

The copyright © of this thesis belongs to its rightful author and/or other copyright owner. Copies can be accessed and downloaded for non-commercial or learning purposes without any charge and permission. The thesis cannot be reproduced or quoted as a whole without the permission from its rightful owner. No alteration or changes in format is allowed without permission from its rightful owner.



**EXPLORING THE CHALLENGES OF LPG CYLINDERS LOGISTICS  
MANAGEMENT: INSIGHTS FROM HOUSEHOLD END USERS AND  
RETAILERS**



**SITI HUMAIRA NAQIAH BINTI AZMI**

**MASTER OF SCIENCE  
SCHOOL OF TECHNOLOGY MANAGEMENT AND LOGISTICS  
COLLEGE OF BUSINESS  
UNIVERSITI UTARA MALAYSIA  
August 2024**

**EXPLORING THE CHALLENGES OF LPG CYLINDERS LOGISTICS  
MANAGEMENT: INSIGHTS FROM HOUSEHOLD END USERS AND  
RETAILERS**

**BY  
SITI HUMAIRA NAQIAH BINTI AZMI**



**UUM**  
**Universiti Utara Malaysia**

**Thesis Submitted to  
College of Business,  
Universiti Utara Malaysia,  
In Partial Fulfilment of the Requirement for the Master of Science  
(Transportation and Logistics Management)**



**Kolej Perniagaan**  
(College of Business)  
**Universiti Utara Malaysia**

**PERAKUAN KERJA TESIS / DISERTASI**  
(Certification of thesis / dissertation)

Kami, yang bertandatangan, memperakukan bahawa  
(We, the undersigned, certify that)

**SITI HUMAIRA NAQIAH BINTI AZMI**

calon untuk ijazah **MASTER OF SCIENCE (TRANSPORTATION & LOGISTICS MANAGEMENT)**  
(candidate for the degree of)

telah mengemukakan tesis / disertasi yang bertajuk:  
(has presented his/her thesis / dissertation of the following title)

**EXPLORING THE CHALLENGES OF LPG CYLINDERS LOGISTICS MANAGEMENT: INSIGHTS  
FROM HOUSEHOLD END USERS AND RETAILERS**

seperti yang tercatat di muka surat tajuk dan kulit tesis / disertasi.  
(as it appears on the title page and front cover of the thesis / dissertation).

Bahawa tesis/disertasi tersebut boleh diterima dari segi bentuk serta kandungan dan meliputi bidang ilmu dengan memuaskan, sebagaimana yang ditunjukkan oleh calon dalam ujian lisan yang diadakan pada:

**06 Ogos 2024.**

(That the said thesis/dissertation is acceptable in form and content and displays a satisfactory knowledge of the field of study as demonstrated by the candidate through an oral examination held on:

**06 August 2024.**

Pengerusi Viva  
(Chairman for Viva)

: **Dr. Haikal bin Ismail**

Tandatangan  
(Signature)

Pemeriksa Dalam  
(Internal Examiner)

: **Dr. Haikal bin Ismail**

Tandatangan  
(Signature)

Pemeriksa Dalam  
(Internal Examiner)

: **Dr. Fadhilah binti Mohd Zahari**

Tandatangan  
(Signature)

Tarikh: **06 Ogos 2024**  
Date:



Nama Pelajar  
(Name of Student) : Siti Humaira Naqiah binti Azmi

---

Tajuk Tesis / Disertasi  
(Title of the Thesis / Dissertation) : Exploring the Challenges of LPG Cylinders Logistics Management: Insights from Household End Users and Retailers

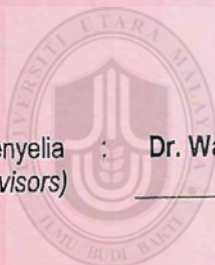
---

Program Pengajian  
(Programme of Study) : Master of Science (Transportation & Logistics Management)

---

Nama Penyelia/Penyelia-penyelia  
(Name of Supervisor/Supervisors) : Dr. Wadi Khalid bin Anuar

---



UUM  
Universiti Utara Malaysia

A handwritten signature in black ink, appearing to be 'Wadi Khalid bin Anuar', is written over a horizontal line.

Tandatangan

Nama Penyelia/Penyelia-penyelia  
(Name of Supervisor/Supervisors) : -

---

Tandatangan

## **Declaration**

I certify that except where due acknowledgement has been made, the work is that of the author alone; the work has not been submitted previously, in whole or in part, to qualify for any other academic award; the content of the thesis is the result of work which has been carried out since the official commencement date of the approved research program; and any editorial work, paid or unpaid, carried out by a third party is acknowledged.

**SITI HUMAIRA NAQIAH BINTI AZMI**

**(832268)**

School of Technology Management and Logistics

College of Business

Universiti Utara Malaysia

O6010 Sintok

Kedah Darul Aman



### **Permission to Use**

In presenting this dissertation/project paper in partial fulfillment of the requirements for a Post Graduate degree from the Universiti Utara Malaysia (UUM), I agree that the Library of this university may make it freely available for inspection. I further agree that permission for copying this dissertation/project paper in any manner, in whole or in part, for scholarly purposes may be granted by my supervisor(s) or in their absence, by the Director of Postgraduate Studies Unit, College of Business where I did my dissertation/project paper. It is understood that any copying or publication or use of this dissertation/project paper parts of it for financial gain shall not be allowed without my written permission. It is also understood that due recognition shall be given to me and to the UUM in any scholarly use which may be made of any material in my dissertation/project paper.

Request for permission to copy or to make other use of materials in this dissertation/project paper in whole or in part should be addressed to:

Director of Postgraduate Studies Unit, College of Business  
Universiti Utara Malaysia  
06010 UUM Sintok  
Kedah Darul Aman

## **Abstract**

The growing demand for liquefied petroleum gas (LPG) has intensified the complexities of its supply chain, posing significant challenges for both household users and retailers. As a vital energy source, the efficient management of LPG cylinder returns, supply, and distribution is crucial for ensuring customer satisfaction and operational effectiveness. This study investigates these processes in Seremban, Malaysia, aiming to identify the key challenges faced by stakeholders in the LPG sector. The research seeks to understand the operational difficulties in managing LPG cylinders and how these issues impact customer experiences and overall supply chain efficiency. The primary objectives are to explore the specific challenges encountered by household users and retailers in the returns, supply, and distribution of LPG cylinders. A qualitative research design was employed, utilizing semi-structured interviews with 14 participants, including both household users and retailers, to gain detailed insights into their experiences. Findings indicate that household users face issues with the limited availability of delivery services and high costs associated with emergency deliveries. Retailers, on the other hand, struggle with inventory management and ensuring customer satisfaction. The study highlights the interconnected nature of these challenges, emphasizing the need for enhanced communication and collaboration within the supply chain. In conclusion, the research underscores the need for strategic improvements in the LPG distribution system to boost operational performance and customer satisfaction. Recommendations include adopting more flexible delivery options, implementing transparent pricing strategies, and fostering better collaboration among stakeholders to optimize the supply chain. By addressing these challenges, the LPG industry can create a more sustainable and user-friendly market, benefiting both household users and retailers and contributing to a more efficient and effective LPG supply chain.

**Keywords:** reverse logistics, supply chain management, customer satisfaction, operational efficiency, distribution challenge



## **Abstrak**

Permintaan yang semakin meningkat terhadap gas petroleum cecair (LPG) telah mempertingkatkan kerumitan dalam rantai bekalnya, menimbulkan cabaran besar untuk pengguna rumah dan peruncit. Sebagai sumber tenaga penting, pengurusan yang cekap terhadap pengembalian, bekalan, dan pengedaran silinder LPG adalah penting untuk memastikan kepuasan pelanggan dan keberkesanan operasi. Kajian ini menyelidik proses-proses ini di Seremban, Malaysia, dengan tujuan untuk mengenal pasti cabaran utama yang dihadapi oleh pihak berkepentingan dalam sektor LPG. Penyelidikan ini bertujuan untuk memahami kesukaran operasi dalam pengurusan silinder LPG dan bagaimana isu-isu ini mempengaruhi pengalaman pelanggan serta kecekapan keseluruhan rantai bekalan. Objektif utama adalah untuk meneroka cabaran khusus yang dihadapi oleh pengguna rumah dan peruncit dalam pengembalian, bekalan, dan pengedaran silinder LPG. Reka bentuk penyelidikan kualitatif digunakan, dengan wawancara separa berstruktur melibatkan 14 peserta, termasuk pengguna rumah dan peruncit, untuk mendapatkan pandangan mendalam tentang pengalaman mereka. Penemuan menunjukkan bahawa pengguna rumah menghadapi masalah dengan ketersediaan perkhidmatan penghantaran yang terhad dan kos tinggi yang berkaitan dengan penghantaran kecemasan. Sebaliknya, peruncit menghadapi cabaran dalam pengurusan inventori dan memastikan kepuasan pelanggan. Kajian ini menyoroti hubungan antara cabaran-cabaran ini, menekankan keperluan untuk komunikasi dan kerjasama yang lebih baik dalam rantai bekalan. Kesimpulannya, penyelidikan ini menekankan keperluan untuk penambahbaikan strategik dalam sistem pengedaran LPG untuk meningkatkan prestasi operasi dan kepuasan pelanggan. Cadangan termasuk mengadopsi pilihan penghantaran yang lebih fleksibel, melaksanakan strategi harga yang telus, dan memupuk kerjasama yang lebih baik antara pihak berkepentingan untuk mengoptimumkan rantai bekalan. Dengan menangani cabaran-cabaran ini, industri LPG dapat mewujudkan pasaran yang lebih mampan dan mesra pengguna, memberi manfaat kepada pengguna rumah dan peruncit, serta menyumbang kepada rantai bekalan LPG yang lebih cekap dan berkesan.

**Kata kunci: logistik terbalik, pengurusan rantai bekalan, kepuasan pelanggan, kecekapan operasi, cabaran pengedaran**

## Acknowledgement

First and foremost, I would like to express my heartfelt gratitude to my esteemed supervisor, Dr. Wadi Khalid bin Anuar, whose unwavering dedication and invaluable guidance have been instrumental in the completion of this dissertation. His support from the inception of the proposal through to the final stages of writing has been indispensable, and I am deeply thankful for his generous sharing of expertise and experience throughout this research journey.

My profound appreciation goes to my parents, whose limitless support and encouragement have been my driving force throughout the dissertation process. Their unwavering belief in me has been a constant source of motivation.

