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THE IMPACT OF DIGITAL TECHNOLOGY ADOPTION ON SUPPLY CHAIN PERFORMANCE IN NEPALESE FMCG DISTRIBUTION COMPANIES

DECLARATION

I, Roshan Sapkota, student number [redacted], declare that this dissertation entitled ″THE IMPACT OF DIGITAL TECHNOLOGY ADOPTION ON SUPPLY CHAIN PERFORMANCE IN NEPALESE FMCG DISTRIBUTION COMPANIES″, submitted in partial fulfilment of the requirements for the degree of MRes Management Studies at York St John University, is my own original work.

Roshan Sapkota

September 09 2026

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ABSTRACT

Current studies on digital technology adoption and supply chain performance have focused on developed economies and, in developing economies, on manufacturing rather than on fast-moving consumer goods (FMCG) distribution. This creates a knowledge gap in terms of the impact of digital technologies on supply chain performance of Nepalese FMCG distribution companies, which is a sector dominated by small and medium-sized companies working under severe infrastructural and resource constraints.

The study examined the effects of adoption of digital technologies such as ERP systems, inventory management software, GPS/IoT tracking and digital payment systems on supply chain performance of Nepalese FMCG distribution companies. The study had three objectives: to explore the use of these technologies, to examine the relationship between these technologies and supply chain performance and to understand the key barriers to adoption. A theoretical framework combining the Technology-Organisation-Environment (TOE) framework, Diffusion of Innovation theory, and the Resource-Based View guided the study.

Primary data were collected from 89 respondents who work for Nepalese FMCG distribution companies, using a quantitative, post-positivist, cross-sectional survey design. Descriptive statistics, correlation and moderated regression were used to analyze the data, with a small thematic analysis of open-ended survey comments. Both hypotheses were supported. Digital technology use was positively related to supply chain performance ($B = .185$, $p = .001$). Barriers to the adoption of digital technologies such as cost, training and infrastructure constraints significantly attenuated the relationship between digital technology use and supply chain performance ($B = -.114$, $p = .019$).

The findings indicate that digital technology does provide benefits to Nepalese FMCG distribution companies, but only when the barriers to its adoption are overcome. The study adds to the theory by showing that the Resource-Based View, the Technology-Organisation-Environment framework and the Diffusion of Innovation theory together provide a fuller explanation than any one theory in isolation. It gives practical advice for companies and policymakers aiming to foster digital transformation in this sector.

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
ASCM	Association for Supply Chain Management
DOI	Diffusion of Innovation
ERP	Enterprise Resource Planning
FMCG	Fast-Moving Consumer Goods
GPS	Global Positioning System
ICT	Information and Communication Technology
IoT	Internet of Things
M	Mean
N	Sample size
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
QR	Quick Response (code)
RBV	Resource-Based View
SCM	Supply Chain Management
SCOR	Supply Chain Operations Reference
SD	Standard Deviation
Sig.	Significance
SME	Small and Medium-sized Enterprise
SPSS	Statistical Package for the Social Sciences
TOE	Technology-Organisation-Environment

CHAPTER 1: INTRODUCTION

1.1 Background and Context

Over the years, the management of the supply chain (SCM) has emerged as a source of growing operational efficiency, customer satisfaction and competitive advantage for businesses around the world (Christopher, 2016). In recent years, digital technologies, such as enterprise resource planning (ERP) systems, warehouse and inventory management software, Global Positioning System (GPS) tracking, and digital payment systems, have increasingly led to the transformation of how supply chains are planned, coordinated and executed (Ben-Daya, Hassini and Bahroun, 2019). Examples of these technologies include the automation of repetitive tasks, enhanced accuracy in demand forecasting, increased visibility in the supply chain, and faster goods, information and payment flow between suppliers, distributors and customers (Hazen et al., 2016; Ben-Daya, Hassini and Bahroun, 2019).

In this context, the fast-moving consumer goods (FMCG) sector is an interesting and relevant context where the study of the adoption of digital technology is located. High stock turn and low margin is the nature of the business for FMCG distribution companies and any efficiency improvement, inventory accuracy and delivery reliability can make a difference to the overall performance (Kamble, Gunasekaran and Dhone, 2019). For these reasons, in Nepal, the distribution companies have started to use digital technologies like ERP system, inventory management software, GPS tracking system, and digital payment system for logistics coordination, inventory management, delivery process, and communication with the distribution chain. Despite these efforts, many distribution companies in Nepal still have technological infrastructure, employee digital skills, and financial constraints and organizational resistance to change that constrain the nature and impact of the digital transformation.

This study also has been influenced by firsthand professional experience in the industry. This was also gained through practical experience in a Nepalese FMCG distribution company in which the function of inventory coordination, the process of logistics activities and the practice of supply chain were gradually being digitized and in which the distribution

companies in Nepal faced technological, financial and skills challenges when it comes to adopting digital technologies. This practical background and lack of academic research in the area of particular interest, in Nepal, gives the motivation to conduct the present study.

1.2 Problem Statement

The relationship between adoption of digital technology and the performance of the supply chain is extensively studied in developed economies as well as in large manufacturing companies in other developing economies like India (Kamble, Gunasekaran and Dhone, 2019; Chauhan, Bangwal and Kumar, 2023). But, limited research has focused so far on this relationship in particular with Nepalese FMCG distribution companies. This gap is not negligible, as the FMCG distribution system in Nepal is structurally different from what most of the existing evidence was derived: a large-firm, manufacturing-based environment, with the small and medium-sized distributors heavily relying on informal retail channels and operating in a business environment, where digital infrastructure is limited and digital literacy is comparatively low (Subedi and Bhatt, 2025).

This study, then, sets out to answer two questions. The first is the lack of an empirically informed understanding of the relationship between the specific digital technologies that most are relevant to the FMCG distribution sector in Nepal, such as ERP systems, inventory management software, GPS tracking and digital payment systems, and the efficiency and performance of the FMCG supply chain in this region. Second, the challenges that Nepalese FMCG distribution companies are encountering when implementing the technologies, such as cost, infrastructure constraints, and digital skills have not been systematically explored and analyzed with respect to their impact on the supply chain performance outcomes.

There are currently few local, evidence-based guidance to help FMCG distribution companies in Nepal make informed decisions about the best investments in digital technology to enhance the performance of their supply chains, and what obstacles are most likely to need to be overcome to get these technologies to work. If there is no evidence, then businesses may make decisions on digital investment on the basis of assumptions about markets and sectors that do not relate to the reality of the Nepalese FMCG distribution environment.

1.3 Research Aim and Objectives

Research Aim

To investigate the effect of the use of digital technology on the performance of supply chains of Nepalese FMCG distribution companies.

Research Objectives

- To explore the use of digital technology in supply chain activities of FMCG distribution companies in Nepal.
- To examine the relationship between the use of digital technology and the efficiency of the supply chain.
- To understand the key challenges that Nepalese FMCG distribution companies are encountering in digital transformation.

1.4 Research Questions

The primary research questions this study seeks to address is:

How is the performance of the supply chain in FMCG companies in Nepal impacted by the adoption of digital technology?

This is supported by the following secondary research questions:

- Which digital technologies are commonly used by FMCG distribution companies in Nepal?
- What is the relationship between the use of digital technology and supply chain efficiency?
- What are the key challenges to digital technology adoption for Nepalese FMCG distribution companies?

1.5 Rationale and Significance of the Study

From an academic perspective, this study is in line with the subset of literature focusing on digital technology adoption and supply chain performance, which is primarily concentrated

on developed economies, and, in the developing economies, manufacturing contexts rather than distribution contexts (Kamble, Gunasekaran and Dhone, 2019). This research builds on existing theory by applying an integrated theoretical framework, which combines the Technology-Organisation-Environment, Diffusion of Innovation, and Resource Based View frameworks to Nepalese FMCG distribution companies specifically, while also filling a significant gap in existing research literature in these two sectors and geographic locations: the adoption of digital transformation in FMCGs companies in Nepal (Subedi and Bhatt, 2025; Adhikari and Molla, 2024; Bhatt, 2025).

The practical implications of the findings are to be directly helpful to the decision makers at FMCG distribution companies in Nepal to understand which technologies are being used most; the correlation of digital technology use across the entire chain; and what the major obstacles are to achieving the benefits of digital technology. The results may also be of interest to policy makers and industry organisations aiming to encourage greater digitalisation of Nepal's distribution sector, such as through infrastructure investments, digital skills training and/or specific support for SME distribution companies.

1.6 Overview of Research Methodology

This study will be quantitative in nature that will be appropriate to study and measure the relationship between adoption of digital technology and the performance of supply chain in a sample of FMCG distribution companies in Nepal. The survey research design is used and primary data is collected from the respondents who are working in the relevant position in FMCG distribution companies of Nepal by using a structured questionnaire.

The data will be analysed with the use of descriptive and inferential statistics such as correlation and regression analysis to test the hypothesis stated in Section 2.9. The research philosophy, research approach, research design, sampling, data collection instrument and analytical methods are discussed in detail in Chapter 3.

1.7 Structure of the Dissertation

This dissertation is organised into six chapters. This Chapter 1 has presented background and context, problem and stated, research aim, objectives, questions, rationale and method of the study. Chapter 2 summarizes the relevant academic literature on digital technology

adoption and supply chain performance, provides theoretical model, delineates research gap investigated in this study and formulates research hypotheses. The Research Methodology used in the study is described in Chapter 3 which covers the philosophical approach, research design, sampling strategy, data collection instrument, data analysis method, and ethical considerations. The study results that consist of respondent profiles and statistical analysis of the results are presented in Chapter 4. These findings are discussed with existing literature and theoretical framework in Chapter 5 and contribute to the theory and practice in Chapter 6. The dissertation is finally wrapped up in Chapter 6, which summarizes the study and its findings as well as offers practical recommendations, identifies the limitations of this study, and provides ideas for future research.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The academic and industry literature regarding the effect of digital technology adoption on performance of supply chain in fast-moving consumer goods (FMCG) distribution companies in Nepal is discussed in this chapter. The aim of the research as stated in Chapter 1 is to investigate the effect of using digital technologies on the performance of supply chain in this sector and three objectives are used to achieve the aim of the research: to explore how digital technologies are used in activities of supply chain; to examine the relationship between digital technology use and supply chain efficiency; and to understand key challenges faced by Nepalese FMCG distribution companies in digital transformation.

This chapter is organized in such a way that the key concepts used in the study are explained in detail, followed by the theoretical and conceptual framework that are used as a guide for the study. The systematic search and selection of the literature reviewed is then described in Section 2.3, in accordance with the PRISMA 2020 reporting guideline (Page et al., 2021). In the next step of the chapter, the empirical and conceptual literature will be explored and summarized as a literature review table, and the body of evidence will be critically synthesized and the research gap, which is to be filled with this study, will be identified and the research hypotheses will be developed.

2.2 Definition and Discussion of Key Concepts

2.2.1 Digital technology adoption

The term digital technology adoption describes the journey from awareness to the adoption of a digital innovation that is used routinely and confirmed by an organisation (Rogers, 2003). Digital technology adoption can be differentiated from digital transformation, a more fundamental shift in processes, culture, and organisation that comes with a firm's immersion in a strategy surrounding the use of digital technologies. Adoption is not a one-time process; it is an innovation-decision process that includes knowledge, persuasion, decision, implementation and confirmation stages as described by Rogers (2003), such that two firms may be technically “adopted” a technology, but be very different at the

implementation and confirmation stage. This is further explored in the discussion of Diffusion of Innovation theory in Section 2.4.2.

Digital technology adoption is considered in this study in terms of four different but related types of technology, each with its different nature, sub-components and role in the supply chain.

Enterprise Resource Planning (ERP) systems

ERP systems are a collection of integrated software modules that share a single common database and are used to manage various business processes, such as Finance and Accounting, HR, Sales and Distribution, Procurement, Supply Chain and Inventory Management (Christopher, 2016; Giri, Thakur and Chatterjee, 2020). There are various parameters of ERP in this category which are relevant to the FMCG distribution companies such as the modules implemented (e.g., finance module, or finance, warehousing and distribution modules); the implementation model (on-premise systems with a need for local servers and IT support staff, as opposed to cloud-based ERP, a model that reduces up-front infrastructure costs and is becoming more relevant for resource-constrained Nepalese SMEs); and the level of customisation versus standardisation (implementation costs and the extent to which the system is aligned with the company's existing processes). According to Giri, Thakur and Chatterjee (2020), the two ERP packages most widely used in Nepalese manufacturing companies are Microsoft Dynamics AX/NAV and SAP, with each package having its own strengths and weaknesses in various functional areas like inventory, sales and quality management.

Warehouse and inventory management software

This is made up of systems that are implemented to keep an eye on stock levels, their whereabouts and where they are going inside a warehouse or distribution centre. Depending on the level of complexity, sub-types include relatively simple digital systems for stock recording, barcode systems for minimizing data entry errors and more sophisticated Warehouse Management Systems (WMS) that can automatically determine a reorder point, optimize stock location and link directly to the inventory module of an ERP system (Ben-Daya, Hassini and Bahroun, 2019; Hazen et al., 2016). The degree of functionality, from the software logging inventory to assisting in inventory decision making, like automated

replenishment, is another facet that sets more from less mature companies, especially in the FMCG space, where they generally have large numbers of stock-keeping units (SKUs) that have a high velocity of change.

GPS and IoT-based tracking

The main applications of global positioning system (GPS) and Internet of Things (IoT) in a supply chain are logistics and fleet visibility. The application of vehicles equipped with the Internet of Things (IoT) sensor networks is possible with the addition of other features such as temperature monitoring while in transit, which is relevant for FMCG products with sensitive shelf-life (Ben-Daya, Hassini and Bahroun, 2019). All of these sub-types require a reliable mobile network and Internet infrastructure which could be a critical aspect in Nepal's diverse geography.

Digital and mobile payment systems

Digital payment systems allow for the transfer of funds between distributors, retailers and suppliers, without the use of cash or paper-based payment methods. This refers to bank-to-bank transfer services like Connect IPS, QR-based payments at point of sale, and mobile wallets, eSewa, Khalti and IME Pay (Nepal, 2024). They are not the same as business-to-business digital banking and treasury systems that are capable of processing payments for suppliers in higher denominations and are usually connected to a business's finance module in its ERP system. Another aspect of the difference is the kind of mobile wallets consumers use versus the mobile wallets and digital banking/treasury solutions designed for businesses, since FMCG distribution companies manage both types of transactions—paying suppliers via formal banking channels and receiving payments from small retailers via mobile wallets or cash.

The following four categories of technologies, ERP, warehouse and inventory management software, GPS/IoT based tracking and digital payment systems are the main focus of this study as per the research proposal. There are broader Industry 4.0 technologies, including big data analytics, artificial intelligence and block-chain that are also recognised in the wider literature as an area of digital supply chain research adjacent to, and growing in importance, however, their focus is outside the scope of the objectives of this study and so are not explored in detail here.

