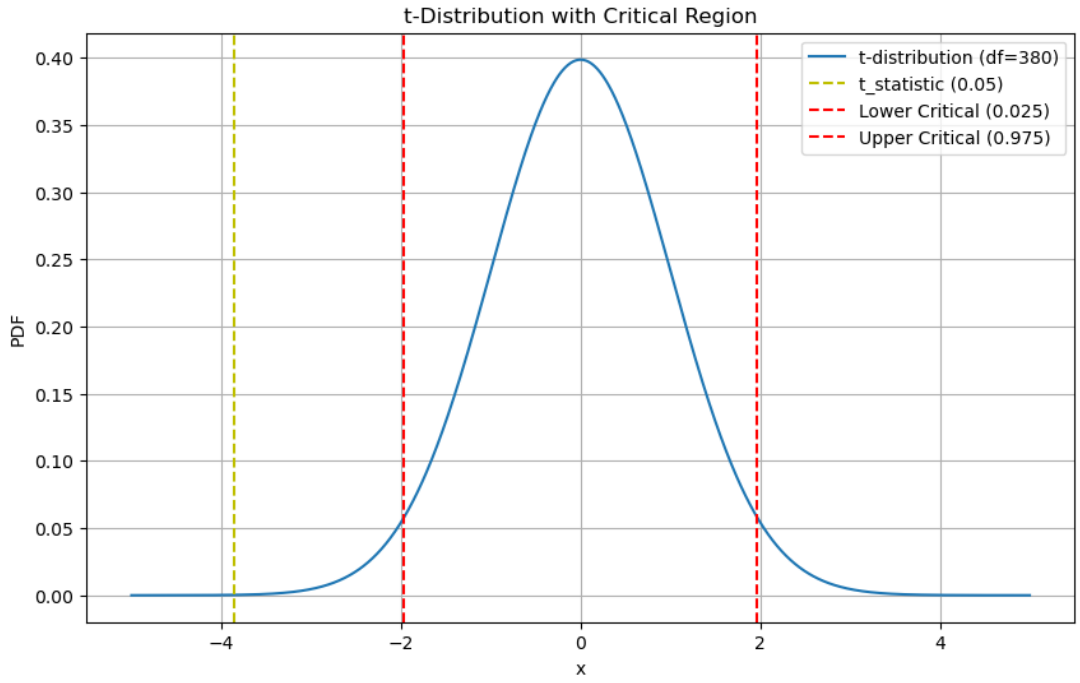


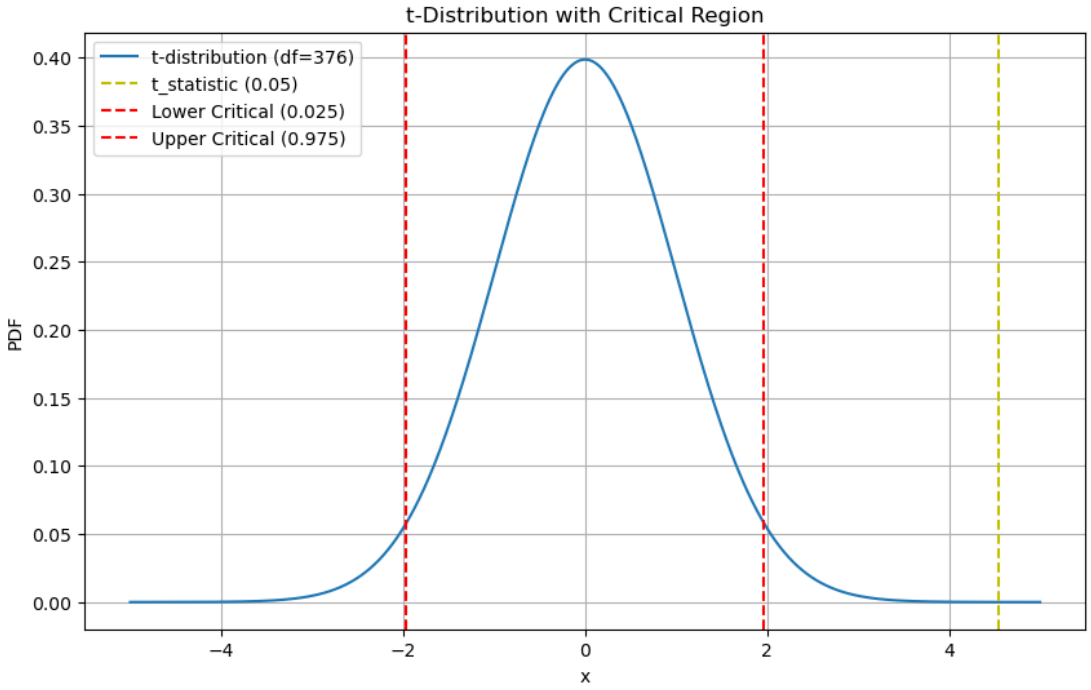
Figure 0-1 t-Distribution with critical regions