Special thanks to my loving husband and my wonderful daughter for their unyielding support, patience, and understanding throughout this journey. Their love and encouragement have been my rock, and their belief in me has been a driving force behind my perseverance.

I extend my sincere thanks to my colleagues and course mates for their continuous inspiration, support, and constructive suggestions. Additionally, I am grateful to my friends for their relentless motivation and encouragement during my studies.

Lastly, I wish to express my deep appreciation to all the respondents who participated in this study. Their cooperation and willingness to contribute have been crucial to the success of this research.

## Table of contents

|                                                          |     |
|----------------------------------------------------------|-----|
| Certification of thesis work                             | i   |
| Declaration                                              | ii  |
| Permission to Use                                        | iii |
| Abstract                                                 | iv  |
| Abstrak                                                  | v   |
| Acknowledgement                                          | vi  |
| List of tables                                           | x   |
| List of figures                                          | xi  |
| List of abbreviations                                    | xii |
| CHAPTER 1                                                | 1   |
| 1.0 Introduction                                         | 1   |
| 1.1 Background of the study                              | 1   |
| 1.2 Problem statement                                    | 4   |
| 1.3 Research questions                                   | 7   |
| 1.4 Research objectives                                  | 7   |
| 1.5 Scope of the study                                   | 8   |
| 1.6 Significance of the study                            | 9   |
| 1.7 Definition of key terms                              | 11  |
| 1.8 Organization of the study                            | 12  |
| CHAPTER 2                                                | 14  |
| 2.0 Introduction                                         | 14  |
| 2.1 Reverse logistics associated with LPG cylinders      | 14  |
| 2.2 Supply and demand associated with LPG cylinders      | 16  |
| 2.3 Customer satisfaction associated with LPG cylinders  | 19  |
| 2.4 Operational efficiency associated with LPG cylinders | 23  |
|                                                          | vii |

|                                                           |    |
|-----------------------------------------------------------|----|
| CHAPTER 3                                                 | 29 |
| 3.0 Introduction                                          | 29 |
| 3.1 Research framework                                    | 29 |
| 3.2 Research design                                       | 30 |
| 3.3 Selection and sampling                                | 31 |
| 3.3.1 Population                                          | 31 |
| 3.3.2 Sample                                              | 32 |
| 3.4 Development of interview protocol                     | 34 |
| 3.5 Data collection method                                | 35 |
| 3.5.1 Primary Data                                        | 36 |
| 3.5.2 Secondary Data                                      | 37 |
| 3.6 Data analysis techniques                              | 37 |
| 3.7 Research instruments                                  | 38 |
| 3.8 Conclusion                                            | 39 |
| CHAPTER 4                                                 | 40 |
| 4.0 Introduction                                          | 40 |
| 4.1 Background of participants                            | 40 |
| 4.2 Challenges associated with LPG cylinders supply chain | 41 |
| 4.3 Supply chain management                               | 41 |
| 4.3.1 Difficulty in obtaining LPG cylinders               | 41 |
| 4.3.2 Accepting different brands of LPG cylinders         | 45 |
| 4.3.3 Challenges in empty LPG cylinder return             | 49 |
| 4.4 Customer service and satisfaction                     | 51 |
| 4.4.1 Difficulty in contacting LPG cylinder retailers     | 51 |
| 4.4.2 Poor response during peak time                      | 53 |
| 4.4.3 Pricing discrepancies and customer awareness        | 54 |
| 4.4.4 Convenience and willingness to pay                  | 55 |

|                                                            |    |
|------------------------------------------------------------|----|
| 4.5 Inventory management                                   | 56 |
| 4.6 Operational efficiency                                 | 59 |
| 4.6.1 The unpredictability of delivery timings             | 59 |
| 4.6.2 Increasing demand for home delivery services         | 60 |
| 4.6.3 Lack of delivery vehicles                            | 62 |
| 4.6.4 Marketing and communication                          | 63 |
| 4.7 Distribution challenges                                | 64 |
| 4.8 Summary of findings                                    | 66 |
| CHAPTER 5                                                  | 68 |
| 5.1 Introduction                                           | 68 |
| 5.2 Summary of research findings                           | 68 |
| 5.3 Research implications                                  | 74 |
| 5.3.1 Theoretical implications                             | 74 |
| 5.3.2 Practical implications                               | 76 |
| 5.4 Limitations of study and direction for future research | 85 |
| REFERENCES                                                 | 87 |
| Appendix A                                                 | 96 |
| Appendix B                                                 | 97 |
| Appendix C                                                 | 98 |

## List of tables

|                                                     |    |
|-----------------------------------------------------|----|
| Table 1.1 Definition of key terms .....             | 11 |
| Table 4.1 Demographics of participants (n=14) ..... | 41 |
| Table 4.2 Summary of findings.....                  | 67 |





## List of figures

|                                                |    |
|------------------------------------------------|----|
| Figure 3.1 Flowchart of research process ..... | 29 |
| Figure 5.1 Proposed framework.....             | 85 |



## List of abbreviations

|      |                                    |
|------|------------------------------------|
| LPG  | liquefied petroleum gas            |
| SMEs | Small and medium-sized enterprises |



## **CHAPTER 1**

### **INTRODUCTION**

#### **1.0 Introduction**

This chapter delves into the study's background, problem statement, research objective, research questions, scope, and limitations of the research. Additionally, this study discusses research significance. Finally, this study defined key terms and organize the study's conduct.

#### **1.1 Background of the study**

Over the decades, the liquefied petroleum gas (LPG) industry in Malaysia has undergone a remarkable growth trajectory. LPG is considered a vital product in Malaysia according to the Petroleum Development Act of 1974 and the Control Supply Act of 1961 (Shahrizan, Kadir, & Ramlee, 2022). In order to lessen the financial strain on the public's cost of living, Malaysia has had a subsidy programme in place since 1983. LPG's versatility allows it to serve multiple applications across different sectors. There are 10 kg, 12 kg and 14 kg weight cylinders specifically made for cooking gas. (Choong, 2019). There are additional cylinders in use, each with special characteristics. These include the 14 kg and 50 kg bottles intended for use in commercial and industrial settings without subsidies, the 12 kg version only offered by the BHP Company, and the F14, a 14 kg LPG cylinder. Commercial uses include fuelling restaurant kitchens, heating public buildings, and powering industrial forklifts. In industrial settings, LPG is used for metal cutting.

LPG has emerged as a vital energy source for households globally, especially in developing areas. Its importance stems from its versatility and efficiency as a fuel for cooking, heating, and various domestic uses (Alnoor, Eneizan, Makhamreh, & Rahoma, 2019). By offering a cleaner alternative to traditional biomass fuels, LPG not only improves living standards but also supports energy sustainability. With ongoing urbanization, the demand for LPG is anticipated to grow, underscoring the need for effective management to meet the increasing energy requirements of households.

Equally important is the process of returning LPG cylinders. Efficient return practices are essential for maintaining the integrity of the supply chain, as they facilitate the timely refill and redistribution of empty cylinders (Kazemi, Modak, & Govindan, 2018). Proper management of returns not only ensures that the supply of LPG remains uninterrupted but also contributes to safety and environmental sustainability by promoting the recycling and proper disposal of used cylinders. The challenges associated with the returns process can significantly affect the overall efficiency of the LPG supply chain.

The distribution of LPG cylinders is a key factor impacting the accessibility and reliability of LPG for households. Efficient distribution practices are vital for ensuring timely delivery, which directly enhances customer satisfaction. However, logistical challenges such as issues with delivery schedules and transportation can disrupt this process, resulting in delays and higher costs for both retailers and household end users (Amutha, 2018). Addressing these distribution challenges is crucial for formulating strategies that boost service delivery and operational efficiency.

The supply of LPG cylinders is a vital aspect of ensuring that households have consistent access to this essential resource. A reliable supply chain is necessary to

maintain the availability of LPG cylinders, which directly impacts the ability of households to meet their cooking and heating requirements. Disruptions in the supply chain can lead to shortages, increased prices, and ultimately, dissatisfaction among consumers. Therefore, understanding the dynamics of LPG cylinder supply is critical for both energy providers and consumers (Kojima, 2011). Effective supply chain management is essential to balance supply and demand, avoid shortages, and ensure timely deliveries, all while adhering to strict safety regulations to prevent accidents (Khadija, 2016).

Inadequate delivery vehicles can lead to increased transportation costs, delivery delays, and safety risks during transit, highlighting the importance of efficient logistics in ensuring timely and safe delivery of LPG (Momtaz & Tasnim, 2019). Meanwhile, proper storage facilities are also critical for maintaining the safety and integrity of LPG cylinders, as these facilities must comply with safety regulations and be equipped to handle specific requirements such as temperature control and ventilation. Inefficient storage practices can result in inventory shortages or excess, adversely affecting the ability to meet customer demand. Effective inventory management is essential to ensure that the right amount of LPG cylinders is available at the right time, which involves tracking usage, forecasting demand, and managing stock levels to prevent shortages or overstock situations.

Service quality plays a crucial role in determining customer satisfaction, as the effectiveness of returns, supply, and distribution impacts the overall experience. Customers anticipate timely deliveries and dependable service; delays can lead to frustration, especially for households reliant on LPG for cooking and heating (Vinayagamoorthy, Sankar, & Sangeetha, 2012). Problems with cylinder availability

may occur due to supply chain disruptions, inventory mismanagement, or sudden increases in demand, causing inconvenience for customers who might face difficulties accessing LPG when required. Additionally, maintaining clear and proactive communication with customers is vital for managing expectations and improving satisfaction.

## **1.2 Problem statement**

The management of LPG cylinder returns, supply, and distribution presents several challenges that affect both household end users and retailers. These challenges include inefficiencies in the returns, supply, and distribution processes of LPG cylinders, which can lead to customer dissatisfaction, increased operational costs, and safety concerns. Efficiently handling the distribution and returns of LPG cylinders is a vital component of the logistics procedure in the LPG sector. Effective reverse logistics guarantees the prompt and cost-efficient return, refill, and redistribution of empty LPG cylinders, thus preserving the integrity of the supply chain and ensuring customer satisfaction.

One of the core issues within the LPG supply chain is the difficulty in maintaining a consistent and efficient supply of LPG cylinders. This inefficiency stems from several factors, including inadequate infrastructure, logistical bottlenecks, and a lack of coordination between the various stakeholders involved in the supply chain. These issues are exacerbated by the fluctuating demand for LPG, which is influenced by seasonal variations and market conditions, making it challenging to ensure a reliable supply.