2.2.2 Supply chain management

Christopher (2016) refers to the management of upstream and downstream relationships with suppliers and customers that provide superior customer value at less cost to the supply chain as supply chain management. SCM can be viewed on multiple aspects as it relates to this research.

Structural dimension: tiers and network position

The typical supply chain consists of a hierarchy of suppliers, Tier 1 suppliers are closest to the focal firm, Tier 2 suppliers are closest to Tier 1 suppliers, and so on, downstream the chain would include distributors, wholesalers, retailers and end consumers (Christopher, 2016). FMCG distribution firms have a specific role in this chain, between the manufacturer/ importer and the retailer, as their performance will rely heavily on the quality and reliability of the information and product flow from their suppliers and their own capacity to provide service to a large and varied customer base.

Flow dimension: product, information and financial flows

Another classification of SCM activities are based on the type of flow being managed, such as the physical or product flow (the movement of goods from origin to point of consumption, which includes procurement, warehousing and transportation); the information flow (order information, demand forecasts, inventory data and shipment tracking, moving both forward and backward along the chain); and the financial flow (payments, credit terms and invoicing between supply chain partners) (Christopher, 2016). Digital technologies fit into these flows in various ways: ERP and inventory software is used for the information flow, GPS/IoT tracking for the physical flow, and digital payment systems for the financial flow.

Strategic versus operational scope

There are also various levels of decision making within SCM, for example strategic decisions (what suppliers to work with, whether to invest in an ERP system or not) will determine the structure and capability of the chain and day to day operational decisions (order processing, route scheduling, stock replenishment) will determine the efficiency of the chain day to day (Christopher, 2016). This study focuses on the operational level and investigates the impact of the use of specific technologies on day-to-day efficiency of supply chains, while at the

same time acknowledging that the decision to use a particular technology is a strategic decision, and this decision is theorised in Section 2.4.

2.2.3 Supply chain performance

A performance in the Supply Chain is a multidimensional construct, and various performance measurement frameworks focus on various dimensions of the construct.

The SCOR framework

The Supply Chain Operations Reference (SCOR) model, developed by the Association for Supply Chain Management (ASCM), breaks down performance into five attributes (ASCM, 2017). Reliability is measured by the ability of the supply chain to provide the right product, the right quantity and quality, at the right place, at the right time; usually a measure of order-fulfilment accuracy and on-time delivery. Responsiveness is the ability of the supply chain to meet the customer's orders promptly, typically through order-to-delivery cycle time. Agility is the capacity of the supply chain to respond to external changes, like unexpected changes in demand, or disruption in supply. Cost is the overall cost of the supply chain covering transportation, warehousing and inventory carrying costs. Asset management efficiency relates to the efficient management of the assets, such as inventory turnover, and the utilisation of warehouse and vehicle assets. The first three are customer related and the other two are customer internal (ASCM, 2017).

Beamon's resource, output and flexibility framework

As suggested by Beamon (1999), an alternative and widely cited framework classifies performance measures of a supply chain into three broad categories: resource measures focus on the effectiveness and efficiency of using resources like inventory and transportation capacity in the supply chain, usually expressed as costs; output measures emphasize the responsiveness of the supply chain to customers and the level of service provided, such as fill rate and on-time delivery; and flexibility measures capture the ability of the supply chain to adapt to changes in volumes and schedules from suppliers and customers. As pointed out by Beamon (1999), flexibility measures are more difficult to measure than resource and output measures and thus have been used much less extensively than these two other groups of measures in supply chain models. The framework is a good addition to SCOR as it puts emphasis on the two most measurable

areas of performance: resource utilisation and service outcomes, which are both covered in the supply chain efficiency construct to which the second objective of this study is directed.

Operationalisation adopted in this study

The efficiency and cost aspects of both models best fit the goals of this study. From a practical perspective, key metrics for supply chain efficiency in an FMCG distribution company often relate to the performance of the order-to-cash process, including: order processing time; inventory turnover; stock-out or overstock rate; order fulfilment accuracy; delivery reliability; delivery cost per order; and Encorporation's resource and output metrics (Beamon). The outcome categories that this study's survey instrument (presented in Chapter 3) aims to capture and that link the specific technologies reviewed in Section 2.5 with the hypotheses developed in Section 2.9 are presented below:

2.3 Systematic Literature Search and Selection Process

To ensure the literature underpinning this review was identified in a transparent and replicable way, the search and selection process followed the PRISMA 2020 (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guideline. This chapter is presented as a narrative review and as is apparent in the course of this chapter, application of the identification, screening, eligibility and inclusion steps outlined in PRISMA's framework for a systematic review (Moher, et al., 2009) gives a systematic basis for the sources discussed throughout Section 2.5 that are relevant to this study, as outlined in the wider principles of evidence-informed management review that has been outlined by Tranfield, Denyer and Smart (2003).

2.3.1 Identification

The records were retrieved by searching the International and regional literature from Google Scholar and ScienceDirect, while Nepal specific literature was searched from Nepal Journals Online (NepJOL). The following keyword sets were used to combine search strings (Boolean operators): (“digital technology” OR “digitalisation” OR “digital transformation” OR “ERP” OR “enterprise resource planning” OR “GPS” OR “IoT” OR “digital payment”) AND (“supply chain” OR “supply chain management” OR “supply chain performance” OR “logistics”) AND (“FMCG” OR “fast-moving consumer goods” OR “distribution” OR

"developing countries" OR "Nepal"). For core theoretical papers (such as Rogers, Barney, Tornatzky and Fleischer), there were no restrictions on search by date of publication.

2.3.2 Screening and eligibility criteria

The records were first screened by title and abstract, based on the following inclusion criteria: the study concerned digital technology adoption, supply chain management, or supply chain performance; the study was published in a peer-reviewed journal, or for Nepal-specific sources, where there is limited peer-reviewed journal coverage, in a NepJOL indexed academic journal; and the study was available in English. Those records that passed title/abstract screening were then evaluated in full text in the same manner.

2.3.3 PRISMA flow diagram

Figure 2.1 summarises the number of records identified, screened, assessed for eligibility and included in this review.

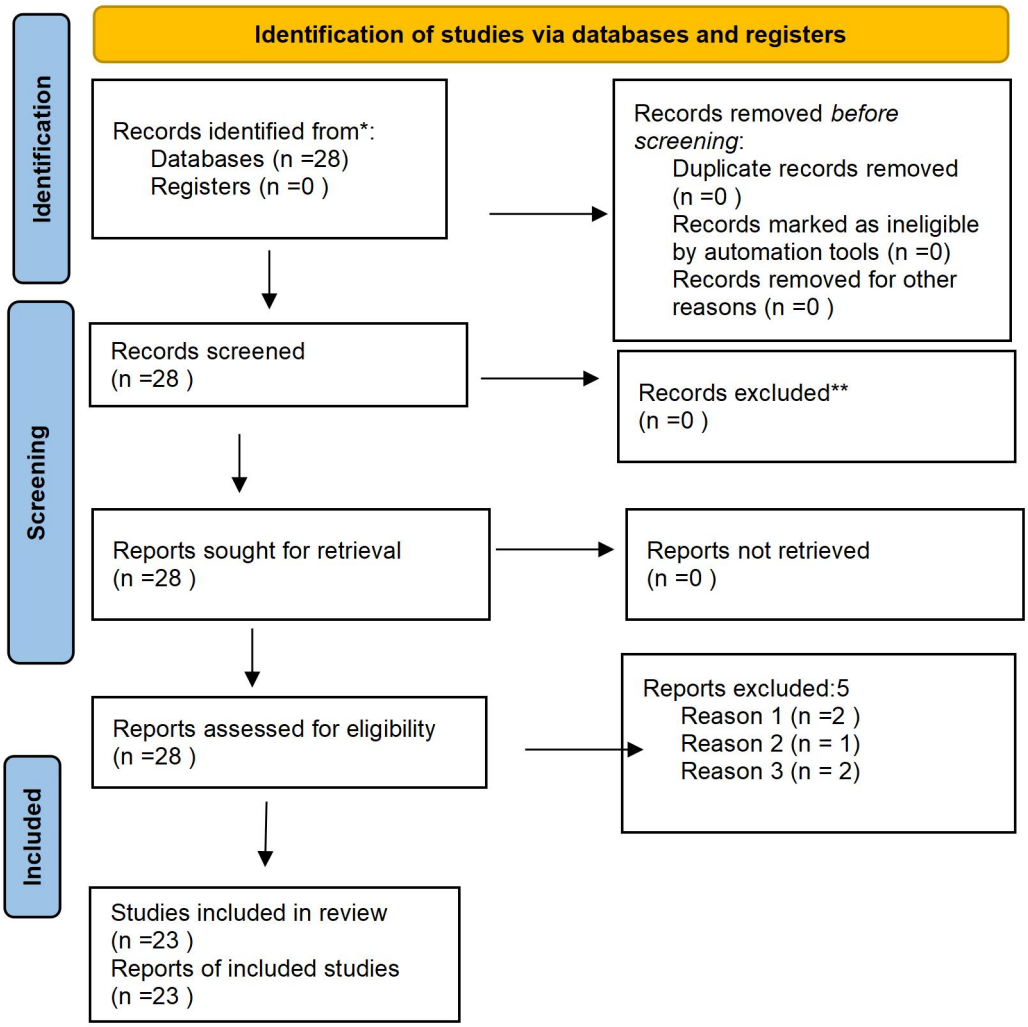


Figure 2.1: PRISMA flow diagram of the literature search and selection process

The resulting set of included studies spans international, regional (South Asian) and Nepal-specific literature, and is summarised in the literature review table in Section 2.6.

2.4 Theoretical and Conceptual Framework

There are three complementary theories that form the foundation for this study: The Technology-Organisation-Environment (TOE) model, Diffusion of Innovation (DOI) theory and the Resource Based View (RBV) of the firm. They provide explanations, respectively, for why firms choose to use digital technology, the process of the decision to use it, and how that choice can lead to a performance gain for the firm. Each theory is discussed in terms of what it is, how it has been used in the information systems and supply chain literature, and what limitations have been noted by other researchers.

2.4.1 Technology-Organisation-Environment (TOE) framework

What the framework proposes

Tornatzky and Fleischer (1990) suggest that the context of an organisation's acceptance of an innovation is determined by three factors in the TOE framework. The technological context refers to the attributes, accessibility and difficulty of pertinent technologies, both internal to the firm and external. The organisational context relates to the level of the firm and the extent of resources available for investment, managerial support and skill/readiness of employees. An environmental context is the factors that are outside the direct control of the firm, such as industry structure, competitive pressure, regulatory conditions and availability of supporting infrastructure (Baker, 2012).

How TOE has been used in the field

TOE has been one of the most widely used frameworks in information systems adoption studies, and has been applied to the study of the adoption of technologies, from e-commerce and electronic data interchange in the 1990s onward, to more recent ones such as cloud computing, big data analytics and Industry 4.0, generally at the organisational level and not at the individual level (Baker, 2012). In the Nepalese context specifically, Subedi and Bhatt (2025) directly test 384 Nepalese SMEs and conclude that the three elements of the TOE framework (technological, organisational and cost) significantly predict their sales

growth efficiency with a significant constraint on sales growth being the poor internet connection in Nepal, which is an environmental-context factor. This is a direct Nepalese application where the appropriateness of TOE was supported.

Limitations of TOE

A number of reasons for the criticism of TOE are known.TOE has been lambasted for a number of reasons. First, it is descriptive rather than predictive as it defines categories of factors that might affect adoption but does not identify specific factors that are likely to be important in a specific context, or which ones are likely to work together in ways that should not be assumed, and the various factors within each context are selected and weighted differently, and sometimes inconsistently, across individual studies (Baker, 2012). Second, it is at the organisational level, so that in turn it does not directly focus on individual-level psychological factors, like a new system's acceptance by an employee, addressed more directly by other theories on employee adoption, such as DOI. Thirdly, the framework was designed based on large formally structured organisations, and constructs, such as "organisational resources", may need to be adapted to maintain their relevance for the small, often informally managed distribution firms in Nepal that dominate the FMCG sector. This last limitation is addressed in part in this study by using TOE along with DOI and RBV, which are discussed next.

2.4.2 Diffusion of Innovation (DOI) theory

What the theory proposes

The explanation of why, how and at what speed innovations spread within a social system rests on Rogers' (2003) DOI theory which describes five stages of decision-making process: knowledge, persuasion, decision, implementation and confirmation. Five perceived attributes that can affect the rate of adoption are identified: relative advantage (the degree to which the technology is perceived as superior to the technology that it replaces), compatibility (how well the technology fits into existing values, processes, and past experience), complexity (how difficult the technology is perceived to be to understand and use), trialability (whether the technology can be tried on a limited basis prior to full commitment), and observability (how visible the technology's results are to others). Rogers (2003) also categorizes people who adopt an innovation into five groups, according to how

quickly they do so in relation to other members in their social system: innovators (about 2.5% of the population, who adopt first, tolerate uncertainty most), early adopters (13.5%), early majority (34%), late majority (34%), and laggards (16%), who are the last to adopt the innovation, and are the most resistant to change.

How DOI has been used in the field

Among the most widely used theories in technology adoption in general, DOI has been applied in information systems, healthcare technology, agricultural extension and marketing research to explain individual and organisational adoption patterns, respectively. In the Nepalese FMCG distribution context these attributes can be explained as to why some technologies (such as digital payment systems) that are generally easier to trial on a smaller scale, have higher visibility of benefits, and are less complex, can diffuse more quickly than others, like ERP systems, which require more organisational change before benefits can be seen, and are harder to trial on a small scale. The concept of digital maturity is important for this study as it outlines the condition that may be observed in different FMCG distribution companies in Nepal either having adopted ERP application and digital payment system or still using manual and paper-based methods.

Limitations of DOI

There are several drawbacks in DOI theory as pointed out by Rogers (2003) and subsequent critics. The theory assumes that an innovation's diffusion is always desired and that a non-adoption is a shortcoming or failure to make the right choice, thus highlighting the "pro-innovation" bias within the theory and potential for overlooking scenarios where a technology is simply not right for a particular company. The individual-blame bias occurs when they blame the person or firm for lack of adoption, for example, as a “laggard” when the reason for not adopting is a structural constraint that is not the control of the person or firm, as is the case here (see Section 2.5.4). Lastly, the application of DOI to organisational level choices of adoption, which are likely to involve multiple decision makers and formal resource allocation procedures, would require some modification, which this study does by using the TOE framework, which is organisational in focus.

2.4.3 Resource-Based View (RBV)

What the theory proposes

The RBV is a theory built by Wernerfelt (1984) and formalised by Barney (1991) that posits a relationship between the resources and capabilities that a company possesses and how they can create and sustain competitive advantage: The VRIP or the five rules of the RBV. A resource is valuable if it allows a firm to take advantage of an opportunity or overcome a threat; rare when there is a small number of competing firms with the same resource; imperfectly imitable when other firms are unable to easily replicate the resource, such as by being integrated into the firm's processes or know-how developed over time; and non-substitutable when no other comparable alternative resource offers as much value to the firm.