Python code for hypothesis for customer satisfaction and real time delivery

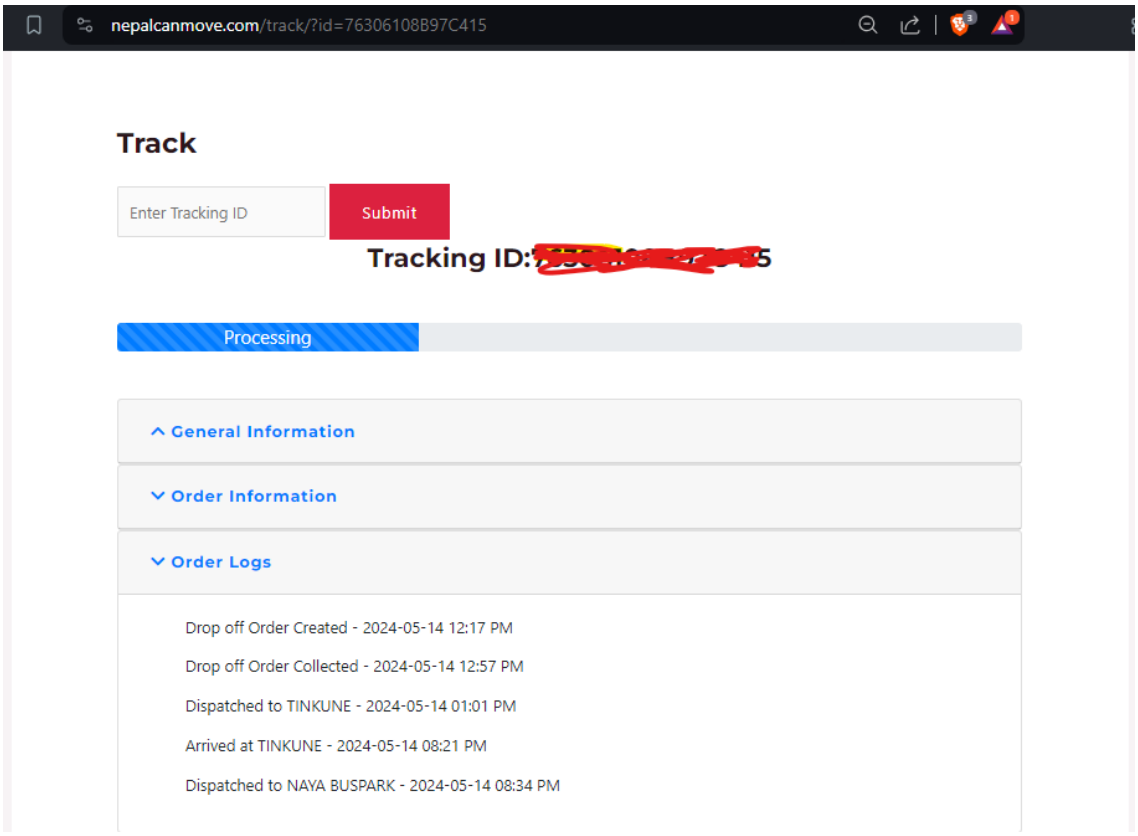
```
import numpy as np

import pandas as pd

from scipy import stats


# import data

df= pd.read_excel("C:/Users/Prabin/Desktop/customer_satisfaction.xlsx","Sheet1")

realtime_not_available = df['A']

realtime_available = df['B']


# Perform t-test

t_statistic, p_value = stats.ttest_rel(realtime_not_available, realtime_available)


# Define the significance level

alpha = 0.05


# Interpret the result

if p_value < alpha:

    print("Reject the null hypothesis. of real-time tracking system in third party logistics in Nepal improves customer satisfaction")

else:

    print("Fail to reject the null hypothesis. No significant improvement observed.")


# Print t-statistic and p-value

print("t-statistic:", t_statistic)

print("p-value:", p_value)

#for t-statistic
```