Household end users often encounter difficulties related to the availability and timely delivery of LPG cylinders. Many users report issues such as limited delivery hours, inconsistent supply, and the inconvenience of having to wait for deliveries, which can disrupt their daily routines. Additionally, concerns about the quality of the LPG cylinders, including the condition in which they are received, further exacerbate user dissatisfaction. These issues not only affect the convenience of using LPG but also raise safety concerns, as leaking or damaged cylinders pose significant risks.

In other writing, there are authors relate the customer experiences and service challenges (Ramapraba, 2020). It highlights that single domestic LPG customers frequently encounter issues such as inadequate and delayed supply of LPG cylinders, which significantly affects their satisfaction and convenience. Additionally, the study identifies the impact of rising prices on customer perceptions. The study emphasizes the need for LPG companies to enhance their service quality, improve delivery mechanisms, and address operational inefficiencies to better meet customer needs and expectations.

On the retailer side, the challenges are equally pressing. Retailers face operational hurdles such as managing inventory effectively, dealing with the quality of cylinders received from distributors, and navigating the complexities of customer demand. Many retailers report receiving leaking or dirty cylinders, which undermines their ability to provide reliable service to end users. Furthermore, the financial implications of emergency deliveries and the costs associated with maintaining quality standards can strain retailer operations, impacting their profitability and sustainability.

The lack of effective communication and feedback mechanisms between household end users and retailers further complicates these challenges. Without a structured

approach to gather and address user feedback, retailers may struggle to adapt their services to meet customer needs, leading to a cycle of dissatisfaction and operational inefficiencies.

Other studies also mentioned through extensive surveys and factor analysis, the research identified eight key dimensions that significantly influence customer satisfaction, including service reliability, responsiveness, and the quality of customer interactions (Satapathy, Mullick, & Yadav, 2017). The results indicate that a substantial portion of consumers express dissatisfaction with the existing cylinder exchange process, primarily due to inefficiencies such as long wait times and difficulties in locating exchange centers. Furthermore, the research underscores the importance of implementing standardized procedures and brand-specific exchange centers to enhance the overall customer experience.

The inefficiencies within the LPG supply chain not only impact the end users but also have broader economic and environmental implications. Inefficient supply chains lead to increased emissions due to the higher transportation needs and result in economic losses from wasted resources and missed opportunities for optimization.

While issues related to LPG cylinder returns, supply, and distribution are well-documented, there remains a notable research gap in understanding the complexities of these problems. Existing literature often emphasizes quantitative metrics, such as delivery times and safety data, but lacks qualitative insights into the challenges of both end users and retailers. There has been limited exploration into how these stakeholders address the challenges they encounter and what specific improvements they seek in the returns and supply processes.



This study aims to explore the challenges by employing in depth interviews from both household end users and retailers of LPG cylinder returns, supply and distribution. By focusing on these qualitative aspects, the research will offer a more comprehensive understanding of the challenges and support the development of effective improvement strategies which intends to contribute to the overall improvement of the LPG supply chain, benefiting all stakeholders involved.

### **1.3 Research questions**

The fundamental research questions of this study are:

1. How do household end users perceive the challenges related to the returns, supply, and distribution practices of LPG cylinders?
2. What can be explored regarding the underlying challenges among retailers in the management of returns, supply, and distribution of LPG cylinders?

### **1.4 Research objectives**

The primary objectives of this research are to address the knowledge gap regarding the challenges faced in the LPG cylinder return, supply, and distribution of LPG cylinders process from both household end users and retailers. By achieving the following objectives, the researcher aims to contribute to the existing literature and offer insights that can help improve the efficiency and effectiveness of LPG cylinder return supply, and distribution practices, ultimately benefiting both retailers and household end users.

1. To explore the perspectives of household end users on the challenges in the returns, supply, and distribution practices of LPG cylinders in the study area.

2. To explore the challenges that retailers faced in the process of managing LPG cylinder returns, supply, and distribution in the study area.

### **1.5 Scope of the study**

The study focuses on the LPG supply chain within the Seremban District, which has a population of approximately 705,200 residents according to the latest census data. Located in Negeri Sembilan, Malaysia, Seremban District is characterized by a blend of urban and suburban areas, making it an ideal setting for examining the LPG supply chain. The population's diverse socioeconomic status reflects the broader dynamics of Malaysia, which is crucial for understanding the various challenges faced by different stakeholders in the LPG supply chain. In Seremban, numerous LPG retailers play a critical role in distributing LPG cylinders to end users. These retailers are integral to the last-mile delivery process, and their operations significantly influence the overall efficiency of the supply chain. The LPG industry's importance to the local economy and daily life underscores the necessity of addressing the challenges that both retailers and consumers encounter.

The primary aim of this study is to explore the challenges within the LPG supply chain in Seremban District, focusing on both household end users and retailers. The research seeks to identify the key challenges impacting supply chain efficiency, customer satisfaction, and overall operational dynamics in LPG distribution. By investigating these challenges, the study intends to offer actionable insights that can enhance the LPG supply chain and improve the experiences of all stakeholders involved.

This study covers several key areas of the LPG supply chain, including supply chain management, customer service and satisfaction, inventory management, operational

efficiency, and distribution challenges. A qualitative research methodology is employed, focusing on in-depth interviews with household end users and LPG retailers in Seremban District.

The rationale for focusing on Seremban District is based on its diverse population and the significant role of LPG in residents' daily lives, as well as the need to address the knowledge gap regarding the challenges faced in the LPG cylinder return, supply, and distribution processes. The LPG supply chain in this district serves as a microcosm of the broader challenges faced across Malaysia, making it an ideal case study for understanding the complexities of LPG distribution and retail. By identifying and addressing these challenges, the study aims to contribute to the improvement of the LPG industry, not only in Seremban but potentially in other similar regions.

This study acknowledges several limitations. The relatively small sample size, focused on a specific geographic area, may limit the generalizability of the findings. Additionally, the qualitative nature of the research may introduce subjectivity into both the data collection and analysis processes. The qualitative approach, relying on participants' subjective experiences, might not fully capture all the challenges within the LPG supply chain.

## **1.6 Significance of the study**

The study holds several significant implications:

### **1.6.1 Academic contribution**

This study significantly advances the understanding of the LPG cylinder returns, supply and distribution processes by addressing the complex challenges faced by both household end users and retailers. By identifying gaps in existing research, it

revitalizes the discourse surrounding LPG cylinders distribution and return practices. The empirical data collected provides a robust foundation for developing innovative models and strategies that can enhance the efficiency of LPG cylinder returns. This contribution not only enriches academic literature but also sets the stage for future research endeavours that can further explore the intricacies of the LPG supply chain.

### **1.6.2 Practical insights for stakeholders**

The findings of this study offer actionable insights and practical recommendations for the stakeholders involved in the LPG cylinders distribution network. By highlighting effective practices and strategies, the research empowers retailers and household end users to navigate the challenges of LPG cylinder returns, supply and distribution more effectively. This transformative approach encourages the stakeholders to adopt solutions that optimize operations, reduce costs, and enhance customer satisfaction. The practical implications of this study can lead to improved service delivery and operational efficiency, ultimately benefiting all parties involved in the LPG supply chain.

### **1.6.3 Policy and industry support**

The study's findings have the potential to reshape the perspectives of policymakers and industry leaders regarding the LPG cylinders supply chain process. By emphasizing the importance of resilient supply chain strategies, the research advocates for policies that support efficient return practices. This can lead to the development of initiatives and regulations that provide stakeholders with the necessary resources to improve their operations. By aligning policy frameworks with the insights gained from this study,

policymakers can foster an environment conducive to industry growth and sustainability, ultimately enhancing the overall LPG market.

#### 1.6.4 Economic growth and competitiveness

Implementing the efficient LPG cylinder returns, supply and distribution methods identified in this study can significantly enhance the competitiveness of stakeholders in both domestic and international markets. By streamlining supply chain processes, stakeholders can achieve cost reductions, increased production efficiency, and improved customer satisfaction. These benefits serve as catalysts for growth and expansion within the LPG sector, contributing to the broader economic development of Malaysia. The insights derived from this research equip stakeholders with the knowledge needed to refine their practices, thereby fostering long-term economic growth and sustainability in the LPG industry.

#### 1.7 Definition of key terms

Table 1.1  
*Definition of key terms*

| Term               | Definition                                                                                                                                                                                                                                                                         | Source                  |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| LPG                | A type of gas that is used for heating, cooking, and fuel. It consists mainly of propane (C <sub>3</sub> H <sub>8</sub> ) but can also include other hydrocarbons such as propylene, butane, and butylene in various mixtures. Generally, the primary component of LPG is propane. | (Momtaz & Tasnim, 2019) |
| Retailer           | A person who supply LPG to small-scale customers, such as households. These retail outlets can be branches or commission agents representing a marketer, or they may be independent resellers who buy LPG and sell it in cylinders that are owned and branded by the marketer.     | (Kojima, 2011)          |
| Household end user | An individual or family that uses LPG for domestic purposes such as cooking, heating, or hot water.                                                                                                                                                                                | (Vahlne, 2017)          |

|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                  |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
|                         | These users typically obtain LPG in cylinders from retailers or through home delivery services.                                                                                                                                                                                                                                                                                                                                    |                                                  |
| Supply chain management | LPG supply chain involves the coordinated process of acquiring, storing, distributing and collecting LPG cylinders to and from end users.                                                                                                                                                                                                                                                                                          | (Prahasto, Jie, & Parton, 2010)                  |
| Customer satisfaction   | A degree to which the expectations and needs of customers are met by LPG retailers and suppliers. It encompasses various aspects such as the quality and reliability of the LPG cylinders, the efficiency and timeliness of delivery services, the responsiveness and helpfulness of customer service, and the overall convenience and safety of the purchasing experience                                                         | (Satapathy, Mullick, & Yadav, 2017)              |
| Inventory management    | The systematic oversight and regulation of the storage, ordering, and distribution of LPG cylinders. This process includes maintaining optimal stock levels to satisfy customer demand, ensuring storage facilities adhere to safety and compliance standards, forecasting future inventory needs, and managing the logistics of restocking from suppliers.                                                                        | (Lopes, Correia, Silva, Monteiro, & Lopes, 2020) |
| Operational efficiency  | It involves retailers optimizing procurement, storage, and distribution processes to ensure timely and reliable access to LPG cylinders for household end users, while end users benefit from easy access, affordability, and safety in using LPG for their cooking and heating needs.                                                                                                                                             | (Khadija, 2016)                                  |
| Reverse logistics       | The processes of returning, recycling, remanufacturing, or disposing of used LPG cylinders and related products after their initial use, focusing on the efficient management of empty cylinders back to retailers or manufacturers for refilling and proper disposal. This approach enhances sustainability, reduces operational costs, and improves customer satisfaction by effectively managing the lifecycle of LPG products. | (Khadija, 2016)                                  |

## 1.8 Organization of the study

This study was organized into five chapters. Chapter 1 set the stage by providing the background of the study, giving context to the research problem. It included the problem statements, research questions, and objectives that guided the investigation.