How RBV has been used in the field

In general strategic management research as well as in particular in information systems research, RBV is one of the prevailing theoretical approaches and has been used extensively to explain performance differences among firms that invest in the same technology, which the RBV suggests are caused by complementary organizational capabilities rather than the technology itself. In this context, digital technologies and the organisations' skills to use them effectively can be interpreted as firm resources; if the firm has resources that are valuable and hard to be replicated or matched by competitors, especially in a market where digital maturity is unevenly distributed, such as the FMCG distribution market in Nepal, then these resources can become a source of a firm's superior chain performance. The VRIN nature of ERP, GPS tracking and digital payment systems depends not only on the technology itself, but on how well a particular company can use it in processes and how capable their staff are of doing so; this is directly related to the organisational aspect of the TOE framework.

Limitations of RBV

There has been significant criticism of RBV, most notably from Priem and Butler (2001), who claim that the theory is tautological: a resource is valuable because the firm using it is performing well; firm performance is explained by reference to that valuable resource, and so there is circularity in the theory, not a testable, predictive theory. However, Priem and

Butler (2001) also suggest that RBV is generally static in nature, and thus can be used to explain why a competitive advantage exists at a particular moment in time, rather than to explain how valuable resources can be created or acquired; moreover, the key constructs of the model, such as those of "value" and "rareness," are also much more difficult to measure and define apart from the performance outcome they are meant to explain, making empirical testing more difficult. Also, RBV has been attacked for its neglect of external (market-level) factors that can influence the performance of a firm irrespective of the internal resources it possesses, for example, competition in the industry, the changes in regulations or the sudden introduction of technology. In this study, these constraints indicate that RBV is utilized as a mechanism that explains why adoption occurs, instead of as a predictor of adoption in its own right, which is a job for TOE and DOI in the integrated framework below.

2.4.4 Integrated conceptual framework for this study

In this research, the theories have been combined into one conceptual framework. The level and type of digital technology use in FMCG distribution companies in Nepal are said to be driven by TOE factors (technological, organisational and environmental conditions) and perceived attributes of specific technologies. After this, RBV gives the theoretical rationale to support the expectation that this adoption is positively related to the performance of the supply chain, which is defined as the efficiency of the supply chain according to the SCOR framework and the Beamon framework discussed in Section 2.2.3. Barriers found in the literature relate to the organisational and environmental context of TOE, and are categorised as factors that could decrease or reduce the impact of the adoption-performance link. This integrated framework is directly related to the research objectives in Section 2.9 and the hypotheses developed in Section 2.9 and will be used to design the survey instrument to be described in Chapter 3.

2.5 Literature Review

This section summarizes the empirical and theoretical literature found as a result of the process described in Section 2.3, and categorizes it thematically under the four broad headings of digital technologies in supply chain management and their linkages with supply chain performance, institutional and sustainability drivers of adoption, and barriers to

adoption, along with the specific context of FMCG distribution in the Nepal context and in similar developing economies.

2.5.1 Digital technologies used in supply chain management

An enterprise resource planning (ERP) system is used to coordinate the procurement, inventory, warehousing and logistics processes into a single information system, which may lead to better decision-making and coordination (Christopher, 2016). Hazen et al. (2016) argue that ERP tools and analytics can enhance the accuracy of inventory and demand forecasts, boost operational efficiency and customer service, and improve the performance of organisations, though significant barriers to the implementation of ERP in developing country environments include high costs and lack of technical expertise. Kamble, Gunasekaran and Dhone (2019) conclude that while ERP can enhance organisational performance when combined with process automation, high implementation costs and limited technical expertise are continuing challenges in developing country environments.

Another study, conducted specifically in Nepal with the manufacturing industries, gives some more directly applicable detail. In a survey and interviews with ERP users in several large manufacturing organizations in Nepal, Giri, Thakur and Chatterjee (2020) conclude that the Internet connectivity and system security were always considered by the ERP users as the most important technical concerns for effective functioning of ERP system, that perceived business value of ERP is strongly correlated with the reported benefits of production standardisation and order accuracy, and that the continuous staff training was always reported as essential to the realisation of ERP benefits. Another major and continuing issue mentioned was cost, especially the customisation and upgrade costs, and the cost of support. Although not directly related to FMCG distribution, this is a close parallel in Nepal from the manufacturing sector, with regard to the connectivity, cost and skills barriers mentioned in Section 2.5.4.

Warehouse and inventory management software offers real-time visibility of stock and movement, which decreases the human error and enhances communication among supply chain partners (Ben-Daya, Hassini and Bahroun, 2019; Hazen et al., 2016). GPS and IoT-based tracking systems also enable this visibility in transportation and last-mile delivery:

Ben-Daya, Hassini and Bahroun (2019) explain that IoT technologies contribute to the efficiency of logistics and supply chain visibility, and also help support operational coordination between nodes in the supply chain. This study, however, warns that the capacity of GPS and IoT tracking can rely on the success of local telecommunication (LTE) networks, which is directly relevant to the rugged topography and patchy telecommunication connectivity of the hills and mountains in Nepal.

Digital payments and mobile payments eliminate paperwork, enhance the accuracy of transactions, and speed up the flow of money from distributors to the retailers and suppliers (Kamble, Gunasekaran and Dhone, 2019). Since the birth of the country's first mobile wallet, eSewa, in 2009, Nepal's digital payment ecosystem has experienced a tremendous growth with the introduction of other mobile wallets like Khalti, IME Pay and Connect IPS (Nepal, 2024). According to Nepal (2024), who surveyed 123 eSewa users in Kathmandu Valley, all of these factors, ranging from transaction convenience to rewards and offers, have a positive impact on the continued affinity of users with eSewa, and are statistically significant. While this study is focused on individual consumer adoption, it offers valuable insights into the critical need for perceived security and trust, which directly apply to FMCG distribution companies evaluating the adoption of digital payments for supplier-to-retailer transactions.

2.5.2 Digital technology adoption and supply chain performance outcomes

A recurring finding across the literature is that digital technology adoption is positively associated with supply chain performance. Hazen et al. (2016) and Kamble, Gunasekaran and Dhone (2019) link ERP- and analytics-enabled processes to reduced error rates and improved efficiency, while Ben-Daya, Hassini and Bahroun (2019) find that IoT-enabled visibility improves delivery reliability and, by extension, customer service levels. In a study directly relevant to this research, Chauhan, Bangwal and Kumar (2023) examine the digitalisation of transportation and warehouse processes in the Indian FMCG sector and find that digitalisation significantly improves logistics distribution performance, providing empirical support for a positive digitalisation-performance relationship in a comparable South Asian, FMCG-distribution setting. The SCOR and Beamon frameworks discussed in Section 2.2.3 have informed how performance is operationalised in much of this literature

and offer a useful methodological reference for the survey instrument to be developed in this study.

2.5.3 Institutional, regulatory and sustainability drivers of adoption

Beyond direct performance effects, several studies situate digital technology adoption within a wider institutional context. Luthra et al. (2018) identify regulatory pressure, top-management commitment and the availability of financial resources as key drivers of information and communication technology (ICT) adoption for sustainability initiatives in supply chains in developing economies, findings that align with the environmental and organisational dimensions of the TOE framework. At a global policy level, the World Economic Forum (2024) argues that digital technologies such as AI, blockchain and IoT can help least-developed countries build more sustainable and efficient supply chains, but stresses that these benefits are not automatic and depend on inclusive access to infrastructure and finance, a caution with direct relevance to Nepal's position among the world's least-developed economies.

2.5.4 Barriers and challenges to digital technology adoption

The literature converges on a consistent set of barriers to digital technology adoption in developing-economy supply chains. High implementation cost and limited access to finance are repeatedly identified as primary obstacles (Kamble, Gunasekaran and Dhone, 2019; Hazen et al., 2016); Giri, Thakur and Chatterjee (2020) find that ongoing costs of customisation, upgrades and support, not just the initial purchase price, are a recurring concern for ERP-adopting firms in Nepal, suggesting that cost is a barrier throughout the technology's lifecycle rather than only at the point of adoption. Inadequate digital and telecommunications infrastructure constrains the effectiveness of IoT, GPS and cloud-based systems in particular (Ben-Daya, Hassini and Bahroun, 2019), and internet connectivity was rated by Nepalese ERP users as one of the most important factors affecting whether the system could function reliably at all (Giri, Thakur and Chatterjee, 2020).

A shortage of digitally skilled personnel and low levels of digital literacy among distribution-sector employees limit firms' ability to implement and sustain new systems (Kamble, Gunasekaran and Dhone, 2019); this is corroborated in the Nepalese ERP context, where

continuous staff training was identified as essential to realising the technology's benefits (Giri, Thakur and Chatterjee, 2020). Cybersecurity and data-privacy risk are increasingly cited as concerns for digital payment and data-sharing systems (Kamble, Gunasekaran and Dhone, 2019); perceived security is similarly one of the strongest determinants of continued use of digital payment platforms among Nepalese users (Nepal, 2024). Finally, weak or uncertain regulatory frameworks slow the pace of adoption at an industry level (Luthra et al., 2018). These barrier categories, cost, infrastructure, skills and security/regulation, map closely onto the technological, organisational and environmental dimensions of the TOE framework introduced in Section 2.4.1, reinforcing its suitability as the primary theoretical lens for this study.

2.5.5 The Nepalese and South Asian FMCG distribution context

Nepal's FMCG distribution sector shares structural features with the wider South Asian region: it is fragmented, dominated by small and medium-sized distributors and traditional retail outlets, and characterised by thin margins and heavy reliance on informal trade channels. Studies of the comparable Indian FMCG distribution environment describe similar characteristics and note that digital tools such as ERP, demand forecasting and digital order management are being adopted to streamline these networks, improve inventory tracking and support last-mile delivery, particularly among larger organised players (Chauhan, Bangwal and Kumar, 2023). Most directly relevant sector-specific evidence therefore continues to be drawn from adjacent regional contexts, principally India, or from global and conceptual literature on digital supply chains in developing economies.

2.5.6 Emerging Nepalese empirical evidence on digital technology adoption

A growing body of Nepal-based, peer-reviewed research, published largely in NepJOL-indexed journals, provides useful, directly relevant evidence, although it is concentrated on SMEs in general or on manufacturing rather than on FMCG distribution specifically. Subedi and Bhatt (2025), applying the TOE framework to 384 SMEs in Nepal's Kailali and Kanchanpur districts, find that the level of digitisation, adoption of digital payments and cost efficiency all have positive and statistically significant effects on sales growth efficiency, while poor internet access, high implementation cost and limited technical expertise remain significant barriers. Adhikari and Molla (2024), writing in the Nepalese Journal of

Management and Technology, similarly find that digital technology adoption is reshaping management practices among Nepalese SMEs but that limited resources and infrastructure constrain the extent of this shift. Bhatt (2025), using a PLS-SEM model with 303 SME respondents in Kathmandu Valley, finds that digital transformation has a significant positive effect on organisational resilience, and that this effect is strengthened where firms combine digital adoption with entrepreneurial orientation, lending indirect empirical support to this study's Resource-Based View argument that digital capability functions as a firm resource whose performance benefit depends on complementary organisational capabilities.

Taken together, this body of Nepalese evidence confirms that the general relationship between digital technology adoption and firm-level performance, and the barriers that constrain it, observed in the wider developing-economy literature also holds within Nepal. What remains largely absent is empirical, survey-based research that examines this relationship specifically within FMCG distribution companies, as opposed to SMEs in general or manufacturing firms, and specifically in relation to the ERP, inventory management, GPS/IoT tracking and digital payment technologies that are the focus of this study. This distinction is central to the research gap identified in Section 2.8.

2.6 Literature Review Table

Table 2.1 summarises the studies most central to this review, indicating their context, focus, underpinning theory, methodology and key findings, and illustrating the geographic, sectoral and theoretical concentration of the existing evidence base discussed in Section 2.8.

Table 2.1: Literature Review Table

Authors and Year	Country / Context	Focus / Technology	Theory Applied	Methodology	Key Findings
Ben-Daya, Hassini and Bahroun (2019)	Global (review)	IoT and SCM	None stated (review)	Systematic literature review	IoT enhances real-time visibility and inventory tracking; adoption constrained by cost and infrastructure in developing regions.
Hazen et al. (2016)	Global (conceptual)	Big data and predictive analytics	None stated (conceptual)	Theory-driven research agenda	ERP- and analytics-enabled forecasting improves inventory accuracy and reduces human error;

Authors and Year	Country / Context	Focus / Technology	Theory Applied	Methodology	Key Findings
					theoretical gaps remain around developing-economy application.
Ivanov et al. (2021)	Global	Digital supply chain and Industry 4.0	None stated (review)	Literature and trend review	Industry 4.0 technologies reshape supply chain resilience and performance; evidence concentrated in developed-economy, large-firm settings.
Kamble, Gunasekaran and Dhone (2019)	India (manufacturing)	Industry 4.0 and lean manufacturing	Not explicitly theory-driven	Survey-based structural model	Industry 4.0 adoption improves organisational performance through automation and resource utilisation; cost and technical know-how remain barriers.
Luthra et al. (2018)	India / developing economies	ICT drivers for sustainable supply chains	Institutional theory (implicit)	Expert-based hierarchical modelling	Regulatory pressure, top-management commitment and financial resources are key drivers of, and barriers to, ICT-enabled sustainability initiatives.
Chauhan, Bangwal and Kumar (2023)	India (FMCG sector)	Digitalisation of logistics distribution	Not explicitly theory-driven	Quantitative survey; moderated-mediated model	Digitalisation of transportation and warehouse processes significantly improves logistics distribution performance in the FMCG sector.
World Economic Forum (2024)	Least-developed countries	AI, blockchain and IoT in supply chains	None (practitioner report)	Industry / practitioner report	Digital technologies can advance supply chain sustainability and efficiency in least-developed countries, but only with inclusive access and infrastructure investment.
Subedi and	Nepal (Kailali &	Digital	TOE	Quantitative	Digitisation, digital

Authors and Year	Country / Context	Focus / Technology	Theory Applied	Methodology	Key Findings
Bhatt (2025)	Kanchanpur SMEs)	transformation and sales growth	framework	survey (n=384)	payment adoption and cost efficiency significantly improve sales growth efficiency; poor internet access, cost and skills gaps remain key barriers.
Adhikari and Molla (2024)	Nepal (SMEs)	Technology and management practice	Not explicitly theory-driven	Survey-based study	Technology adoption reshapes SME management practices in Nepal but is constrained by limited resources and infrastructure.
Bhatt (2025)	Nepal (Kathmandu Valley SMEs)	Digital transformation and organisational resilience	Dynamic capabilities (implicit)	Quantitative survey (n=303); PLS-SEM	Digital transformation significantly improves organisational resilience; benefits are stronger where firms combine digital adoption with entrepreneurial orientation.
Giri, Thakur and Chatterjee (2020)	Nepal (manufacturing)	ERP implementation	DeLone-McLean IS success model	Mixed-methods survey and interviews (n=167)	Internet connectivity, security and staff training are the strongest determinants of successful ERP use; cost of customisation and support is a recurring concern.
Nepal (2024)	Nepal (Kathmandu Valley, eSewa users)	Digital / mobile payment adoption	Not explicitly theory-driven	Quantitative survey (n=123); correlation and regression	Transaction convenience, compatibility, ease of use, perceived security, trust and rewards all significantly predict continued use of digital payment platforms.