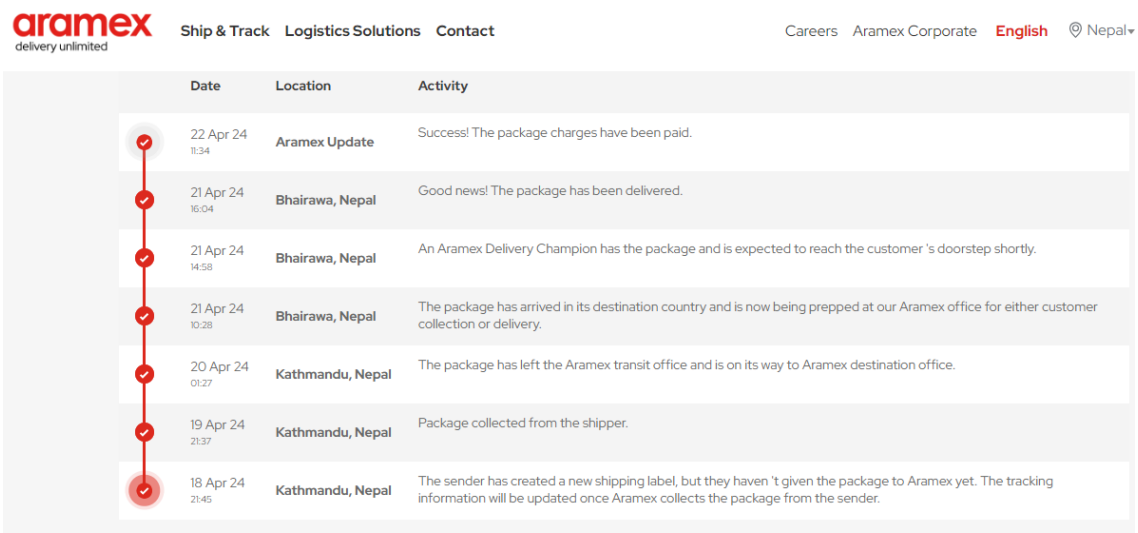
```
import numpy as np
import matplotlib.pyplot as plt
from scipy.stats import t
import math

# Parameters
degrees_of_freedom = 376
significance_level = 0.05
x = np.linspace(-5, 5, 1000)  # Range of x values
meana = 3.391534392
meanb = 2.947089947
na=189
nb=189
sda= 1.059472106
sdb=0.829864445
t_value= ((meana-meanb)/(math.sqrt(((sda**2)/na)+((sdb**2)/nb))))

# Probability density function (PDF) of the t-distribution
pdf = t.pdf(x, degrees_of_freedom)

# Plotting
plt.figure(figsize=(10, 6))
plt.plot(x, pdf, label=f't-distribution (df={degrees_of_freedom})')

# Highlighting the critical region for significance level
lower_critical = t.ppf(significance_level/2, degrees_of_freedom)
upper_critical = t.ppf(1 - significance_level/2, degrees_of_freedom)
```

```
plt.axvline(x=t_value, color='y', linestyle='--', label=f't_statistic ({significance_level})')

plt.axvline(x=lower_critical, color='r', linestyle='--', label=f'Lower Critical ({significance_level/2})')

plt.axvline(x=upper_critical, color='r', linestyle='--', label=f'Upper Critical ({1 - significance_level/2})')


plt.title('t-Distribution with Critical Region')

plt.xlabel('x')

plt.ylabel('PDF')

plt.legend()

plt.grid()

plt.show()
```



ANNEX THREE: REAL TIME STATUS EXAMPLE





ANNEX FOUR: PLAGIARISM REPORT

Examining the Emergence of Information Technology and its Impact on Third Party Logistics in Nepal

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9%

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