Additionally, the scope of the study defined the boundaries within which the research was conducted, while the significance of the study highlighted the potential impact and contributions of the research to the field.

Chapter 2, the literature review section presents an overview of the drawing on previous research to identify significant factors influencing the LPG cylinders returns, supply and distribution. Previous studies on LPG cylinders returns are reviewed to identify gaps and build upon existing knowledge.

Chapter 3 details the qualitative research methodology employed in this study. It describes the research framework, data collection methods, and the rationale behind the selection of participants. The chapter also outlines how the data were analysed.

Chapter 4 focuses on the findings derived from the data collection and analysis. It discusses the backgrounds of the participants and also interprets the research findings.

Finally, Chapter 5 offers a discussion and conclusion based on the findings. It introduces the implications of the research, suggests improvements for LPG cylinder return, supply and distribution processes, and presents recommendations for future studies. The chapter concludes with a summary of the study's overall contributions.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.0 Introduction**

In this chapter, relevant literature is reviewed to provide a deeper understanding of the challenges that impact the return, supply and distribution processes of LPG cylinders. This examination will highlight existing research and insights that shed light on the challenges faced by both household end users and retailers in the LPG retail market.

#### **2.1 Reverse logistics associated with LPG cylinders**

A study on inventory models with reverse logistics in the LPG industry highlighted the significant impact of efficiently managing the flow of returned LPG cylinders and reintegrating them into the inventory system on the asset acquisition process (Lopes, Correia, Silva, Monteiro, & Lopes, 2020) . Effective reverse logistics begins with the systematic collection of empty or partially used LPG cylinders from end users. This process ensures that these valuable assets are not lost or wasted.

Under the direct replacement policy, LPG cylinders remain the property of the selling companies. When customers purchase an LPG cylinder, they do not actually own the cylinder itself; instead, they are essentially renting it. This ownership model ensures that the company retains control over the cylinders throughout their lifecycle (Aldina , Lopes, & Silva, 2019). As LPG cylinders are returned, they undergo a thorough inspection to assess their condition. This step is crucial for identifying any damage, wear, or potential safety hazards that could affect the LPG cylinders' usability (Lopes et. al, 2020).



The policy facilitates a streamlined refilling process for customers. When customers deplete the gas in their cylinders, they return the empty LPG cylinders to the company for refilling. Notably, the policy allows customers to return empty cylinders to any company, irrespective of where the cylinder was initially purchased. This flexibility enhances customer convenience and promotes the timely return of empty LPG cylinders. The direct replacement policy has a direct impact on the forecasting of return rates for LPG cylinders. Since customers can return cylinders to any participating company, the return rates are closely aligned with sales patterns. As sales volumes increase, the number of returned cylinders also rises proportionally.

The complexity of reverse logistics, which involves managing the flow of returned LPG cylinders, inspecting, cleaning, and refilling them for reuse, posed significant challenges within the context of traditional inventory management approaches that do not inherently account for such reverse flows. Furthermore, the study by Lopes, Correia, Silva and Monteiro (2020) addressed the unique challenge of asset reuse and ownership considerations in the LPG industry. The company needed to optimize asset reuse by refilling returned cylinders for resale while adhering to ownership restrictions that mandate each company to refill its own cylinders. This requirement added a layer of complexity to inventory planning and acquisition strategies.

Moreover, this study focused on cost optimization and efficiency in balancing the costs associated with acquiring new cylinders, managing returns, and maintaining optimal stock levels. This comprehensive approach considered both deterministic and stochastic demand and return scenarios to develop strategies that enhance cost-effectiveness and operational performance.

Besides, it focused on the impact of efficiently managing the flow of returned LPG cylinders and reintegrating them into the inventory system solely by LPG companies. However, it is crucial to also consider the perspectives of household end users and retailers. For instance, the effectiveness of customer engagement strategies and incentives in encouraging timely cylinder returns; the impact of reverse logistics on customer satisfaction and loyalty towards LPG retailers, with an emphasis on service quality; the role of effective communication between retailers and customers in facilitating cylinder returns and promoting sustainable practices; the effect of customer education and awareness campaigns on promoting responsible cylinder return behaviour and environmental stewardship and the interaction between retailers and customers in the reverse logistics process and its implications for operational efficiency and cost management.

## **2.2 Supply and demand associated with LPG cylinders**

According to Pathirana (2019), the dynamic nature of the LPG distribution process introduced various challenges that affected the visibility and efficiency of the distribution network. One key challenge stemmed from the varying usage patterns of LPG cylinders, influenced by factors such as household size, seasonal variations, and cooking activities. Larger households necessitated more frequent refills, while seasonal changes and cooking habits led to fluctuations in demand, making it challenging for distributors to anticipate and manage inventory levels effectively.

These demand fluctuations directly impacted inventory management at distribution points, requiring a delicate balance to meet customer needs without experiencing stock outs or excess inventory. The lack of predictability in usage patterns and demand shifts further complicated forecasting and decision-making processes, hindering visibility

into the distribution network and creating challenges in order fulfilment. Distributors struggled to align supply with demand due to limited visibility over inventory levels and consumption patterns, leading to operational inefficiencies such as suboptimal route planning, excessive handling of cylinders, and delays in order fulfilment.

This study also identifying key research gaps which include the limited exploration of predictive analytics to improve demand forecasting, and insufficient focus on tailored inventory optimization strategies to enhance efficiency. Additionally, there is a lack of comprehensive studies on supply chain visibility, which is crucial for addressing barriers to transparency and improving the role of information sharing among stakeholders.

Another study was conducted to examine and understand the key drivers that impacted the efficiency, effectiveness, and overall performance of the supply chain specifically in the context of subsidized LPG products (Adibah Mohd Shahrizan, Abdul Kadir, & Ramlee, 2022). The study highlighted that environmental uncertainty played a critical role in influencing decision-making, resource allocation, and overall supply chain effectiveness. It introduced ambiguity in forecasting demand and managing inventory due to factors such as market fluctuations and regulatory changes. Supply chain managers had to strategically allocate resources to mitigate risks and adapt to shifting conditions, fostering resilience through contingency planning and diverse sourcing strategies. Additionally, the study underscored the importance of factors such as information technology utilization, supply chain relationships, and customer satisfaction in driving supply chain performance in the context of subsidized LPG products.

This study identified several research gaps including the need for an in-depth investigation into the regulatory framework governing the LPG sector in Malaysia and its impact on supply chain practices, which directly affects the availability and pricing of LPG for customers and the operational compliance for retailers. The adoption of emerging technologies, such as blockchain, IoT, and data analytics, requires further investigation to optimize supply chain processes, improve efficiency, and provide real-time tracking and transparency that benefits both customers and retailers. Finally, understanding the role of collaborative partnerships and information-sharing practices among supply chain stakeholders is essential to drive performance, create value, and ensure that both customers and retailers experience a reliable and efficient LPG distribution network.

Meanwhile, according to Makhanda and Pwaka (2019), the demand for LPG in rural hospitals was shaped by a confluence of marketing, distribution, financial constraints, and consumer preferences. Effective marketing strategies were crucial for raising awareness of LPG's benefits, such as safety, convenience, and environmental advantages, thus influencing consumer perceptions and driving demand. A robust distribution network ensured the efficient and timely supply of LPG, though infrastructure limitations, including inadequate storage and transportation, hindered this process, highlighting the need for infrastructure investment (Sari, Zuhra, & Erwin, 2023). Financial constraints significantly impacted the affordability and accessibility of LPG in rural healthcare settings, necessitating targeted interventions and pricing strategies to overcome these barriers. Consumer preferences, particularly regarding safety, convenience, and environmental sustainability, also played a pivotal role in the adoption of LPG in healthcare facilities (Makhanda & Pwaka, 2019). The viewpoints of LPG suppliers are crucial for understanding supply chain challenges and

infrastructure requirements, thereby identifying barriers to efficient distribution and opportunities for collaboration.

### **2.3 Customer satisfaction associated with LPG cylinders**

According to Sri Yogi (2015), the relationship between order fulfilment lead time and the number of orders placed by customers is a critical factor in the context of reverse logistics for LPG agencies, significantly affecting both operational efficiency and customer satisfaction. As customers placed a higher number of orders, the increased demand exerted considerable pressure on these systems. The processing of a larger volume of orders often led to congestion, resulting in potential delays in order fulfilment. This congestion was primarily due to the higher workload associated with managing an influx of orders, which strained the available resources and operational capabilities. Consequently, as the number of orders increased, the lead time required to process and fulfil each order also lengthened.

It is crucial to ensure a seamless and dependable reverse logistics operation in order to uphold customer satisfaction. Users expect prompt and effective collection services, as well as open and transparent information regarding the handling and replacement of returned cylinders. To preserve the customer loyalty and trust, LPG agencies must handle the problems of meeting consumer expectations and offering a great user experience.

Additionally, delayed supply of LPG cylinders poses another critical issue for customers. Timely delivery is essential for households that depend on LPG for their daily cooking routines. Delays can disrupt these routines, forcing customers to rely on less efficient and more time-consuming alternative cooking methods. This

inconsistency in supply not only leads to inconvenience but also negatively affects the overall customer experience. Studies indicate that reliable service delivery is a key determinant of customer satisfaction in the service industry, as emphasized by Vinayagamoorthy et al. (2007). When customers encounter delays, their trust in the service provider diminishes, which can result in a loss of loyalty and a search for more reliable alternatives.

Timely order fulfilment was crucial for customer satisfaction in the LPG industry. This required efficient handling of a higher number of orders without compromising lead times, which necessitated careful planning and resource allocation. Agencies coordinated across the reverse logistics network to optimize workflows, ensuring that sufficient manpower and equipment were available to meet demand. Timely order fulfilment contributed to positive customer experiences, fostering trust and loyalty among consumers. As agencies consistently met customer expectations regarding lead times, particularly during peak demand periods, they strengthened their reputation in the market. Future research could benefit from larger sample sizes involving multiple stakeholders for a more comprehensive understanding of reverse logistics performance especially the end users and retailers.