2.7 Critical Synthesis of the Literature

The literature reviewed reveals clear points of convergence, but also significant tensions and gaps. First, there is a consistent consensus that the use of digital technologies, ERP, IoT, GPS tracking and digital payment systems, is associated with improved supply chain efficiency, accuracy, visibility and responsiveness across multiple contexts (Hazen et al., 2016; Ben-Daya, Hassini and Bahroun, 2019; Kamble, Gunasekaran and Dhone, 2019; Chauhan, Bangwal and Kumar, 2023). Second, there is equally consistent agreement on the barriers to adoption; cost, infrastructure, digital skills and regulatory uncertainty recur across geographically diverse studies (Kamble, Gunasekaran and Dhone, 2019; Luthra et al., 2018; World Economic Forum, 2024) suggesting that these are structural features of technology adoption in developing economies rather than isolated, country-specific anomalies.

Yet there is a tension between the 'digital supply chain promise' narrative, in which digital and Industry 4.0 technologies are framed as transformative (Kamble, Gunasekaran and Dhone, 2019), and a more circumspect 'adoption-gap' narrative, in which literature on SMEs and least-developed countries cautions that these benefits are not automatically, nor uniformly, available (World Economic Forum, 2024; Luthra et al., 2018). This study's empirical focus on Nepalese FMCG distribution companies is situated directly in the second, more cautious, body of literature. This is the reason that barriers are modeled in this study as a condition on the adoption-performance relationship rather than as a separate outcome.

Methodologically, much of the underpinning global evidence is either conceptual or review based in nature (Hazen et al., 2016) or is derived from single-country, often larger-firm or manufacturing settings, such as Kamble, Gunasekaran and Dhone's (2019) study of Indian manufacturing or Chauhan, Bangwal and Kumar's (2023) study of the Indian FMCG sector. The same general pattern of positive digital-adoption-performance relationships and barriers of cost/infrastructure/skills/security in terms of digital adoption is confirmed in Nepal's literature that comes from Sections 2.5.1 and 2.5.6 (Giri, Thakur and Chatterjee, 2020; Nepal, 2024; Subedi and Bhatt, 2025; Adhikari and Molla, 2024; Bhatt, 2025). The TOE-based study by Subedi and Bhatt (2025) even uses the same theoretical framework as this study.

However, this Nepalese literature is always either concerned with SMEs in general or manufacturing firms specifically (Giri, Thakur and Chatterjee, 2020), or with individual consumer tech use (Nepal, 2024), not with FMCG distribution companies. There is nothing that requires a look at the combined effect of ERP, inventory management, GPS/IoT tracking and digital payments as a technology set.

Theoretically, a further pattern is visible in Table 2.1: the great majority of the studies reviewed, both international and Nepalese, either state no explicit theoretical framework or apply only a single theory in isolation, most often TOE or an institutional-theory-style argument, to explain adoption. Very few combine an adoption-focused theory with a performance-focused theory such as RBV to explain the full mechanism from adoption to outcome; adoption and performance are frequently treated as directly and simply related, without the mediating logic that RBV supplies, and without accounting for the conditions under which the expected benefits fail to materialise. This combination of sectoral, methodological and theoretical limitations in the existing literature directly informs the research gap identified in the next section.

2.8 Identification of Research Gap

Most existing studies are based in India or look at Nepalese SMEs and manufacturing firms in general, not FMCG distribution companies. The literature search identified very limited research examining how ERP, GPS tracking, inventory management software and digital payments together affect supply chain performance in Nepal's FMCG sector, and few studies combine an adoption theory (TOE, DOI) with a performance-mechanism theory (RBV) in a single model or test the conditions under which the expected performance benefits are weakened. This study fills that gap by testing this relationship directly among Nepalese FMCG distribution companies, using an integrated TOE-DOI-RBV framework.

2.9 Development of Research Hypotheses

This section develops the study's research hypotheses. Propositions and hypotheses are distinct: a proposition is a theoretical statement about a relationship between concepts, typically used in qualitative or conceptual research, whereas a hypothesis is a specific, empirically testable statement about the expected relationship between measurable

variables, appropriate to the quantitative, survey-based design adopted for this study (outlined in Chapter 1 and detailed in Chapter 3). For this reason, the study's testable statements are developed and presented here as hypotheses (H1 and H2) rather than as propositions.

2.9.1 Alignment of hypotheses with research objectives and questions

Table 2.2 shows how each hypothesis developed in this section connects back to the research objectives and research questions set out in Chapter 1, ensuring that the empirical model tested in this study addresses the research aim directly. The first objective and its corresponding question, concerning which digital technologies are used by Nepalese FMCG distribution companies, are addressed descriptively through the survey instrument rather than through a formal hypothesis, since this objective is exploratory rather than relational in nature.

Table 2.2: Alignment of research objectives, questions and hypotheses

Objective	Research Question	Hypothesis
Obj. 1: Explore the use of digital technology in supply chain activities of FMCG distribution companies in Nepal.	RQ1: Which digital technologies are commonly used by FMCG distribution companies in Nepal?	Addressed descriptively (no hypothesis; exploratory objective).
Obj. 2: Examine the relationship between the use of digital technology and the efficiency of the supply chain.	RQ2: What is the relationship between the use of digital technology and supply chain efficiency?	H1
Obj. 3: Understand the key challenges that Nepalese FMCG distribution companies are encountering in digital transformation.	RQ3: What are the key challenges to digital technology adoption for Nepalese FMCG distribution companies?	H2

2.9.2 Digital technology adoption and supply chain performance (H1)

Supply chain efficiency, as defined in Section 2.2.3, refers to how well a firm utilises its resources in delivering goods to its customers, encompassing measures such as order-processing time, inventory turnover, the rate of stock-outs or overstocking, order-fulfilment accuracy, delivery reliability and cost per order (ASCM, 2017; Beamon, 1999). It therefore captures both the internal, resource-utilisation dimension of supply chain performance and

the service outcomes that follow from it, corresponding to Beamon's resource and output measures and to SCOR's reliability, cost and asset management attributes.

The Resource-Based View (Section 2.4.3) provides the primary theoretical basis for expecting a positive relationship between digital technology adoption and supply chain performance: where ERP, inventory management software, GPS tracking and digital payment systems are effectively integrated into a firm's operations, they function as valuable organisational resources that reduce waste, error and duplication of effort, directly improving resource utilisation and the reliability of delivery to retail customers. The Technology-Organisation-Environment framework (Section 2.4.1) complements this by identifying the organisational conditions, adequate resourcing, managerial support, and technological fit, under which this performance gain is more likely to be realised. Diffusion of Innovation theory (Section 2.4.2) adds an important qualification: because DOI conceptualises adoption as a process that only ends at the confirmation stage, performance gains are expected to be strongest where technology use has moved beyond initial trial into confirmed, routine use, rather than being assumed automatically upon a firm's first adoption of a given technology.

Hazen et al. (2016) argue that ERP- and analytics-enabled processes improve inventory accuracy and reduce human error, directly supporting resource-based efficiency gains. Ben-Daya, Hassini and Bahroun (2019) similarly find that IoT-enabled visibility improves logistics efficiency and delivery reliability, and Chauhan, Bangwal and Kumar (2023) provide direct evidence in a comparable South Asian FMCG distribution setting, finding that digitalisation of transportation and warehouse processes significantly improves logistics distribution performance in the Indian FMCG sector. Within Nepal specifically, Subedi and Bhatt (2025) find that the level of digitisation and cost efficiency are significant, positive predictors of business performance among Nepalese SMEs, using the same TOE framework applied in this study; Giri, Thakur and Chatterjee (2020) link successful ERP use directly to gains in production standardisation and order accuracy among Nepalese manufacturing firms; and Bhatt (2025) finds that digital transformation significantly improves organisational outcomes among Nepalese SMEs, particularly where firms combine digital adoption with complementary organisational capability, consistent with the RBV-based reasoning set out above.

Given that ERP and inventory management software are specifically designed to reduce manual data-entry error and improve stock visibility, and that GPS tracking and digital payment systems reduce delay and reconciliation effort in the physical and financial flows of the supply chain (Section 2.2.2), it is reasonable to expect that Nepalese FMCG distribution companies making greater use of these technologies will report higher supply chain performance, including more reliable and lower-cost delivery to retail customers, than those relying on manual, paper-based processes. This expectation is consistent with both the international literature and the emerging Nepalese evidence reviewed above, and forms the basis for the following hypothesis:

H1: Using digital technology (ERP, GPS tracking, inventory software, digital payments) is positively associated with supply chain performance in Nepalese FMCG distribution companies.

2.9.3 Barriers as a moderator of the digital technology-performance relationship (H2)

Barriers to digital technology adoption, reviewed in Section 2.5.4, include cost (both initial and ongoing), inadequate digital infrastructure, low digital literacy and skills gaps, and cybersecurity or regulatory uncertainty. Rather than being treated as a separate outcome, these barriers are conceptualised in this study as moderating conditions: factors that weaken the strength of the positive relationship hypothesised in H1, even where some level of digital technology adoption has taken place.

The Technology-Organisation-Environment framework (Section 2.4.1) provides the primary theoretical basis for H2, since cost and skills gaps map onto the organisational context, while infrastructure and regulatory uncertainty map onto the environmental context; TOE explicitly predicts that adoption outcomes depend on the interaction of technological opportunity with these organisational and environmental conditions, rather than on technology availability alone. Diffusion of Innovation theory's individual-blame bias critique (Section 2.4.2) is also relevant here: rather than treating weaker performance gains among some firms as a failure of those firms to adopt “correctly”, this study follows Rogers' (2003) own caution and treats such barriers as structural constraints outside a firm's immediate control, consistent with a TOE-based explanation.

Kamble, Gunasekaran and Dhone (2019) identify cost and technical know-how as persistent constraints on the performance benefits of Industry 4.0 adoption, while Luthra et al. (2018) identify regulatory and resource-related barriers to ICT-enabled supply chain initiatives in developing economies. Within Nepal specifically, Subedi and Bhatt (2025) find that poor internet access, high implementation cost and limited technical expertise significantly constrain the sales-growth benefits of digitisation; Giri, Thakur and Chatterjee (2020) find that internet connectivity, security and staff training are the strongest determinants of whether ERP delivers its intended benefits; and Nepal (2024) finds that perceived security is a significant determinant of continued digital payment use, underlining cybersecurity as a live concern rather than a theoretical one.

Because the Nepalese evidence reviewed above shows barriers affecting the realisation of digital technology's benefits rather than preventing adoption outright, it is reasonable to expect that these barriers do not simply have an independent, negative effect on performance, but specifically weaken the positive effect that digital technology adoption would otherwise have. This distinguishes H2 as a moderating hypothesis rather than a further direct-effect hypothesis, and forms the basis for the following hypothesis:

H2: Problems such as high cost, poor internet and low digital skills weaken the positive effect of digital technology on supply chain performance.

2.10 Chapter Summary

This chapter presented the key ideas of digital technology adoption, supply chain management and supply chain performance, discussing the specific technologies, structural dimensions and performance frameworks relevant to this study. It described a systematic search and selection process based on PRISMA to ensure transparency during the procedure of literature identification. It developed an integrated theoretical framework, combining the Technology-Organisation-Environment framework, Diffusion of Innovation theory and the Resource-Based View, explaining what each theory proposes, how each has been applied in the field and the limitations each has attracted.

It reviewed the literature on digital technologies in supply chains, the relationship between the technologies and performance outcomes, institutional and sustainability drivers of

adoption and barriers to adoption in developing economies. The literature review table summarizes the theory and methodology used in each study. The critical synthesis found a high degree of convergence on both the benefits of performance and the barriers to digital technology adoption; a tension between optimistic and cautious accounts of digital transformation in least-developed and SME-dominated contexts; and a consistent lack of studies combining an adoption theory and a performance-mechanism theory. This resulted in the recognition of a particular sectoral, methodological and theoretical research gap concerning Nepalese FMCG distribution companies, from which two research hypotheses were generated; the first hypothesizes the direct relationship between digital technology use and supply chain efficiency, and the second hypothesizes the moderating effect of adoption barriers on that relationship. Each of these hypotheses is directly aligned to the research objectives and questions outlined in Chapter 1 and each is explained through its underlying concept, theoretical support, existing evidence and reasoning. The hypotheses, and the conceptual framework upon which they are based, directly guide the methodological approach detailed in Chapter 3.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter explains how the study was carried out. It sets out the methods used to answer the research aim from Chapter 1, which is to study the effect of digital technology use on supply chain performance in Nepalese FMCG distribution companies, and to test the two hypotheses developed in Section 2.9. The chapter moves from broad choices to specific ones. Sections 3.2 to 3.4 explain the research philosophy, approach and design, and give reasons for each choice rather than simply stating it. Section 3.5 describes how the data are collected and how the questionnaire is built. Section 3.6 defines the target population and explains the sampling method and sample size. Section 3.7 sets out how the data are analysed, linking each method to the objective and hypothesis it answers. Section 3.8 covers reliability and validity, Section 3.9 covers ethics, Section 3.10 gives the limitations of the design, and Section 3.11 summarises the chapter.

3.2 Research Philosophy

Research philosophy refers to the assumptions a researcher makes about what reality is (ontology) and about what counts as acceptable knowledge of it (epistemology). These assumptions shape every later choice in the study (Saunders, Lewis and Thornhill, 2019). This study follows a post-positivist philosophy. In terms of ontology, post-positivism accepts that the things being studied, such as the technologies firms use and how well their supply chains run, exist outside the researcher and can be studied in an organised way. In terms of epistemology, it differs from classical positivism because it holds that this reality can never

be known perfectly. All observation is shaped by theory and by the tools used, measurement is always imperfect, and so findings are probable, temporary and open to being proved wrong rather than fully proven (Phillips and Burbules, 2000; Creswell and Creswell, 2018). The aim of research, on this view, is not to prove a hypothesis true but to test it fairly and keep it only while the evidence supports it.

Post-positivism suits this study for four reasons. First, the main concepts here, digital technology adoption, supply chain efficiency and adoption barriers, are treated in the literature as firm-level features that can be measured, and they have been measured in this way in similar studies (Chauhan, Bangwal and Kumar, 2023; Subedi and Bhatt, 2025). A realist view of reality is therefore reasonable. Second, the research questions are about relationships, not about meaning. They ask whether digital technology use is linked to supply chain efficiency, how strong that link is, and whether barriers weaken it. These are questions about patterns across many firms, not about how single managers see their work. Third, the study starts from a settled theory base (TOE, DOI and RBV) and moves to clear hypotheses that can be tested and, if wrong, rejected.

Fourth, and most important for this study, post-positivism matches the kind of evidence this design can actually produce. Supply chain efficiency is measured through what informed staff report, not through audited records. The sample is not random, because no full list of firms exists. The data are collected at one point in time. A strict positivist stance would claim a level of objective, exact measurement that these features cannot support. Post-positivism instead treats imperfect measurement as a normal part of social research, to be reduced and reported openly rather than hidden, and treats the results as sound but correctable estimates. The testing logic in Section 3.7 follows this directly: tests are framed as attempts to reject a null hypothesis, and results are described as supported or not supported, never as proven.

Post-positivism also fits the conditional form of H2 better than positivism does. Positivism looks for rules that hold everywhere, while H2 states that the effect of digital technology on supply chain efficiency depends on the conditions a firm faces. A philosophy that expects social patterns to hold in most cases rather than in all cases is a better base for a moderation hypothesis.

Other philosophies were considered and set aside. Interpretivism would suit a study of how managers make sense of digital change, and would give richer detail, but it would not allow the strength of a relationship to be measured across many firms or a moderating effect to be tested, both of which the objectives require. Critical realism was the closest alternative, because it focuses on the hidden mechanisms that produce results and this fits the conditional claim in H2. It was not chosen because critical realist work normally looks for those deeper mechanisms and usually needs qualitative or mixed data to do so; a single questionnaire could not meet that expectation, and choosing a philosophy the methods cannot deliver would be a bigger fault than the safer position taken here. Pragmatism was also set aside, since this study asks one clear set of relational questions and does not need mixed methods. It should be noted that Saunders, Lewis and Thornhill (2019) do not include post-positivism by name in their research onion. The term is used here in the sense given by Phillips and Burbules (2000) and Creswell and Creswell (2018), meaning a realist view of reality joined with a cautious, probability-based view of knowledge.

3.3 Research Approach

In line with its post-positivist stance, this study uses a deductive approach. Deduction moves from theory to observation. Theory is used to build hypotheses, data are gathered to test them, and the theory is then supported, adjusted or rejected in light of the results (Saunders, Lewis and Thornhill, 2019). This study follows that order. Chapter 2 built a combined TOE-DOI-RBV framework and drew two hypotheses from it: H1, that digital technology use improves supply chain efficiency, and H2, that barriers such as cost, weak internet and low digital skills weaken that positive effect. Both are stated before any data are collected, are written in terms of variables that can be measured, and are tested using statistics.

Deduction also fits the cautious view of knowledge set out above. Because post-positivism holds that a hypothesis can be disproved but never fully proved, the value of a test lies in its ability to show the hypothesis wrong. The hypotheses are written so that the data could fail to support them, and the analysis is designed to allow that result. A non-significant result for either hypothesis is therefore treated in Chapter 5 as a useful finding about the Nepalese FMCG distribution sector, not as a failed study.

An inductive approach, which builds theory out of data, would suit a topic with no existing explanation. That is not the case here, as the literature already offers strong theory and steady findings from similar settings. The gap is whether those known relationships also hold in Nepalese FMCG distribution, which calls for testing rather than theory building. An abductive approach was also unnecessary, since the study begins with a settled framework rather than with a surprising result that needs explaining.

3.4 Research Design

Purpose of the design

This study uses an explanatory design. Exploratory designs are used when a problem is not well understood and needs clarifying. Descriptive designs are used to give an accurate picture of a situation. Explanatory designs are used to establish links between variables (Saunders, Lewis and Thornhill, 2019). This study has a descriptive part, since the first objective asks which technologies are in use and is answered with descriptive statistics. Its main purpose, however, is explanatory: to show the link between digital technology use and supply chain efficiency, and the conditions that weaken that link.

Research strategy

A survey strategy is used, based on a structured questionnaire that respondents complete themselves. Surveys allow standard, countable data to be gathered from a fairly large number of people at low cost, and produce data suited to correlation and regression (Bryman and Bell, 2015). This matches hypotheses about the strength of relationships across firms. Other strategies were considered. A case study would give depth on a few Nepalese distributors but would not allow the results to be generalised and could not test a moderating effect. An experiment gives the strongest basis for claiming cause, but is not possible here, because the researcher cannot decide which firms adopt digital technology.

Time horizon

The study is cross-sectional, meaning data are collected once rather than over time. This suits the time available for a dissertation and matches the similar studies reviewed in Chapter 2 (Subedi and Bhatt, 2025; Bhatt, 2025; Chauhan, Bangwal and Kumar, 2023). It does mean the study shows a link rather than proof of cause. It cannot rule out the reverse explanation, that firms already performing well can better afford digital technology. The hypotheses are therefore read as expected links supported by theory, in line with the probability-based view of cause set out in Section 3.2, and this point is returned to in Section 3.10.

3.5 Data Collection Methods

Primary data are collected using a structured questionnaire that respondents complete themselves. It is distributed online only, through professional and industry contacts and through referrals from early respondents. Online distribution was chosen because it reaches staff in distribution firms across Nepal at very low cost and within the time available, and because it removes the typing errors that occur when paper answers are entered by hand. It also allows key questions to be set as required, which reduces the number of part-finished replies. Secondary data, meaning the literature reviewed in Chapter 2, guide the design of the questionnaire but are not analysed as data.

The effect of collecting data online only is accepted openly. Taking part needs a working internet connection and some confidence with digital tools, so the method may miss the very firms that face the connection and skills barriers this study sets out to examine. This could make those barriers look less common than they are and could weaken the moderating effect proposed in H2. It is therefore treated as a limitation of the design, not as a neutral practical choice, and is revisited in Section 3.10.

The questionnaire has six parts:

- Part A: Respondent and firm details, covering job role, years of experience, firm size by number of staffs, and area of operation. These give the profile reported in Chapter 4 and the control variables used in the regression models.
- Part B: Digital technology use, measuring how far each of the four technology types defined in Section 2.2.1 is used, namely ERP systems, warehouse and inventory

software, GPS and IoT tracking, and digital payment systems, along with questions on which are used at all. This part answers Objective 1 and RQ1 and provides the independent variable for H1.

- Part C: General perceptions of digital technology. The questionnaire also included five extra questions on general beliefs about digital technology and how ready the organisation is to use it, covering things like whether inventory software improves accuracy, whether staff get enough training, and whether digital tools improve communication. These questions are different from Part B. Part B asks how much a technology is actually used. These five questions instead ask what people believe about digital technology in general, not how much it is used. They were collected to give a fuller picture of the working environment around digital technology, not to test the main hypotheses. For this reason, they are reported in Chapter 4 as background information only and are not used in the regression models for H1 and H2.
- Part D: Supply chain efficiency, measuring the outcomes set out in Section 2.2.3, including order processing time, stock turnover, stock-outs and overstocking, order accuracy, delivery reliability and cost per order. This part provides the dependent variable for both hypotheses.
- Part E: Barriers to adoption, measuring the cost, infrastructure, skills and security or regulation problems reviewed in Section 2.5.4. This part answers Objective 3 and RQ3 and provides the moderating variable for H2.
- Part F: An optional comment box, where respondents may add context. These answers are not analysed statistically; instead, they are analysed separately using a simple thematic analysis, and the resulting themes, sub-themes and codes are presented alongside the quantitative results in Chapter 4.

Parts B, C, D and E use a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). This is the format used in the similar studies reviewed in Chapter 2 and gives data suited to correlation and regression (Field, 2018). Wherever possible, questions are adapted from instruments already used and tested by other researchers rather than written from scratch. Technology use questions draw on Kamble, Gunasekaran and Dhone (2019),

Chauhan, Bangwal and Kumar (2023) and Subedi and Bhatt (2025); efficiency questions draw on Beamon (1999) and ASCM (2017); and barrier questions draw on Luthra et al. (2018), Giri, Thakur and Chatterjee (2020) and Nepal (2024). This supports content validity and allows the results to be compared with earlier findings. Wording is changed only to fit the FMCG distribution setting in Nepal.

For analysis, the questions in each part are combined into a single average score for that concept, once internal consistency has been checked as described in Section 3.8. Digital technology use is analysed as one combined score, to test H1 as it is stated. The four individual technology items are also reported descriptively in Chapter 4, showing how commonly each one is used, which answers Objective 1 and RQ1 directly. A separate regression comparing the effect of each technology on performance was not carried out in this study, and is noted as a direction for future research in Chapter 6.

The questionnaire is given in English only. English is widely used at professional and managerial level in Nepalese business, including in distribution, and the technical words used here, such as ERP, GPS, inventory software and the names of digital wallets, are already used in English by the staff who work with these systems. Using one language also removes the risk that meaning shifts between versions, which would make the reliability checks in Section 3.8 harder to trust. To help understanding, questions are written in plain English with short sentences and everyday words, and any technical term that may be unfamiliar is explained in brackets the first time it appears. Before full distribution, the questionnaire is tested on a small group from the target population who are then excluded from the final sample, to check that the questions are read as intended. Anything unclear is reworded before the survey goes out.

3.6 Sampling Strategy

Target population

The target population is staff working in supply chain related roles in FMCG distribution companies in Nepal. Suitable roles include owners and general managers, supply chain and logistics managers, warehouse and stock staff, sales and distribution supervisors, and IT staff, because these people know both which technologies are used and how well the supply chain runs. Staff in unrelated or purely clerical roles are excluded, as they are unlikely to

answer reliably. The unit of analysis is the firm, so each respondent answers about the company they work for.

Sampling technique

There is no complete public list of FMCG distribution companies in Nepal or of their staff, so random sampling and other probability methods, which need a full list, are not possible. The study therefore uses non-probability sampling, combining purposive and snowball methods. Purposive sampling is used to select people who meet the role criteria above, so that answers come from those with the right knowledge. Snowball sampling is then used to widen reach, with early respondents asked to pass the questionnaire to suitable contacts in other firms. This is a practical necessity in a sector made up of many small and medium firms with little online presence. The result is that the sample cannot be assumed to represent the whole sector and the findings must be generalised with care, as noted in Section 3.10.

Sample size

This study aims for 80 to 120 usable responses. The size is set by what the planned analysis needs and by the access available in the setting. Hair et al. (2019) advise at least 10 to 15 cases for every predictor in a regression. The main model for H1 has one combined predictor plus three control variables, so 80 responses is more than enough. The moderated model for H2 adds the barriers variable and the interaction term, giving six predictors, so 80 meets the 10:1 rule and 120 comes close to the stricter 15:1 rule. The extra model that enters the four technology types separately has seven predictors and so needs the higher end of the range.

Two things justify this target rather than a larger one. First, the population is narrow: respondents must hold a supply chain role in an FMCG distribution firm in Nepal, and the sector is made up mainly of small and medium firms with limited online presence, so the reachable pool is much smaller than for studies covering SMEs in all sectors. Second, the study is limited by the time and resources of a dissertation. The target still matches published Nepalese survey work, including Nepal (2024) with 123 respondents and Giri, Thakur and Chatterjee (2020) with 167, though it is smaller than the 384 of Subedi and Bhatt (2025) and the 303 of Bhatt (2025), both of which had wider sampling frames.

The effect of this choice is stated openly. Tests of interaction effects have less statistical power than tests of direct effects and so need larger samples (Aiken and West, 1991). A sample of 80 to 120 can detect a medium interaction effect but may miss a small one, which means a non-significant result for H2 could not be read as proof that barriers make no difference. Effect sizes and confidence intervals are therefore reported next to significance tests in Chapter 4, so that readers can see how precise the estimates are and not only whether they are significant. This fits the position taken in Section 3.2, where findings are presented as provisional estimates with a stated level of uncertainty.

3.7 Data Analysis Methods

Data are analysed using IBM SPSS Statistics. Returned questionnaires are first checked for missing answers, for respondents who do not meet the role criteria, and for people who have given the same answer to every question. Valid answers are then coded, and any negatively worded questions are reverse scored before the combined scores are calculated. Where only a few answers are missing, the average of that scale is used in their place; cases with a large amount missing are removed, and the number removed is reported.

Descriptive statistics

Frequencies, percentages, means and standard deviations are used to describe the respondents and their firms and to show which digital technologies are used and how widely. This answers Objective 1 and RQ1, which Chapter 2 identified as exploratory and therefore answered descriptively rather than by a hypothesis. The same methods are used to rank the barriers reported in Part D, which answers Objective 3 and RQ3.

Assumption checks

Before the hypotheses are tested, the main assumptions behind regression are considered. Normality of the study variables is checked using skewness and kurtosis values, reported alongside the descriptive statistics in Chapter 4. Given the sample size and the exploratory nature of this study, formal diagnostic statistics such as variance inflation factors and the Durbin-Watson statistic are not reported in detail in this thesis; instead, the correlation matrix in Chapter 4 is used to check informally that predictor variables are not too closely related to one another. Any concern noted from this informal check is discussed as a

limitation in Chapter 6, rather than being formally tested and corrected within the regression itself.

Correlation and regression: testing H1

The link between digital technology use and supply chain efficiency is first checked using Pearson correlation, which shows the direction and strength of the relationship between the two. Multiple regression is then used to test H1, with supply chain efficiency as the outcome. H1 is supported where the null hypothesis of no relationship can be rejected at the 5% level and the coefficient for digital technology use is positive. In line with Section 3.2, a significant result is reported as support for H1 and not as proof of it, and the effect size is given alongside the significance test so that the practical size of the relationship can be judged, not only whether it can be detected.

Moderated regression: testing H2

H2 claims a moderating effect rather than a direct one, so it needs moderated regression rather than another direct-effect model. Following the usual method (Aiken and West, 1991; Hayes, 2018), the technology use and barriers scores are mean-centred to reduce unnecessary multicollinearity, and an interaction term is created by multiplying the two centred scores. Technology use, barriers and the interaction term are entered together into a single regression model, rather than in separate steps, given the sample size available. H2 is supported where the interaction term is significant and negative, showing that the positive effect of technology use is weaker for firms reporting higher barriers. The pattern of the interaction is illustrated with a plot of the predicted relationship at low, mean and high levels of barriers, as reported in Chapter 4.

Table 3.1 shows how each objective, research question and hypothesis links to the method used to answer it.

Table 3.1: Alignment of objectives, questions, hypotheses and analysis methods

Objective	Research question	Hypothesis	Analysis method
Obj. 1: Explore the use of digital technology in supply chain activities	RQ1: Which digital technologies are commonly used?	None (exploratory)	Descriptive statistics: frequencies, percentages, means, standard deviations
Obj. 2: Examine the	RQ2: What is the	H1	Pearson correlation; multiple

Objective	Research question	Hypothesis	Analysis method
relationship between digital technology use and supply chain efficiency	relationship between digital technology use and supply chain efficiency?		regression
Obj. 3: Understand the key challenges encountered in digital transformation	RQ3: What are the key challenges to digital technology adoption?	H2	Descriptive ranking of barriers; moderated regression with mean-centred interaction term

3.8 Reliability and Validity

Reliability

Reliability is about consistency, that is, whether the questionnaire would give similar results if used again in similar conditions (Bryman and Bell, 2015). Internal consistency is checked using Cronbach's alpha for each scale, where 0.70 or above is treated as acceptable and 0.60 as the lowest tolerable figure for a newly adapted scale (Hair et al., 2019). Where a scale falls below this, the questions are checked one by one, and any question whose removal would clearly raise alpha is considered for deletion. Any deletion is reported openly in Chapter 4 rather than made quietly. Reliability is also supported at the design stage by using the same wording for every respondent, the same five-point scale for every concept, and the same online format throughout, so that differences in answers reflect real differences between firms and not differences in how the question was asked.