Another study was conducted on customer satisfaction towards LPG in households in Thoothukudi City which presents a comprehensive analysis of the socio-economic factors influencing customer experiences and satisfaction levels (Amutha, 2018). The findings of the study highlights the economic constraints faced by many households and underscores the importance of maintaining affordable pricing structures for LPG cylinders. Sudden and unpredictable price hikes can create economic strain, particularly for low- and middle-income families who rely heavily on LPG for their

cooking and heating needs. The financial burden of these price fluctuations can lead to frustration and dissatisfaction among consumers, as they often lack transparency regarding the pricing mechanisms employed by suppliers and the government.

Research by Ruangwud and Nopalak (2012) highlights that customers are particularly sensitive to price changes, and irregularities in pricing can significantly influence their perceptions and choices regarding energy sources. Future research could explore the impact of government policies on LPG pricing and subsidies on customers behaviour and satisfaction.

Additionally a study revealed that customer satisfaction is a critical predictor of loyalty, with specific service quality dimensions influencing this relationship (Pathrabe, 2016). Meanwhile, the study on the service quality perception of domestic LPG demonstrated that awareness varied significantly by residential area, with urban respondents showing greater awareness than their rural counterparts (Vinayagamoorthy, Sankar, & Sangeetha, 2012). This finding underscores the importance of targeted marketing and communication strategies to enhance brand visibility and customer engagement in less aware demographics. The overall sentiment among customers indicated a pressing need for improvements in service delivery, which is critical for maintaining customer loyalty and satisfaction in a competitive market.

Another study on customer satisfaction and service quality of HP LPG provides a critical examination of the factors influencing consumer perceptions and experiences within the LPG sector (Dhanabhakym & Sumathi, 2014). One of the significant findings of the study is the strong correlation between customer satisfaction regarding delivery times and their willingness to recommend HP LPG to others. This finding

underscores the importance of timely delivery in shaping customer perceptions and loyalty.

In light of these findings, the study proposed several solutions aimed at enhancing customer satisfaction and service quality. Recommendations included improving service delivery by increasing the number of dealers to facilitate quicker delivery of gas cylinders, ensuring consistent service, as well as enhancing customer care through better communication during the booking and delivery processes, establishing effective customer feedback mechanisms, enhancing infrastructure by installing additional gas cylinder godowns, and implementing regular maintenance checks to ensure safety and reliability and investing in employee training and development (Satapathy, Mullick, & Yadav, 2017).

Additionally, addressing customer concerns regarding delivery delays and maintaining price stability were highlighted as essential steps to foster trust and satisfaction among customers. While previous studies have explored service quality in various sectors, there has been limited focus on the domestic LPG sector. This gap is critical, as understanding customer perceptions and expectations in this specific context is essential for developing effective service strategies. Moreover, there is a need for comparative studies that examine the perspectives of both customers and retailers in the LPG industry. Such research could provide a more holistic view of the service quality landscape, revealing discrepancies between customer expectations and retailer capabilities, and ultimately guiding improvements in service delivery.

Understanding the perspectives of both parties can illuminate discrepancies in expectations and satisfaction levels, thereby informing strategies for improving service delivery. For instance, while customers may prioritize timely delivery and product



quality, retailers might focus on operational efficiency and cost management. Future research could also investigate how retailers perceive customer feedback and how this feedback influences their service strategies, thereby creating a more holistic view of the customer-retailer relationship in the LPG delivery context.

#### **2.4 Operational efficiency associated with LPG cylinders**

A study was conducted on the challenges encountered by LPG companies in the industry, highlighting the practical constraints faced by industry professionals (Khadija, 2016). The problem of limited storage capacity is widespread among LPG companies, resulting in operational inefficiencies and difficulty in managing inventories due to a lack of space for cylinders. This constraint might lead to delays in meeting customer demands and higher expenses related to off-site storage alternatives. Another major concern is the safety risks associated with handling and storing LPG cylinders, which are inherently dangerous due to the volatile nature of the gas. It is essential to implement adequate safety measures, adhere to regulatory requirements, and provide comprehensive employee training on safe handling procedures in order to effectively reduce these risks and prevent accidents, injuries, and property damage.

Another study revealed on the optimising transportation costs is a crucial concern due to the high demand for LPG cylinders for household use and the volatility of market prices (Sriyogi, 2013). Efficiently handling the logistics involved in retrieving empty cylinders from customers and delivering them to refill stations at a reasonable cost is crucial for sustaining profitability competitiveness in the market. Multiple factors, such as fuel costs, vehicle maintenance, and the quality of logistics infrastructure, add to the overall expenses of transportation. This highlights the need for efficient management methods to maintain market competitiveness. Furthermore, the LPG

sector is marked by extreme competition, as companies vigorously compete for market dominance and customer loyalty. Competitors often engage price wars, aggressive marketing, and product differentiation strategies in order to obtain a competitive advantage (Khadija, 2016).

One of the inefficiencies identified in the LPG cylinder distribution network was transportation bottlenecks, such as traffic congestion, inefficient routing, or limited transport capacity, which caused delays in the movement of LPG cylinders from distribution centers to customer locations. These bottlenecks resulted in delayed deliveries and impacted customer satisfaction. Meanwhile, inventory bottlenecks, characterized by stockouts or imbalances in inventory levels at distribution points, further exacerbated delays by hindering the timely fulfillment of customer orders. (Pathirana, 2019).

According to Asamoah, Amoakohene and Adiwokor (2012), technical and transportation disruptions are significant contributors to the persistent shortages of LPG in Ghana. These disruptions lead to long queues at gas stations, indicating a systemic inefficiency within the supply chain (Asamoah, Amoakohene, & Adiwokor, 2012). The literature supports this observation, as previous studies have noted that disruptions in supply chains can result in increased lead times, reduced customer service levels, and heightened operational costs (Riddalls et al., 2002).

The study highlights various strategies employed by consumers, such as early ordering and maintaining safety stock, which reflect adaptive behaviors in response to supply chain disruptions. This aligns with existing literature that emphasizes the importance of consumer resilience and adaptability in the face of supply chain challenges.

Order processing delays stemming from manual order processing procedures or communication gaps between suppliers and distributors also led to delays in processing customer orders and initiating delivery. Logistical delays, caused by inefficient logistics planning or suboptimal route optimization, further prolonged the delivery timeline. Improving order processing efficiency, implementing automation in order management systems, and enhancing communication channels were identified as measures that could help mitigate these delays and streamline the delivery process (Pathirana, 2019).

Furthermore, duplicate processes within the distribution network, such as multiple layers of approval for order fulfilment or unnecessary documentation requirements, introduced inefficiencies and prolonged the delivery timeline. Excess handling of LPG cylinders, involving unnecessary transfers between multiple points in the distribution network, increased the risk of errors, damages, and delays in delivery.

Infrastructure played a crucial role in the operations of LPG agencies, significantly influencing responsiveness and customer waiting times in both urban and rural areas (Sriyogi, 2013). In urban settings, better internet connectivity enabled LPG agencies to leverage technology for order processing, inventory management, and real-time tracking of deliveries, enhancing operational efficiency. The well-developed road network in urban areas facilitated smooth transportation of LPG cylinders, reducing transit times and ensuring timely deliveries. In contrast, rural areas faced challenges due to inadequate internet facilities, which hindered the adoption of technology-driven logistics solutions, and underdeveloped road infrastructure that led to longer travel times and increased transportation costs. This disparity in infrastructure significantly impacted operational efficiency and customer service levels, with urban areas

benefiting from advanced connectivity and reliable transport while rural areas struggled with limitations.

Another study was discussed the issues such as reasons for low adoption, including cost and distance to LPG filling stations, and the need for infrastructure expansion to improve LPG access (Asante, et al., 2018). Poor LPG access due to limited distribution infrastructure in rural areas posed significant challenges to the widespread adoption of LPG as a cooking fuel. Rural areas often lacked the necessary infrastructure for LPG distribution, including refilling stations and storage facilities. The absence of infrastructure such as roads, transportation networks, and storage facilities further impeded the efficient distribution of LPG to households, hindering the seamless flow of LPG from suppliers to end-users in remote communities.

Additionally, LPG refilling stations were typically concentrated in urban and peri-urban areas where demand was higher and population density was greater. This uneven distribution of refilling stations created disparities in LPG access between urban and rural areas, with rural populations experiencing limited availability of LPG services.

Furthermore, rural households often had to travel long distances to reach the nearest LPG refilling station, increasing the time, effort, and cost associated with refilling their cylinders. The logistical challenges of transporting empty cylinders for refilling and returning them to households were burdensome for rural residents.

Moreover, a study was conducted to enhance productivity and operational efficiency in the transportation and distribution of filled LPG cylinders by implementing a semi-telescopic conveyor system for loading (Wijeratne, Kumara, & Karunarathna, 2020). The research findings provided comprehensive insights into the health concerns, inefficiencies, manual handling issues, and productivity challenges associated with

traditional loading processes in the transportation and distribution of filled LPG cylinders. Employees engaged in traditional loading work faced numerous health issues due to the physically demanding nature of the job, which led to a range of health complications and created an unsustainable loading system. The repetitive lifting, carrying, and stacking of heavy LPG cylinders put significant physical strain on workers, contributing to musculoskeletal disorders and other health problems, including back pain. The manual handling of heavy cylinders also increased the risk of injuries, particularly back injuries, and the monotonous and repetitive nature of these tasks led to a higher incidence of repetitive stress injuries, affecting both workers' health and productivity. The continuous manual handling of cylinders under traditional loading systems created a hazardous work environment, making workers more susceptible to accidents and injuries.

Traditional loading systems were plagued by inefficiencies that created bottlenecks and disrupted the workflow. Excessive stacking of cylinders in the loading bay led to congestion and slowed down the overall process, delaying loading times and adding extra work for loaders. This inefficiency disrupted the smooth flow of operations, prolonged loading times, and created challenges in managing transportation and distribution processes effectively. These inefficiencies often led to extended operational hours and delays in distribution, increased labour costs, and impacted the ability to meet distribution targets on time. These inefficiencies and low productivity in loading operations often led to delays in meeting distribution targets, affecting the supply chain's overall performance and the ability to deliver LPG cylinders to customers on time.