Validity

Validity is about whether the questionnaire measures what it claims to measure, and it is handled here in three ways. Content validity is supported by adapting questions from instruments already tested by other researchers, as described in Section 3.5, and by making sure the questions for each concept cover every dimension defined for it in Chapter 2. Supply chain efficiency, for example, is measured across all six dimensions listed in Section 2.2.3 rather than by one general question.

Construct validity in this study is addressed through internal consistency reliability, using Cronbach's alpha for each scale as described above and reported in full in Chapter 4. Exploratory factor analysis, the Kaiser-Meyer-Olkin measure and Bartlett's test of sphericity, and formal tests of convergent and discriminant validity were not undertaken in this study.

External validity, meaning how far the findings apply beyond the sample, is the weakest of the three in this study, because non-probability sampling means the sample cannot be assumed to represent all Nepalese FMCG distribution companies. This is handled by reporting the full profile of respondents and firms in Chapter 4, so that readers can judge which firms the findings are likely to apply to, and by limiting conclusions to firms of the type sampled rather than to the whole sector. In line with Section 3.2, validity is treated throughout as a matter of degree that must be evidenced and reported, not as something a questionnaire either has or does not have.

3.9 Ethical Considerations

The study follows the university's research ethics policy, and no data are collected until ethical approval is granted. Taking part is voluntary. Each questionnaire begins with an information statement explaining the purpose of the study, what taking part involves, how long it takes, how the data will be used, and the right to withdraw at any time before submitting without giving a reason and without any consequence. Consent is obtained through a clear consent question that must be answered before the questionnaire can be opened.

Confidentiality and anonymity are built into the design. The questionnaire does not ask for names, contact details or anything else that identifies a person, and firms are recorded only by broad size and location bands, so no individual or company can be identified in the reported results. For data protection, answers are held on password protected storage that only the researcher can access, are used only for this dissertation, and are kept and destroyed in line with university rules.

Because the study takes place in Nepal, care is taken that recruitment does not rely on any position of authority over respondents. In particular, the researcher's earlier work in the sector, noted in Section 1.1, is not used to place any pressure on former colleagues to take part. No vulnerable groups are involved, no deception is used, and no personal or sensitive questions are asked. Results are reported honestly and in full, including any that do not support the hypotheses.

3.10 Research Limitations

Several limitations are accepted in advance, and their effect on how the findings should be read is carried into Chapters 5 and 6. In line with Section 3.2, these are treated not as faults that ruin the study but as the normal conditions of imperfect measurement in social research, stated openly so that the findings can be judged at their true strength.

First, the cross-sectional design shows a link rather than cause. It cannot rule out the reverse explanation, that firms already doing well can better afford digital technology, nor the effect of variables that are not measured. Second, using non-probability sampling together with online-only distribution means the sample cannot be assumed to represent all Nepalese FMCG distribution companies. Both features favour firms that are already more digital and easier to reach online, which may make adoption look more common than it is and, more seriously here, may leave out the firms facing the very connection and skills barriers examined in H2.

In addition, construct validity was addressed only through internal consistency reliability (Cronbach's alpha), rather than through exploratory factor analysis or formal tests of convergent and discriminant validity, as noted in Section 3.8.

Third, a target of 80 to 120 responses is enough for the main regression models but modest for interaction testing. If the final sample is near the lower end, the study may be too small to detect a weak interaction, so a non-significant result for H2 would have to be read as an inconclusive test rather than as proof that barriers do not matter, and the model comparing the four technology types should be treated as indicative only. Fourth, all variables are measured through what respondents report rather than through records such as actual stock turnover or on-time delivery, which brings a risk of inaccurate perception and of shared-method variance inflating the links between concepts measured on the same questionnaire.

Fifth, a quantitative design shows how strong relationships are but not the reasons behind them, so it cannot explain why some firms succeed in embedding a technology and others do not. A critical realist or mixed-methods study would be better placed to find those reasons, as noted in Section 3.2 and revisited in Chapter 6. Finally, running the questionnaire in English only brings two related risks. Respondents who use English as an

additional language may read some questions differently from the way they were meant, especially the more abstract efficiency and barrier statements, and eligible staff with weaker written English may choose not to take part at all, which would tilt the sample towards more senior or better educated respondents. Plain English wording and testing before distribution reduce but do not remove these risks, and any resulting imbalance in the respondent profile is reported in Chapter 4.

3.11 Chapter Summary

This chapter has explained and justified the methods used to answer the research aim and test the two hypotheses. It set out a post-positivist philosophy, which joins a realist view of reality with a cautious view of knowledge under which findings are provisional rather than final, and a deductive approach suited to a study that draws testable hypotheses from an existing TOE-DOI-RBV framework. It adopted an explanatory, cross-sectional survey design as the best fit for questions about relationships, and described a five-part structured questionnaire, distributed online and in English only, using five-point Likert scales with questions adapted from tested instruments and combined into average scores.

It defined the target population as staff in supply chain roles in Nepalese FMCG distribution companies, explained why the lack of a full list makes purposive and snowball sampling necessary, and justified a target of 80 to 120 responses by reference to the number of predictors in each model, the small reachable population and the resources available, while stating openly that this range is modest for interaction testing. The analysis plan was then set out: descriptive statistics for the first objective and for ranking barriers, correlation and regression for H1, and with a mean-centred interaction term. Reliability is established through Cronbach's alpha and consistent administration, and validity through content, construct and external validity checks. Ethical safeguards covering approval, consent, anonymity and data protection were described, and the limitations of the design were stated directly. Chapter 4 presents the findings produced by these methods.

CHAPTER 4: FINDINGS

4.1 Introduction

This chapter presents the findings from the primary data collected via the structured online questionnaire distributed to employees, supervisors, managers, logistics officers, supply chain managers and inventory officers working in Nepalese FMCG distribution companies, as described in Chapter 3. The study tests two hypotheses: H1, that digital technology usage is positively associated with Supply Chain Performance (SCPerf), and H2, that barriers to adoption negatively moderate the usage-performance relationship. Section 4.2 presents the demographic profile of respondents. Section 4.3 presents the results, covering data preparation, descriptive statistics, scale reliability, correlation analysis and the moderated regression used to test H1 and H2. Section 4.4 summarises the key findings and Section 4.5 closes the chapter.

4.2 Profile of Respondents

Table 4.1 summarises the demographic and organisational characteristics of the 89 respondents included in the final analysis.

Table 4.1: Demographic Profile of Respondents (N = 89)

Characteristic	**Category**	**n**	**%**
Job Position	Employee	47	52.8%
	Manager	13	14.6%
	Supervisor	9	10.1%
	Logistics Officer	6	6.7%
	Inventory Officer	5	5.6%
	Other	5	5.6%
	Supply Chain Manager	4	4.5%
Years of Experience	1-3 years	32	36.0%
	Less than 1 year	28	31.5%
	4-6 years	20	22.5%
	7-10 years	6	6.7%
	More than 10 years	3	3.4%
Organisation Size	Medium enterprise	43	48.3%
	Small enterprise	31	34.8%
	Large enterprise	15	16.9%
Uses Digital Technology	Yes	76	85.4%
	No	13	14.6%

The sample is dominated by respondents in Employee roles (52.8%), with more senior or directly technology-relevant roles (Manager, Supervisor, Logistics Officer, Inventory Officer, and Supply Chain Manager) together accounting for 47.2% of the sample. The majority of respondents (85.4%) reported that their organisation currently uses digital technologies in supply chain operations in some form.

4.3 Presentation of Results

This section presents the results of the analysis, beginning with the preparation of the data and the checks carried out on the measurement scales, and ending with the moderated regression model used to test the two hypotheses.

4.3.1 Data Preparation and Cleaning

A total of 89 responses were collected via Google Forms. All 89 responses were complete, with no missing values on any of the 21 Likert-scale items. As part of data quality screening, each response was checked for straight-lining, defined as the use of a single identical response option across all 21 items; three responses (3.4% of the sample) showed this pattern. These responses were retained, as the pattern could not be reliably distinguished from genuine agreement, and all results reported in this chapter are based on N = 89.

4.3.2 Descriptive Statistics for Study Variables

Table 4.2 presents the mean and standard deviation for each composite variable, and also breaks down the Digital Technology Usage composite into its four individual items (ERP, inventory software, GPS/IoT tracking, and digital payments), measured on a five-point scale (1 = Strongly Disagree, 5 = Strongly Agree).

Table 4.2: Descriptive Statistics for Composite Variables (N = 89)

Variable	Items	Mean	SD	Min	Max
Digital Technology Usage	4	3.51	1.05	1.0	5.0
ERP systems	1	3.44	1.10	1.0	5.0
Inventory/warehouse management software	1	3.53	1.26	1.0	5.0
GPS/IoT tracking systems	1	3.39	1.31	1.0	5.0
Digital/mobile payment systems	1	3.69	1.35	1.0	5.0
Technology Adoption	5	3.94	0.99	1.0	5.0
Supply Chain Performance	6	3.97	0.89	1.3	5.0
Barriers to Adoption	6	3.90	0.89	1.0	5.0

Table 4.2 also breaks the Digital Technology Usage composite down into its four individual items, directly answering Objective 1 and RQ1 on which technologies are commonly used. Digital or mobile payment systems were the most used technology (M = 3.69, SD = 1.35), with 66.3% of respondents agreeing or

strongly agreeing that their organisation makes regular use of them. Inventory or warehouse management software was next (M = 3.53, SD = 1.26; 56.2% agreement), followed by ERP systems (M = 3.44, SD = 1.10; 51.7% agreement), with GPS or IoT tracking systems the least used of the four (M = 3.39, SD = 1.31; 52.8% agreement). All four technologies show a similar spread of responses (SD around 1.1 to 1.35), indicating that usage varies considerably between organisations rather than being uniformly high or low. This pattern, with simpler, transaction-based technologies such as digital payments showing somewhat higher usage than more complex, integration-heavy systems such as ERP, is discussed further in Chapter 5 in relation to Diffusion of Innovation theory.

Supply Chain Performance is measured through six items covering order processing, inventory accuracy, delivery reliability and cost, consistent with the operationalisation set out in Chapter 2. On average, respondents reported a moderate level of digital technology usage (M = 3.51, SD = 1.05), with higher and more consistent agreement that digital technology has improved overall supply chain performance (M = 3.97, SD = 0.89). Perceived barriers to adoption were also rated moderately highly (M = 3.90, SD = 0.89), indicating that most respondents perceive barriers as continuing to affect digital technology adoption even where some level of usage is already in place. The Technology Adoption Perceptions variable, comprising the benefit-perception and readiness items, is reported descriptively but is not used in hypothesis testing.

4.3.3 Reliability Analysis

The internal consistency of each multi-item scale was assessed using Cronbach's alpha. Table 4.3 presents the results.

Table 4.3: Reliability of Measurement Scales (N = 89)

Scale	Items	Cronbach's Alpha	Interpretation
Digital Technology Usage	4	0.858	Good
Technology Adoption Perceptions	5	0.931	Excellent
Supply Chain Performance	6	0.916	Excellent
Barriers to Adoption	6	0.914	Excellent

Table 4.3 shows two technology-related scales that are easy to confuse: Digital Technology Usage and Technology Adoption Perceptions. These measure different things. Digital Technology Usage (4 items) asks how much each technology is actually used, and this is the scale used to test H1 and H2. Technology

Adoption Perceptions (5 items) instead asks about general beliefs, such as whether digital tools help or whether staff get enough training. This second scale has high reliability (alpha = 0.931), but it is not used in the main regression models. It was collected to add background context about the study companies, not to test the hypotheses, since it measures beliefs about technology in general rather than how much a specific technology is actually used.

All four scales substantially exceed the commonly applied threshold of 0.70, indicating that the items within each scale measure their intended construct consistently. The Supply Chain Performance scale's alpha of 0.916 is particularly strong, supporting the treatment of its six items as a single construct.

4.3.4 Correlation Analysis

Table 4.4 presents Pearson correlation coefficients between the composite variables.

Table 4.4: Pearson Correlations Between Composite Variables (N = 89)

Correlations

		TechUsage	TechAdapt	SCPerf	BarTechAdapt
TechUsage	Pearson Correlation	1	.626***	.571***	.504***
	Sig. (2-tailed)		0.000	0.000	0.000
	N	89	89	89	89
TechAdapt	Pearson Correlation	.626***	1	.740***	.741***
	Sig. (2-tailed)	0.000		0.000	0.000
	N	89	89	89	89

SCPerf	Pearson Correlation	.571***	.740***	1	.835***
	Sig. (2-tailed)	0.000	0.000		0.000
	N	89	89	89	89
BarTechAdapt	Pearson Correlation	.504***	.741***	.835***	1
	Sig. (2-tailed)	0.000	0.000	0.000	
	N	89	89	89	89

***. Correlation is significant at the 0.001 level (2-tailed).

Digital technology usage is positively and significantly correlated with Supply Chain Performance ($r = 0.571$, $p < 0.001$), providing initial bivariate support for H1. Barriers are also positively and significantly correlated with both usage ($r = 0.504$) and performance ($r = 0.835$). As noted above, this uniformly positive pattern across conceptually distinct variables, rather than barriers behaving as a straightforward negative predictor, is most plausibly explained by acquiescence response bias, and is addressed directly in the regression analysis below and revisited in Chapter 5.

4.3.5 Moderated Regression: Interaction Model

H1 and H2 were tested using a single interaction model, entering mean-centred Technology Usage (TechUsage_c), mean-centred Barriers (BarTechAdapt_c), and their interaction term simultaneously as predictors of Supply Chain Performance (SCPerf). Mean-centring was applied before computing the interaction term in order to reduce non-essential multicollinearity between the predictors and the product term (Aiken and West, 1991).

Model Summary

Table 4.5: Model Summary for the Interaction Model

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.863	.744	.735	.45560

ANOVA

Table 4.6: ANOVA for the Interaction Model

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	51.366	3	17.122	82.488	<.001
	Residual	17.644	85	.208		
	Total	69.010	88			

Coefficients

Table 4.7: Regression Coefficients for the Interaction Model

Model	B	Std. Error	Beta	t	Sig.	95% CI Lower	95% CI Upper
(Constant)	4.020	.053		75.536	<.001	3.914	4.125
TechUsage_c	.185	.054	.220	3.439	.001	.078	.291
BarTechAdapt_c	.612	.081	.614	7.587	<.001	.451	.772
Interaction	-.114	.048	-.172	-2.386	.019	-.210	-.019

Interpretation

The overall interaction model was statistically significant, $F(3, 85) = 82.488$, $p < .001$, and explained 74.4% of the variance in Supply Chain Performance ($R^2 = .744$, Adjusted $R^2 = .735$).