Addressing these challenges through the implementation of innovative solutions like semi-telescopic conveyors significantly enhanced worker safety, improved operational efficiency, and increased productivity in the transportation and distribution of filled LPG cylinders. Semi-telescopic conveyors automated the loading process, reducing physical strain on workers and minimizing the risk of injuries, streamlining operations, and ensuring a smoother workflow. However, a notable research gap exists in the study's scope, as it does not explore the inefficiencies and health concerns experienced by retailers in the LPG supply chain.



## CHAPTER 3

### METHODOLOGY

#### 3.0 Introduction

This chapter outlines the methodology that employed in this study. The methodology includes the research design, sampling methods, interview protocol, data collection procedures, and concludes with a discussion on the strategies used for data analysis.

#### 3.1 Research framework

The research framework was designed to explore the key challenges in LPG cylinders returns, supply and distribution from the perspectives of household end users and retailers.

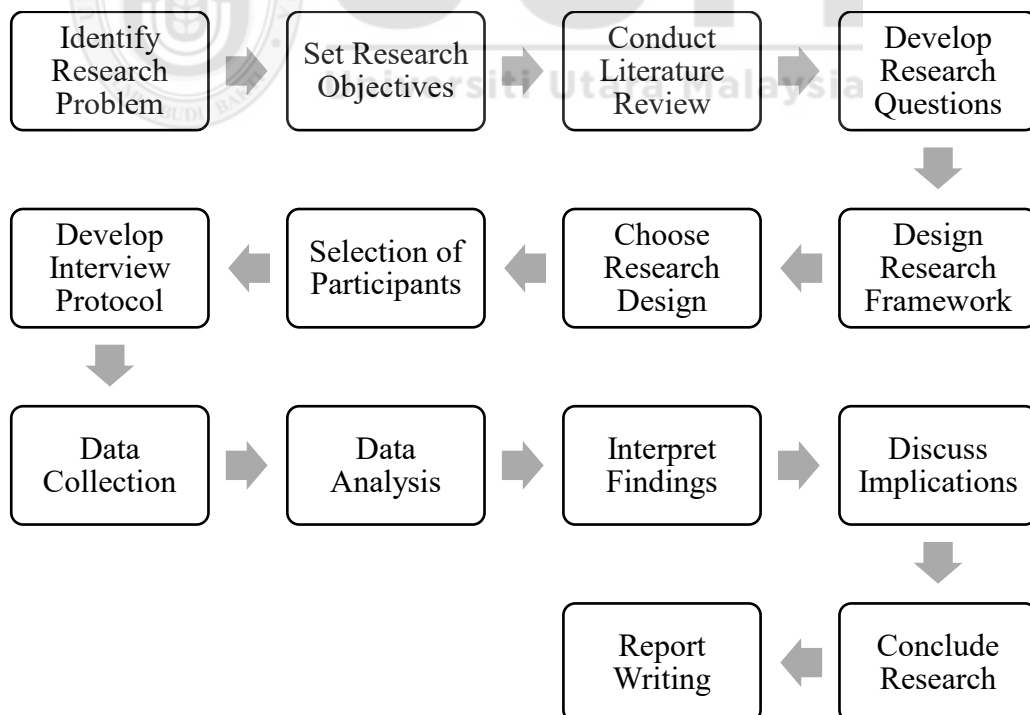


Figure 3.1  
*Flowchart of research process*

### **3.2 Research design**

This study adopted a qualitative research design, which, as supported by previous scholars, enables an in-depth examination of issues without imposing preconceived ideas on the research environment (Patton, 2002). Qualitative research involves uncovering participants' range of behaviours and perceptions regarding specific issues (QRCA, 2017). It employs various methods to understand participants' views on the research objective (Silverman, 2013). Meanwhile, qualitative research focuses on the diverse ways people perceive reality (Hancock, Ockeleford, & Windridge, 2009). In this study, qualitative research was selected to explore the key challenges in LPG cylinder returns from the perspectives of household end users and retailers. This approach utilizes qualitative data, such as interviews, documents, and participant observation, to understand and explain social phenomena (Patton, 2002).

To comprehensively understand the challenges in LPG cylinders returns, supply and distribution from the perspectives of household end users and retailers, guided semi-structured interviews were used as the primary data collection method. Semi-structured interviews involve the researcher using an interview guide consisting of a list of questions or topics they aim to address, while allowing flexibility in how and when questions are posed and how respondents can answer (Rosalind & Holland, 2013). The potential limitations of this design will include the difficulty in generalizing findings to a larger population due to the non-quantitative nature of the data.

Another author highlighted semi-structured interviews allow participants to express their feelings in more detail, offer interpretations that researchers might not have anticipated, and provide a richer and deeper data set than typical questionnaire surveys (Bachiochi & Weiner, 2002). Semi-structured interviews have several strengths as a



data collection method which they can reveal participants' perspectives, help in describing complex interactions, and facilitate a comprehensive understanding of the research problem without imposing pre-existing notions (Fontana & Frey, 2005). In this study, semi-structured interviews were used to explore the key challenges in LPG cylinders returns, supply and distribution from the perspectives of household end users and retailers.

### **3.3 Selection and sampling**

#### **3.3.1 Population**

The population selected for this qualitative study comprised household end users and retailers directly engaged in the LPG cylinders supply chain within Seremban District, Negeri Sembilan, Malaysia. Seremban District was chosen due to its unique blend of urban and suburban characteristics, which mirror the broader national dynamics in Malaysia. This district's diverse socioeconomic environment provides a rich context for examining the LPG supply chain, allowing the study to capture a wide range of challenges encountered by different stakeholders, including household end users and retailers. By focusing on this area, this study aims to produce findings that are not only contextually significant but also closely aligned with the broader research objectives.

Moreover, Seremban District serves as a representative microcosm of Malaysia's LPG market. With a population of approximately 705,200 as of 2023, the district offers a diverse pool of participants from various socioeconomic backgrounds, making it an ideal setting for qualitative research. This diversity is vital for capturing the nuanced practices and challenges related to LPG cylinder returns, supply, and distribution,

ensuring that the insights gained are applicable to similar urban and suburban contexts across Malaysia.

The LPG market in Seremban, involves multiple stakeholders, such as household end users, small-scale retailers, and larger distributors. These retailers play a crucial role in the distribution chain, particularly in ensuring the availability and accessibility of LPG cylinders to end users across various socioeconomic backgrounds. Given the district's size and economic activity, it is likely that a substantial number of small and medium-sized enterprises (SMEs) operate as LPG retailers, particularly in urbanized areas like Seremban town and its suburbs.

The practical considerations of accessibility also played a crucial role in selecting Seremban District. The proximity of participants within this district facilitated more efficient data collection and allowed for repeated interactions, a key aspect of qualitative research. This accessibility enabled the researcher to establish strong rapport with participants, which is essential for conducting in-depth interviews and exploring the intricacies of the LPG supply chain.

### **3.3.2 Sample**

Sampling involves selecting specific data sources to collect information that addresses the research objectives (Gentles, Charles, Ploeg, & McKibbin, 2015). In this study, the convenience sampling method was employed to select participants from the LPG cylinder supply chain within the Seremban District due to its practicality and suitability for the study's qualitative nature. Given the broad scope of the population associated with reaching a large number of participants, convenience sampling was determined to be the most effective method. This approach allowed the researchers to focus on a

manageable sample by engaging with participants who were readily available and willing to share their experiences and perspectives. The selection of participants was guided by their direct involvement in the LPG supply chain, ensuring they could provide valuable insights into issues such as LPG cylinder returns, supply, and distribution processes.

The convenience sampling method was particularly suitable given the time and resource constraints faced by the researchers. This approach emphasized the depth and quality of the data collected, which is a hallmark of qualitative research, rather than striving for statistical representativeness. While this method may limit the generalizability of the findings to the broader population of LPG consumers and retailers, it enabled the researchers to gather rich, detailed data that directly informed the study's findings (Golzar, Tajik, & Noor). The flexibility offered by convenience sampling was essential for exploring the LPG cylinder retail market in depth, yielding insights that are invaluable for understanding the specific challenges of those involved in the LPG supply chain within the Seremban District.

In this study, 14 participants were chosen from household end users and retailers engaged in the LPG cylinders supply chain. Participants were chosen based on their availability and willingness to participate in the study. The selection was also guided by their direct involvement in the LPG supply chain, ensuring that they had relevant experiences to share. This method facilitated the inclusion of participants who could provide valuable insights into issues such as LPG cylinder returns, supply, and distribution processes. These individuals were selected to offer insights into the primary challenges associated with LPG cylinder returns, supply and distribution.

Appropriate sample size for qualitative research is one that sufficiently answers the research questions. (Martin, , 1996).

Household end users comprised individuals or families residing in the Seremban District who relied on LPG cylinders for domestic purposes, particularly cooking. This selection ensured that perspectives were gathered from those directly impacted by the utilization and management of LPG cylinders within their households. The criteria included having direct challenges in returning and buying LPG cylinders and representing diverse demographic backgrounds, socioeconomic statuses, and geographical locations within the Seremban District. Efforts were made to include participants from both urban and suburban areas to capture a comprehensive range of challenges related to LPG cylinder returns, supply and distribution.

Meanwhile, the retailers included were businesses, shops, or vendors operating within the Seremban District. These entities were responsible for selling LPG cylinders to end users and managing the supply, distribution and returns processes for refilling. By incorporating retailers into the study, the research aimed to capture insights from key stakeholders actively involved in the distribution and management of LPG cylinders within the local community. Retailers were required to be actively involved in the distribution and management of LPG cylinders within the Seremban District.

### **3.4 Development of interview protocol**

The interview questions were developed based on the research objectives and existing literature on LPG cylinder returns, supply and distribution. The questions focused on understanding the key challenges of household end users and retailers involved in the LPG supply chain. Specifically, the interviews explored participants' perceptions of

the LPG cylinder returns, supply and distribution processes. The interview materials were prepared in English and Malay, as some participants had difficulties conversing in English. The detailed interview protocol developed for this study is presented in Appendix A.

### **3.5 Data collection method**

In this study, the data collection method involved conducting semi-structured interviews using a phenomenological approach to explore the challenges in LPG cylinder returns, supply and distribution from the perspectives of household end users and retailers. This method facilitated an in-depth understanding of participants' challenges related to the LPG cylinder return, supply and distribution processes within Seremban District, Negeri Sembilan, Malaysia. The interview process commenced on June 1, 2024, and concluded on June 30, 2024. All interview sessions were conducted outside of the organization in a very informal manner. Prior to beginning the interviews, each participant was briefed about the study and the procedures involved.