Technology Usage significantly and positively predicted Supply Chain Performance (B = .185, β = .220, p = .001), supporting H1: Nepalese FMCG distribution companies reporting greater use of ERP, inventory management software, GPS/IoT tracking and digital payment systems also report significantly higher supply chain performance.

The interaction between Technology Usage and Barriers was statistically significant and negative (B = -.114, β = -.172, p = .019, 95% CI [-.210, -.019]), supporting H2: the positive association between technology usage and supply chain performance becomes measurably weaker as perceived barriers increase, consistent with a possible moderating relationship.

Barriers also showed a significant positive direct effect on Supply Chain Performance (B = .612, β = .614, p < .001). As noted in Section 4.3.4, this direct effect runs counter to

theoretical expectation and is most plausibly attributable to acquiescence response bias rather than a genuine substantive relationship. This is not treated here as a minor inconvenience: it is a substantive and methodological finding that affects how confidently the results in this chapter, including the H2 interaction result, can be interpreted, and it is considered fully in Chapter 5.

Figure 4.1 illustrates this interaction, plotting the predicted relationship between technology usage and supply chain performance at low (-1 SD), mean, and high (+1 SD) levels of barriers. The slope of the relationship is visibly steepest for organisations reporting low barriers and flattest for organisations reporting high barriers, consistent with the significant negative interaction term. The simple slope of technology usage falls from .286 at low barriers, to .185 at mean barriers, to .083 at high barriers, a reduction of approximately two thirds.

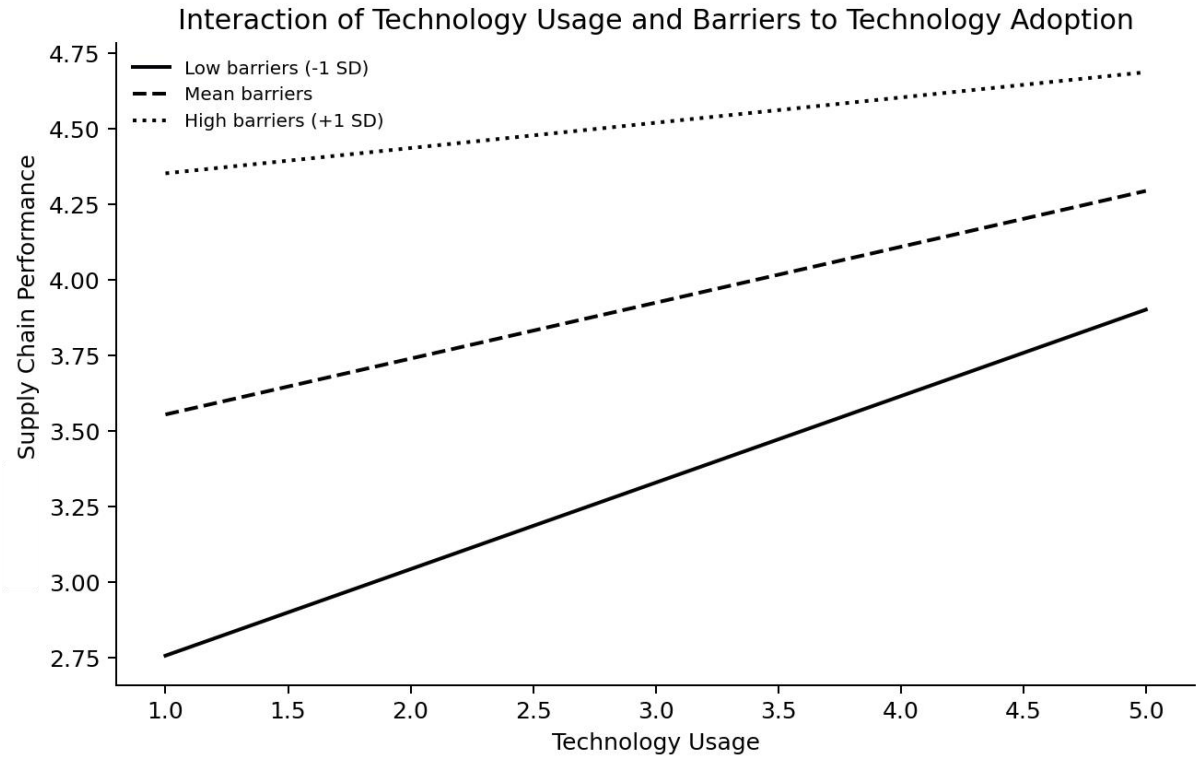


Figure 4.1: Interaction of Technology Usage and Barriers to Technology Adoption

4.3.6 Thematic Analysis of Open-Ended Comments

Alongside the quantitative results above, the questionnaire included one open-ended question: “Please provide any additional comments regarding digital technology adoption and supply chain performance in your organisation.” Of 89 respondents, 13 provided a written response. Five of these

were too short or too unclear to code (for example, single words such as “NA” or “Thank you”), leaving eight usable comments. Given this very small number, these comments are presented here as supplementary, illustrative material alongside the main quantitative findings, rather than as a substantial qualitative study or as independent confirmation of the study's hypotheses.

Coding followed an inductive approach: themes and codes were developed directly from the wording of the eight comments themselves, rather than being decided in advance or drawn from the study's existing hypotheses or theoretical framework. Each comment was first read in full, then broken into short phrases and given a descriptive code capturing its meaning; for example, a mention of improved delivery times was coded as “delivery performance”. Codes that shared a common idea were grouped into sub-themes, and sub-themes that shared a broader common idea were grouped into the three themes shown in Table 4.8. This process broadly follows the approach described by Braun and Clarke (2006). Table 4.8 also reports the number of the eight comments in which each theme was present, and includes a brief anonymised quotation illustrating each theme.

Table 4.8: Themes, Sub-themes and Codes from Open-Ended Comments

Theme	**Sub-theme**	**Codes**	**n (of 8)**	**Illustrative Quotation**
1. Benefits	Better internal work	efficiency, inventory accuracy, communication	8	“Digital technology has improved supply chain efficiency, communication, and visibility in our organisation.” (Manager)
	Better customer service	delivery, customer service, forecasting		
	Better visibility	tracking, visibility, resilience		
2. Problems	Money and people problems	cost, training	4	“The high cost of implementation and employee training remain major challenges.” (Supply Chain Manager)
	Outside problems	infrastructure, rules, capability		
	Safety problems	cybersecurity		
3. Still improving	Need more investment	more investment needed	3	“Further adoption of digital tools could improve coordination, tracking and reduce delays.” (Employee)

	Getting better slowly	slow but steady improvement		

The table shows three simple themes. The first theme, Benefits, was present in all eight of the coded comments. People mostly talked about digital technology making work better in three ways: better internal work (efficiency, inventory, communication), better customer service (delivery, forecasting), and better visibility (tracking, resilience).

The second theme, Problems, was present in four of the eight coded comments. Even when people said good things about digital technology, some of them also mentioned problems that were still there, such as the cost of the technology, the need for more training, problems from outside the company (like poor infrastructure or unclear rules), and worries about cybersecurity.

The third theme, Still improving, was present in three of the eight coded comments. These respondents did not describe digital technology as fully finished. They said the company still needs more investment, or that things are getting better only slowly, step by step, rather than all at once.

This simple, supplementary analysis of a small number of comments is broadly consistent with the quantitative findings reported earlier in this chapter. The Benefits theme is broadly in line with H1, which found that using digital technology is associated with better reported supply chain performance, and the Problems theme is broadly in line with H2, which found that barriers are associated with a weaker version of this relationship. Given that only eight comments were coded, this should be read as illustrative supporting context rather than as independent confirmation of either hypothesis.

Figure 4.2 below shows a word cloud built from the eight comments. In a word cloud, words that were used more often are shown bigger. This gives a quick, simple picture of what people talked about most, before looking at the themes in detail. (*Figure redacted from this version)*

Figure 4.2: Word cloud of respondents' open-ended comments

The biggest words in the picture, such as technology, digital, improve, supply, chain, efficiency, and communication, are the words people used most often. This matches Theme 1 (Benefits) in Table 4.8. Smaller words such as cost, training, and cybersecurity are used less often, but they still appear, matching Theme 2 (Problems)

4.4 Summary of Key Findings

Table 4.9: Summary of Hypothesis Testing Results

Hypothesis	Statement	Result
H1	Digital technology usage is positively associated with supply chain performance.	Supported (B = .185, p = .001)
H2	Barriers negatively moderate the usage-performance relationship.	Supported (B = -.114, p = .019)

Both hypotheses were supported. Digital technology usage is positively associated with supply chain performance, and that positive effect is significantly weakened as perceived barriers to adoption increase.

4.5 Chapter Summary

This chapter presented the findings from 89 valid survey responses from employees and managers across Nepalese FMCG distribution companies. All measurement scales demonstrated good to excellent internal reliability. A moderated regression interaction model provided statistically significant support for both H1 and H2: digital technology usage is positively associated with supply chain performance, and this relationship is significantly weakened by perceived barriers to adoption. An unexpected positive direct relationship between barriers and performance was also identified, most plausibly attributable to acquiescence response bias rather than a genuine substantive effect. These findings are interpreted in relation to the literature and theoretical framework developed in Chapter 2 in the Discussion that follows in Chapter 5.

CHAPTER 5: DISCUSSION

5.1 Introduction

Chapter 4 presented what the study found. This chapter explains what those findings mean. Chapter 4 answered the question "what happened?". This chapter answers the harder question: "why did it happen, and what does it tell us?"

The chapter is organised in a simple order. First, it looks at what the results say about each of the three research questions from Chapter 1, drawing on both the numeric results and the thematic analysis of respondents' comments from Chapter 4. Second, it compares the results with the studies discussed in Chapter 2, to see where they agree and where they differ. Third, it explains what the study adds to existing theory, since a dissertation is expected to say something new, not just repeat what is already known. Fourth, it explains what the findings mean for real companies and for policymakers in Nepal.

5.2 Interpretation of Key Findings

The first research question asked which digital technologies are commonly used by FMCG distribution companies in Nepal. Chapter 4 showed that digital technology is present in this sector, but not used fully everywhere. On average, people rated their use of ERP, inventory software, GPS tracking, and digital payments as moderate, not high. This is an important starting point for the rest of the discussion, because it means the companies in this study are not at two extremes. They are not companies with no digital technology at all, and they

are not companies that have adopted everything fully. This means the study is capturing a sector that is in the middle of a change, not one that has finished changing or has not started.

The second research question asked what the relationship is between using digital technology and supply chain performance. This was tested through H1. The result was clear and positive: companies that use more digital technology also report better supply chain performance (B = .185, p = .001). In plain terms, this means that each one-point difference in reported technology use is associated with reported performance being about 0.185 points higher, once other factors in the model are considered. This is not a huge jump, but it is a real and statistically reliable one, and it answers the second research question directly.

The third research question asked about the key challenges to digital technology adoption. This was tested through H2. Barriers, such as cost, poor training, and weak infrastructure, do more than just exist alongside digital technology use. They change how strong the relationship between technology use and performance is. The interaction result was significant and negative (B = -.114, p = .019), meaning that as barriers go up, the positive effect of technology use on performance goes down. Put simply: technology usage is associated with reported performance, but this association appears weaker where barriers are higher. Two companies could report exactly the same level of ERP and GPS use, and still report very different performance outcomes, a pattern consistent with one company facing fewer cost, training, or infrastructure problems than the other.

A small, supplementary set of open-ended comments, reported in Chapter 4 (Section 4.3.6), is broadly consistent with these numeric findings, though given the very small number of usable comments (eight), this should be read as illustrative supporting context rather than as independent confirmation. All eight coded comments mentioned some kind of benefit from digital technology, broadly in line with the positive H1 result. One respondent, for example, described improvements in "efficiency, communication, and visibility" after using digital tools. Four of the eight comments also mentioned barriers such as cost and training, broadly in line with the H2 result. This pattern is consistent with, though it does not independently prove, the quantitative findings.

5.3 Comparison with Existing Literature

The finding that digital technology use is linked to better performance (H1) agrees with most of the literature reviewed in Chapter 2. Outside Nepal, Hazen et al. (2016) argue that ERP and data tools reduce errors and improve planning, and Ben-Daya, Hassini and Bahroun (2019) show that IoT and tracking tools give companies better visibility of their goods. Inside Nepal, Subedi and Bhatt (2025) and Bhatt (2025) also found that digital technology use is linked to better outcomes for Nepalese SMEs, even though they measured slightly different outcomes to this study. This agreement across different countries and company types makes the H1 finding more trustworthy, because it is not just one study reaching this conclusion by chance.

The finding that barriers are associated with a smaller reported benefit (H2) also agrees with the barrier literature discussed in Chapter 2. Kamble, Gunasekaran and Dhone (2019) list cost and a lack of technical know-how as major problems facing Industry 4.0 adoption in India, Luthra et al. (2018) point to weak regulation and limited resources across developing economies, and Giri, Thakur and Chatterjee (2020), writing specifically about Nepal, found that poor internet connectivity was one of the biggest problems facing ERP users. These studies mostly describe barriers as separate, standalone problems. What this study adds is a way to test barriers differently: not as a separate list, but as something associated with the size of the benefit a company reports getting from the technology it already has. This is a more precise, more testable way of describing the same real-world issue.

One difference is worth noting. Much of the wider international literature, especially studies of larger companies in richer countries, tends to write about digital technology as though its benefits arrive almost automatically once the technology is bought and installed. This study's findings, coming from smaller, resource-constrained Nepalese FMCG distribution companies, tell a more careful story: the benefits are real, but they are conditional on local conditions such as internet access, staff training, and available funding. This fits closely with the World Economic Forum's (2024) warning that the benefits of digital transformation are not shared equally around the world, and that companies in less developed economies often need extra support to capture the same gains that companies in richer economies capture more easily. It is also worth noting that several of the studies cited above focus on

larger firms or on manufacturing rather than distribution specifically. This study's focus on FMCG distribution, where many companies are small or medium-sized, extends the existing literature into a sector and firm size not tested together in this way before within the Nepalese context.

5.4 Contribution to Theory or Knowledge

This study uses three theories together: TOE, DOI, and RBV. They are used to help explain the results, not as one single model that was fully tested. The study only measured technology use, barriers, and reported performance. It did not measure every specific part of each theory.

RBV says a resource can give a company an advantage. The H1 result fits this idea: companies using more technology report better performance. But the study did not check RBV's exact rules about what makes a resource valuable or hard to copy.

TOE says a company's success depends on the technology, the company itself, and its environment. The H2 result fits this idea: barriers are linked to a smaller benefit from technology. But only one scale was used to measure barriers, not the fuller set of things TOE usually looks at. DOI says some technologies are easier to adopt than others. This may explain why simple tools, like digital payments, were used more than complex ones, like ERP. This was not tested directly.

Using all three theories together gives a fuller picture than using just one. But this is a way of thinking about the results, not proof that the three theories work together as one tested model. Testing that fully would need more measurements than this study used. This is offered as a useful way to think about the findings, and a starting point for future research.

5.5 Implications for Practice or Policy

For Nepalese FMCG distribution companies, the findings give a clear, practical message: investing in digital technology is worth it, but investing in technology alone is not enough. A company that spends money on an ERP system or GPS tracking, but does not also spend on staff training, reliable internet access, and basic cybersecurity, is likely to get a smaller benefit than expected. Managers should treat barriers as part of the technology investment

itself, for example by setting aside part of any technology budget specifically for training and support, rather than spending the whole budget on hardware and software alone.

For policymakers and industry bodies, the findings support continued investment in reducing these barriers: more reliable internet infrastructure, particularly outside the Kathmandu Valley; low-cost digital skills training aimed at small and medium-sized distribution businesses; and easier access to financing. Since the H2 result is consistent with barriers being associated with a smaller reported benefit from technology companies already use, addressing these barriers may be a measurable way to help companies capture more value from investments already being made across the sector.

These recommendations are grounded directly in this study's own evidence, not just general assumption. The same regression model that found a positive link between technology and performance also found that this link becomes noticeably weaker when barriers are high. This gives Nepalese policymakers a data-based reason to prioritise these specific barriers, rather than treating digital growth and barrier reduction as two separate, unrelated goals.

5.6 Discussion of Unexpected Findings

One result requires careful attention, because it is not simply an inconvenient outlier to be explained away. It is a substantive and methodological finding that changes how confidently the whole model, not only this one coefficient, can be interpreted. Within the interaction model, barriers also showed a significant positive direct effect on performance ($B = .612$, $\beta = .614$, $p < .001$). Read on its own, this result says that companies facing more barriers report better performance, which is the opposite of what the theory and literature discussed in Chapter 2 would predict.

The most likely explanation is not that barriers really improve performance, but a pattern in how some people answered the survey. Because all the questions used the same agreement scale, from Strongly Disagree to Strongly Agree, some respondents may have tended to pick similar answers across most questions, whether about a benefit or a problem. This is a known issue in survey research, sometimes called acquiescence bias. If present, this does not only affect the barriers-performance relationship; it plausibly affects the precision of every relationship estimated in this study, since all the variables were measured using the

same type of question, from the same respondents, in the same survey. This makes the finding a signal about the overall reliability of the measurement approach used here, not only a puzzling result attached to one coefficient. Other explanations, such as companies going through recent change reporting both barriers and gains at the same time, cannot be fully ruled out either, and this is noted as a limitation in Chapter 6.

This finding does not mean the H2 result should be dismissed, but it does mean the H2 result should be read with more caution than a straightforward interpretation of the interaction coefficient alone would suggest. The interaction term does behave in the theoretically expected direction, which is a meaningful pattern, but it was estimated using the same data affected by this same measurement concern, so it cannot be treated as fully independent of it. This result is therefore evidence of a genuine limitation in the precision of this study's findings as a whole, rather than an isolated curiosity confined to one coefficient. A smaller, related point also came from the open comments: a few respondents described digital technology as something still improving, not yet finished, which fits Diffusion of Innovation theory's view of adoption as a process that unfolds over time. This is picked up again in Chapter 6 as an idea for future research.

5.7 Chapter Summary

This chapter explained what the findings from Chapter 4 mean. Both hypotheses were supported: using more digital technology is associated with better reported supply chain performance (H1), and barriers are associated with a weaker version of this link (H2), a pattern also reflected in respondents' own comments. These results mostly agree with earlier studies, both from Nepal and from other countries, which strengthens confidence in them. The study's main contribution to theory is to offer a way of understanding the results that draws on all three theories together, rather than on any one alone, although the study did not test them as a single integrated model: RBV explains why technology helps, TOE explains why that help is not always the same size, and DOI helps explain why some technologies are adopted more fully than others. The findings also give practical, evidence-based advice: companies should plan for barriers alongside new technology rather than treating them as separate problems, and policymakers should keep reducing barriers such as poor infrastructure, limited training, and difficult access to financing. One surprising

result, a positive direct link between barriers and performance, was discussed in detail and most likely explained by a common pattern in how people answer surveys, though this cannot be fully separated from other possible explanations with the present data. The next chapter brings all of this together, explains what the study achieved against its original objectives, and looks at what should happen next.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

This is the final chapter of the study. It brings everything together in a short and simple way. It reminds the reader what the study set out to do, summarises what was found, checks whether the research objectives were met, gives the main conclusions, offers practical recommendations, is honest about the limitations of the study, and suggests ideas for future research.

6.2 Summary of the Study

This study looked at how digital technology use is associated with the reported performance of supply chains in Nepalese FMCG distribution companies. It focused on four common technologies: ERP systems, inventory management software, GPS tracking, and digital payment systems. Chapter 2 explained that most existing research on this topic comes from bigger companies in richer countries, or from manufacturing companies rather than distribution companies, which meant Nepalese FMCG distribution companies were not well studied. To help fill this gap, the study built a simple framework using three theories together: The Technology-Organisation-Environment (TOE) framework, Diffusion of Innovation (DOI) theory, and the Resource-Based View (RBV).

Data was collected using an online questionnaire, answered by 89 people working in Nepalese FMCG distribution companies, including employees, supervisors, managers, logistics officers, and supply chain managers. The data was analysed using simple statistics, including a regression model that tested how technology use and barriers relate to supply chain performance. A small thematic analysis of respondents' written comments was also carried out, to add a second, simpler type of evidence alongside the numbers. Two hypotheses were tested. Both were supported: using more digital technology was linked to better supply chain performance, and barriers, such as cost and poor training, made this benefit smaller.

6.3 Achievement of Research Objectives

The first objective was to explore how digital technology is used in supply chain activities of FMCG distribution companies in Nepal. This was achieved. The study found that digital technology is present in this sector, but not used fully everywhere. On average, respondents rated their use of ERP, inventory software, GPS tracking, and digital payments as moderate, not high.

The second objective was to examine the relationship between the use of digital technology and the efficiency of the supply chain. This was achieved through H1, which found a clear, positive, and statistically reliable link between digital technology use and supply chain performance.

The third objective was to understand the key challenges that Nepalese FMCG distribution companies are encountering in digital transformation. This was achieved through H2 and the thematic analysis together. The quantitative result showed that barriers such as cost, poor training, and weak infrastructure make the benefit of digital technology smaller. The comments respondents wrote added simple, real examples of these same challenges.

All three objectives were therefore met. However, this should be read alongside the limitations explained later in this chapter, since the study used a specific sample, a specific

method, and covers a specific point in time, not the whole of Nepal's FMCG sector across all time.

6.4 Key Conclusions

Three main conclusions can be drawn from this study.

First, technology usage is associated with reported supply chain performance. Companies that report using more of it also tend to report better supply chain performance, and this is supported both by the numbers and by what people wrote in their own words. This is not a small or uncertain finding; it held up across the statistical test and the separate thematic analysis, which is a stronger form of evidence than either type of data could give alone.

Second, the reported benefit of digital technology is not fixed. It appears smaller where barriers such as cost, poor training, weak infrastructure, and cybersecurity worries are high, consistent with a possible moderating relationship rather than a fixed benefit. This means simply owning technology may not be enough on its own; how well the surrounding conditions are managed appears to matter just as much. A company that buys the same ERP system as a competitor may still report a smaller benefit, in organisations that also report managing the barriers around using that system less well.

Third, no single theory explains everything this study found. Using RBV, TOE, and DOI together gives a fuller picture than using just one theory alone. This is a way of understanding the results, not proof that all three theories work together as one tested model. The study measured technology use, barriers, and performance, not every part of each theory.

6.5 Practical Recommendations

The recommendations below follow directly from the study's findings, rather than being general advice that could apply anywhere. They are grouped by who they are most relevant to.

For Nepalese FMCG distribution companies:

- Do not buy digital technology without also planning for training. Set aside part of any technology budget specifically for staff training and support, rather than spending the whole budget on hardware and software alone.
- Check internet reliability and cybersecurity before relying heavily on tools such as GPS tracking or digital payments, since weak infrastructure can reduce the benefit of these tools, sometimes without the company realising why the expected gains have not appeared.
- Treat digital transformation as a step-by-step process, not a single event. Simpler tools, such as digital payments, may be easier to adopt fully first, before moving to more complex systems such as full ERP, which take longer to embed properly into daily operations.

For policymakers and industry bodies:

- Keep investing in reliable internet infrastructure, especially outside the Kathmandu Valley, since poor connectivity was repeatedly mentioned as a barrier, both in the numeric results and in respondents' own comments.
- Offer low-cost digital skills training aimed at small and medium-sized distribution businesses specifically, not just larger companies that can often already afford their own training.
- Make financing easier to access for smaller FMCG distribution companies, so that upfront cost is less of a barrier to adopting technology that could otherwise improve their performance.

6.6 Limitations of the Study

Every study has limits, and being honest about them helps the reader judge how far the findings can be trusted and applied. The main limitations of this study are set out below.

- The study collected data at only one point in time, rather than following the same companies over months or years. This means it can show that technology use and performance are linked, but it cannot prove that one directly causes the other; it

remains possible, for example, that already better-performing companies simply find it easier to invest in technology, rather than technology being the only cause of their better performance.

- The sample was not fully random. Purposive and convenience sampling were used because a complete list of Nepalese FMCG distribution companies does not exist, making random sampling impractical. This means the results may not fully represent every company in the sector, particularly very small or informal businesses that are harder to reach through professional networks.

- All the data came from the same people, using the same type of scale, in the same survey. This may have added a common pattern to some answers, which is the most likely reason for the surprising positive link between barriers and performance discussed in Chapter 5.

- The sample size, 89 people, is enough for the main tests used, but it limits how much more detailed or complex analysis could be done, such as comparing results separately across different company sizes with strong statistical power.

- The thematic analysis was based on only eight usable comments, out of 13 written responses. This gave useful extra evidence that matched the numeric findings, but it is too small to be treated as a full or complete qualitative study on its own.

6.7 Recommendations for Future Research

Building on the limitations above, several directions for future research would help build on what this study has started.

- Future studies could collect data at more than one point in time, following the same companies as they adopt more technology, to check whether digital technology use really causes better performance, not just whether the two are linked at one moment.

- Future studies could use random sampling, if a full list of Nepalese FMCG distribution companies becomes available, to get results that represent the whole sector more confidently than purposive and convenience sampling can.

- Future studies could use a mix of agree/disagree questions and other types of questions, such as ranking questions or open text boxes for every section, to reduce the risk of the same response pattern affecting every answer in the same way.

- Future studies with a larger sample could run a separate regression comparing the individual effect of each technology, ERP, inventory software, GPS/IoT tracking, and digital payments, on supply chain performance, to give a clearer, evidence-based answer to which technologies companies should prioritise, rather than relying on usage frequency alone.

- Future studies could collect more written comments, or run proper structured interviews, to build a fuller qualitative picture alongside the numbers than the small comment box used in this study allowed.

- Future studies could look more closely at newer technologies, such as artificial intelligence or blockchain, which were not covered in this study but may become more common in Nepal's FMCG sector over time as infrastructure and skills continue to improve.

- Future studies could follow up on the idea, raised by a few respondents in this study, that digital transformation is still an ongoing process. Studying the same companies over a longer period could show how the benefits of technology change as adoption becomes more complete, rather than treating adoption as something that has either happened or not.

Overall, this study's findings are consistent with digital technology usage being associated with better reported performance among Nepalese FMCG distribution companies, and this association appears weaker where barriers to adoption remain unaddressed. With continued investment in infrastructure, training, and support, Nepalese FMCG distribution companies are well placed to get more value from the digital technology they already have, and from what they choose to adopt next.

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APPENDICES

Questionnaire

The Impact of Digital Technology Adoption on Supply Chain Performance in Nepalese FMCG Distribution Companies

Section A: Demographic Information

1. What is your current job position?

☐Employee

☐Supervisor

☐Manager

☐Logistics Officer

☐Supply Chain Manager

☐Inventory Officer

☐Other: _____

2. How many years of work experience do you have in supply chain/logistics operations?

☐Less than 1 year

☐1–3 years

☐4–6 years

☐7–10 years

☐More than 10 years

3. What is the size of your organisation?

☐Small enterprise

☐Medium enterprise

☐Large enterprise

4. Which department do you work in?

☐Supply Chain

☐Logistics

☐Inventory Management

☐Procurement

☐Transportation

☐Operations

☐Other: _____

5. Does your organisation currently use digital technologies in supply chain operations?

☐Yes

☐No

Section B:

Digital Technology Usage

Please indicate your level of agreement with the following statements about your organisation's use of digital technologies in supply chain operations.

Statement	Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly Disagree
My organisation makes regular use of ERP systems in supply chain activities.	☐	☐	☐	☐	☐
My organisation makes regular use of digital inventory / warehouse management software.	☐	☐	☐	☐	☐
My organisation makes regular use of GPS or IoT-based tracking systems for logistics and delivery.	☐	☐	☐	☐	☐
My organisation makes regular use of digital or mobile payment systems.	☐	☐	☐	☐	☐

Section C:

Digital Technology Adoption

Please indicate your level of agreement with the following statements.

Statement	Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly Disagree
Digital inventory management systems improve inventory accuracy.	☐	☐	☐	☐	☐
GPS tracking systems improve delivery coordination.	☐	☐	☐	☐	☐
Digital payment systems improve operational processes.	☐	☐	☐	☐	☐
Employees receive adequate training on digital technologies.	☐	☐	☐	☐	☐
Digital technologies improve communication within the supply chain.	☐	☐	☐	☐	☐

Section D:

Supply Chain Performance

Please indicate your level of agreement with the following statements.

Statement	Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly Disagree
Digital technology adoption has improved supply chain efficiency.	☐	☐	☐	☐	☐
Digital systems help reduce operational costs.	☐	☐	☐	☐	☐
Delivery times have improved due to digital technologies.	☐	☐	☐	☐	☐
Customer satisfaction has improved through digital systems.	☐	☐	☐	☐	☐
Digital technology improves inventory management performance.	☐	☐	☐	☐	☐
Digital systems increase overall operational productivity.	☐	☐	☐	☐	☐

Section E:

Challenges of Digital Technology Adoption

Please indicate your level of agreement with the following statements.

Statement	Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly Disagree
High implementation costs are a challenge for digital adoption.	☐	☐	☐	☐	☐
Lack of employee training affects digital technology adoption.	☐	☐	☐	☐	☐
Poor technological infrastructure limits digital transformation.	☐	☐	☐	☐	☐
Resistance to organisational change affects digital adoption.	☐	☐	☐	☐	☐
Cybersecurity concerns affect the use of digital technologies.	☐	☐	☐	☐	☐
Lack of financial resources affects technology implementation.	☐	☐	☐	☐	☐

Section F: Additional Comments

Please provide any additional comments regarding digital technology adoption and supply chain performance in your organisation.

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