Semi-structured interviews were conducted to provide individual participants with a platform to share their insights and perspectives in a flexible and open-ended manner. This approach allowed for the exploration of specific themes and issues pertinent to the research objectives while offering the flexibility to probe further into interesting or unexpected topics that arose during the conversation.

The interviews were scheduled to last between 30 to 45 minutes and were conducted at locations convenient for the participants. This extended duration was planned to provide ample time for participants to share their challenges and insights in detail, ensuring that all relevant aspects of their challenges were thoroughly explored. The

longer timeframe allowed the interviewer to delve deeply into each participant's perspectives, capturing comprehensive and nuanced data.

The interviews were digitally recorded to ensure the accurate preservation of participants' responses and non-verbal cues. Digital recording enabled the researcher to capture the full detail of the conversations, including tone, pauses, and emphasis, which were critical for qualitative analysis. By recording the interviews, it ensured that no important information was lost and that the data could be reviewed multiple times if necessary.

Following the interviews, the recorded data were transcribed verbatim. This process involved converting spoken words into written text for further analysis and interpretation. Verbatim transcription ensured that all nuances and details of the conversations were captured, preserving the authenticity and richness of the participants' responses. The transcription process enabled to systematically analyse the data, identifying key themes and patterns that emerged from the interviews. By capturing the exact words of the participants, the researcher was able to conduct a thorough and detailed examination of the data, ensuring that the findings accurately reflected the participants' challenges and insights.

### **3.5.1 Primary Data**

Primary data were collected through semi-structured interviews with household end users and retailers. The interviews allowed for an in-depth exploration of the participants' challenges related to the LPG cylinders supply chain and return processes.

### **3.5.2 Secondary Data**

Secondary data were gathered from existing literature, industry reports, and regulatory documents related to the LPG cylinders supply chain and return processes. This data provided context and support for the primary data findings.

### **3.6 Data analysis techniques**

All responses obtained from the interviews were transcribed and examined closely. Each response was coded through open coding, which enabled categories and themes to develop organically without focusing selectively on specific points of interest (Coffey & Atkinson, 1996). As the coding process advanced, new categories were identified and incorporated into the coding guide, following the same method.

Transcript analysis was a pivotal component of the data analysis process. The recorded interviews underwent verbatim transcription, ensuring that every nuance and detail of the participants' responses were accurately captured and made available for rigorous analysis. Subsequently, thematic coding was employed to meticulously review the transcripts and identify salient themes, concepts, and patterns that emerged from the participants' narratives. Each segment of the text reflecting similar ideas or concepts was assigned a code, facilitating the organization and grouping of related segments under thematic categories.

The theme development process involved a systematic and iterative approach to identifying and refining themes that encapsulated the essence of participants' perspectives on the challenges surrounding the LPG cylinders supply chain and returns processes. Through close examination of the coded segments, meaningful patterns and

connections were discerned, contributing to a comprehensive understanding of the underlying dynamics.

The data was entered into ATLAS.ti software version 9.1.3 for coding and theme allocation. Directed thematic analysis was utilized in the study to identify recurring themes by categorizing the codes. Additionally, the analysis remained open to the emergence of new themes that surfaced during the data analysis process. These emergent themes held the potential to offer fresh insights into previously unexplored aspects of the challenges encountered by household end users and retailers in navigating the LPG cylinder returns, supply and distribution practices.

### **3.7 Research instruments**

In this study, the strategies employed to ensure the validity and reliability of the research instrument are well-aligned with qualitative research best practices. First, the thorough literature review conducted was essential for establishing a solid theoretical foundation. By situating the research within the context of existing knowledge, the researchers developed interview questions that were not only relevant but also informed by previous findings in the LPG supply chain and retail market. This grounding in established research allowed them to identify gaps in the literature and build on insights from prior studies, thereby enhancing the rigor of their inquiry. This approach is critical in qualitative research, as it ensures that the study addresses pertinent issues and contributes meaningfully to the field.

Additionally, the use of a standardized interview protocol was a key strategy, ensuring that all participants were asked the same core set of questions. This uniformity in data collection facilitated reliable comparisons across responses, allowing the researchers



to draw consistent conclusions about the challenges faced by household end users and retailers in the LPG market. By maintaining a structured approach, the researchers minimized variability in how questions were posed, which is crucial for enhancing the reliability of qualitative data.

Furthermore, the incorporation of triangulation through the use of secondary data on LPG distribution significantly bolstered the study's findings. By validating interview data with external sources, the researchers were able to corroborate their insights and ensure that the data collected was consistent and robust. This method not only enhanced the credibility of the findings but also provided a more comprehensive understanding of the LPG supply chain dynamics, allowing for cross-verification of information from multiple sources. Collectively, these strategies contributed to the study's overall credibility and trustworthiness, ensuring that the findings accurately reflected the participants' experiences and challenges regarding the LPG cylinders retail market.

### **3.8 Conclusion**

This chapter detailed the research method and strategy employed in the study. It covered the research sampling, the development of the interview protocol, and the interview process. Additionally, this chapter provided a brief overview of the strategy used for transcribing the interviews. The responses given by the participants during the interviews will be presented and discussed in the next chapter, Chapter 4.

## **CHAPTER 4**

### **RESULTS AND DISCUSSIONS**

#### **4.0 Introduction**

This chapter presents the findings from the interviews conducted with participants who answered the research questions for this study. Before delving into the findings, a description of the participants' backgrounds is provided to introduce those who shared their challenges for this research. The interview data were gathered, transcribed, sorted, and summarized into a presentable format before being coded and reported.

#### **4.1 Background of participants**

Detailed of the participants' profiles are presented in Table 4.1. It is noted that the majority of the household end users (85.7%) are from urban areas. In terms of the participants' occupation, all household end users have provided detailed insights into their challenges with LPG cylinders returns, supply and distribution. Among the household end users, 14.3% reside in suburban areas.

For the retailer participants, 42.9% offer home delivery services for LPG cylinders, while the remaining 57.1% do not provide such services. All participants in this study are involved in the LPG cylinders retail market. The demographic breakdown is detailed in the table below:

Table 4.1

*Demographics of participants (n=14)*

| <b>The participants</b>                  | <b>Total</b> | <b>Percentage (%)</b> |
|------------------------------------------|--------------|-----------------------|
| <b>Household end user</b>                |              |                       |
| Urban resident (A1, A2, A3, A4, A5, A6,) | 6            | 85.7                  |
| Suburban resident (A7)                   | 1            | 14.3                  |
| <b>Total</b>                             | <b>7</b>     | <b>100</b>            |
| <b>Retailer</b>                          |              |                       |
| Home delivery service (B1, B2,B3)        | 3            | 42.9                  |
| No home delivery service (B4,B5, B6,B7)  | 4            | 57.1                  |
| <b>Total</b>                             | <b>7</b>     | <b>100</b>            |

## 4.2 Challenges associated with LPG cylinders supply chain

Based on the research objectives, the interview data in this study were thoroughly analysed. Through interview sessions with 14 selected participants, the identified various challenges through their personal experiences. The interviews specifically examined challenges related to LPG cylinders returns, supply and distribution from the perspectives of both household end users and retailers. The study uncovered the following themes such as supply chain management, customer service and satisfaction, inventory management operational efficiency and distribution challenges.

## 4.3 Supply chain management

### 4.3.1 Difficulty in obtaining LPG cylinders

Six out of fourteen participants expressed a preference for home delivery service of LPG cylinders. They frequently mentioned difficulties in obtaining LPG cylinders due to limited delivery schedules, especially during night time. Several participants shared their challenges:

*"...Most of the home delivery cooking gas services operate only until 6 PM or 7 PM. This makes it challenging for us to get a new supply of cooking gas*

*cylinder if we run out at night. We have to either purchase gas from a nearby retail store or wait until the next day..." [A5]*

*"...There is only one home delivery gas service in my residential area that I am aware of. Once, I ran out of gas and called them for an urgent delivery. However, there was an additional charge for night time delivery..." [A4]*

*"...In the past, I often called a retail store in my residential area to buy the cooking gas cylinder. However, recently, they stopped providing home delivery services for cooking gas cylinder. I am not sure why. Since then, I only purchase cooking gas cylinder from the cooking gas truck that passes through my neighbourhood during weekend..." [A2]*

*"...I live in a suburban area in Seremban district. The cooking gas truck rarely comes to my village, usually only every 3 to 4 days to sell cooking gas cylinder. The only retail store in my village also closes quite early. Previously, the retail store had an employee who delivered cooking gas cylinder to homes, but after the COVID-19 pandemic, that employee left. Fortunately, I have an extra cooking gas cylinder, so I do not run out of cooking gas. However, I must buy a new one quickly to avoid running out if both cooking gas cylinders are empty..." [A7]*

*"... Previously, there were two retail stores near my house that sold cooking gas cylinders. However, they have discontinued their services. One of the retailer stopped because they have aged and are no longer able to continue selling cooking gas cylinders. The other retailer ceased operations after their store was broken into and all their cooking gas cylinders were stolen. As a result, I now prefer to use home delivery services..." [A5]*

The findings indicated that the limited availability of home delivery services, particularly during the evening, presents significant challenges for participants. This restriction becomes especially problematic for those who run out of LPG cylinders at night and have no immediate means of replenishment. The unpredictable nature of LPG cylinder depletion, often occurring at night when delivery services are generally unavailable, can leave household end users without a ready alternative for cooking (Satapathy, Mullick, & Yadav, 2017).

Participants have to pay extra for night time delivery service or wait until the next day when their LPG cooking gas runs out at night. The increased costs associated with emergency night time delivery services for LPG cylinders can significantly burden household end users, particularly those on tight budgets, leading to financial strain and difficult choices regarding essential expenses. Many household end users perceive the additional charges as unfair, resulting in dissatisfaction and potential loss of loyalty to service providers.

The discontinuation of home delivery services by some local retail stores exacerbates the issue, forcing participants to depend on LPG cylinders trucks that pass through their residential areas during the day. This reliance can also be particularly problematic in suburban areas where LPG cylinders trucks visit infrequently, exacerbating the issue of timely access to LPG cylinders. This infrequency can lead to situations where household end users are left without LPG cylinders for extended periods, highlighting the need for more reliable delivery options.

The overall situation underscores the inconvenience and lack of flexibility in the current LPG cylinders delivery system. Household end users require more adaptable

delivery options that can accommodate their schedules and needs, particularly in emergencies when they run out of gas unexpectedly.

In contrast, a one-on-one interview session with another participant revealed different outcomes:

*"...I am more prefer to buy cooking gas cylinder myself from the local retail store. In my residential area, there are several stores that sell cooking gas cylinders until 11 PM. As a small business owner, this method is more convenient for me. Besides, I do not like paying extra for delivery charges when I can easily buy cooking gas cylinder myself from the store..." [A3]*

The participant expressed a clear preference for purchasing LPG cylinders directly from local retail stores, driven by a desire for immediate access to the product without the wait associated with delivery services. This preference is further supported by the convenience of local retail stores that remain open until late at night which is 11 PM, allowing household end users with irregular hours to plan their purchases around their schedules. Additionally, the participant's reluctance to pay extra delivery charges underscores a significant cost consideration for many household end users. For cost-sensitive individuals, the added expense of delivery can be a deterrent, especially when they perceive that they can obtain the same product without incurring additional fees. This scenario highlights the importance of pricing strategies in the LPG cylinders market and how they can influence household end users choices (Mahendran & Sumathi, 2015).

#### 4.3.2 Accepting different brands of LPG cylinders

As highlighted by several participants, there are significant challenges associated with returning LPG cylinders of different brands and sizes. They shared their challenges, emphasizing the difficulties they faced in this regard:

*"...I once used yellow cooking gas cylinder at home, which I buy from the cooking gas truck that passes through my neighbourhood. One day, I had to buy from one of the retail stores in my residential area, but the store only accepted green cooking gas cylinders of a specific brand. I did not know I could only exchange my cylinder for the same brand, and it caused a lot of inconvenience. Thus, I had to find another retail store that would accept my yellow cooking gas cylinder..." [A4]*

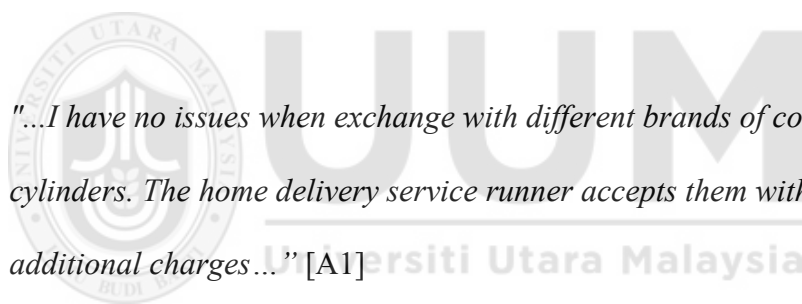
*"...I'm not sure when I ended up with a smaller 12kg cooking gas cylinder instead of the usual 14kg. Perhaps I did not notice it when I bought it. So, I can only get a 12kg cooking gas refilled cylinder when the distributor has it in stock. They will call me and inform me if they have it, and on the next gas truck trip, they will bring and sell it to me..." [A2]*

These statements highlight significant challenges associated with the exchange and compatibility of LPG cylinders among brand-specific exchanges and size-specific refills. Participants frequently faced inconvenience due to the lack of standardization, where retail stores would only accept specific brands or sizes of LPG cylinders. It complicates the return process and prevents household end users from easily exchanging cylinders at various retail outlets. This incompatibility forces participants

to search for alternative retailers willing to accept their existing cylinders, resulting in additional effort and frustration.

The issue of LPG cylinders size further complicates the supply chain, as participants must rely on distributors' stock availability for specific sizes. This dependency often leads to delays and uncertainty in obtaining refilled LPG cylinders, particularly when dealing with less common sizes. Additionally, the complexity of the LPG supply chain, especially regarding the availability of different LPG cylinder sizes, can lead to delays as participants rely on distributors for stock information.

Meanwhile, one participant mentioned that she do not have difficulties returning different brands of LPG cylinders.



*"...I have no issues when exchange with different brands of cooking gas cylinders. The home delivery service runner accepts them without any additional charges..." [A1]*

The participant's positive experience indicates that some LPG cylinders retailers offer more flexible and accommodating return policies, which can greatly enhance customer satisfaction and loyalty by minimizing the inconvenience of brand-specific exchanges. Notably, the participant mentioned that certain retailers accept different brands of LPG cylinders without imposing additional charges. This flexibility likely arises from a customer-centric approach focused on improving convenience and overall satisfaction. By implementing more flexible return policies and standardizing cylinder designs, LPG cylinders retailers can enhance their reverse logistics performance, leading to better service delivery and increased customer loyalty.



While some retailers were flexible in accepting various brands and types of LPG cylinders, this was not a universal practice among all participants. This variation in acceptance policies highlighted inconsistencies in the LPG cylinders returns process, adding to the challenges faced by household end users.

*"...Our retail store does not accept cooking gas cylinders from different brands because the distributor has warned us against it. Accepting different brands would cause difficulties on the distributor side during the exchange process..."*  
[B4]

*"...Our retail store accepts the exchange of cooking gas cylinders from different brands. Usually, we have no issue accepting yellow and green cylinders. However, we do not accept red cooking gas cylinders because the distributor is located outside of Seremban..."* [B7]

*"...Our retail store accepts the exchange of cooking gas cylinders from different brands, except for composite cooking gas cylinders and regular cooking gas cylinders. We source them from different distributors, and the prices of these two types of gas cylinders are quite different..."* [B6]

Participant's refusal to accept different LPG cylinders brands due to distributor instructions highlights a significant challenge in the reverse logistics system. This rigidity can lead to customer dissatisfaction, as household end users may find it inconvenient to exchange LPG cylinders at different outlets.

Another participant illustrates a more accommodating approach, where the retail store accepts exchanges of LPG cylinders for certain brands but not others, specifically red cylinders due to logistical constraints. This partial acceptance reflects a compromise

between operational limitations and customer service, suggesting that while some flexibility exists, it is still constrained by distributor relationships and geographic considerations.

One participant further emphasizes the complexity of the LPG cylinders supply chain, where different pricing and sourcing from various distributors complicate the acceptance of certain cylinder types. This situation underscores the need for LPG agencies to develop more cohesive and standardized return policies that can accommodate a wider range of cylinder types without compromising operational efficiency.

*"..Until this day, I am still unaware of the significance of the different colours of cooking gas cylinders that indicate different brands. For me, I only need a cooking gas cylinder without worrying about the brand..." [A7]*

The participant's lack of awareness about the different colours representing various brands suggests that many household end users prioritize the availability and functionality of LPG cylinders over brand loyalty. This perspective indicates that household end users may not be as concerned with brand differentiation as retailers assume. In the context of reverse logistics, this indifference can have significant implications. If household end users are less attached to specific brands, retailers may have more flexibility in accepting returns and exchanges across different brands, potentially simplifying the reverse logistics process. Additionally, effective reverse logistics systems should be responsive to household end user needs and preferences. The participant's focus on functionality rather than brand loyalty indicates an opportunity for retailers to streamline their operations by adopting more flexible return

policies that cater to household end user needs. This could involve accepting a wider range of cylinder brands and types, thereby enhancing the overall efficiency of the reverse logistics process.

#### **4.3.3 Challenges in empty LPG cylinder return**

Returning empty LPG cylinders presents several challenges for household end users, as revealed by the participants. Their challenges underscore the difficulties and frustrations associated with the current return process, highlighting a significant gap in the market. The following statements illustrate the various obstacles encountered when attempting to return or sell empty LPG cylinders:

*"...I once wanted to sell my empty cooking gas cylinder because I was moving to a different state. I tried selling them to a retail store in my neighbourhood, but the store did not buy empty cooking gas cylinders. So, I had to find a buyer through Facebook application. Lucky I found the new buyer..." [A5]*

*"...For returning empty cooking gas cylinders, a purchase receipt should be kept when the cooking gas cylinder was originally bought. In the 2000s, cooking gas cylinders were cheap, around RM 50 each. Nowadays, the price has risen to RM 130 each. If a customer wants to sell the cooking gas cylinder back, for example, at RM 80, I would negotiate for a lower price otherwise, I would incur a loss buying the empty cooking gas cylinder. Therefore, having the purchase receipt is crucial to reclaim the deposit of cooking gas cylinder..." [B2]*

*"...our retail store does not accept the return of empty cooking gas cylinders alone from customers because we operate on a one-to-one exchange policy*

*with the distributor which is exchanging empty for full cooking gas cylinders basis..." [B5]*

Participant revealed the difficulty in selling empty LPG cylinders to local retail stores reflects a gap in the market where household end users are left with limited options for disposing of or reclaiming value from their used LPG cylinders. This situation often forces individuals to resort to social media platforms to find buyers, which can be time-consuming and uncertain. Such challenges can lead to frustration and dissatisfaction among household end user, indicating a need for more accessible and efficient channels for the sale or return of empty LPG cylinders.

Another participant mentioned that the requirement for an original purchase receipt to return an empty LPG cylinder adds another layer of complexity to the process. This policy can be particularly burdensome for household end users who may have lost their receipts over time, especially considering the significant price increase of cylinders from RM 50 in the 2000s to RM 130 today. The financial implications of this increase, coupled with the need to negotiate lower prices when selling back the LPG cylinders, can create a perception of unfairness and loss among household end users.

Additionally, the one-to-one exchange policy enforced by distributors, which requires household end users to exchange an empty LPG cylinder for a full one, further complicates the returns process. This policy can be inconvenient for household end users who may not need a full LPG cylinder at the time of return or who may have multiple empty LPG cylinders to manage. Such rigid policies can lead to dissatisfaction and may deter household end users from utilizing the services of certain

distributors or retailers. These challenges highlight the need for a more streamlined and consumer-friendly approach to managing the return of empty LPG cylinders.

#### **4.4 Customer service and satisfaction**

##### **4.4.1 Difficulty in contacting LPG cylinder retailers**

Effective communication is a cornerstone of customer satisfaction in the LPG cylinders retail industry. The issues shared by participants in this study highlight significant challenges in contacting retailers for home delivery services, underscoring the need for more reliable and accessible communication channels. The following participant statements reveal the extent to which these communication difficulties disrupt daily routines and contribute to customer dissatisfaction:

*"...I only have one phone number for the home delivery gas service. So, when the person is busy or on leave, I cannot reach him to order cooking gas cylinder. As a result, I have to ask my family members to buy cooking gas cylinder from the retail store. Although there is always a supply of cooking gas cylinders in our area, when the home delivery gas service is unavailable, it becomes quite difficult because sometimes my family members are working and cannot buy gas from the store immediately..." [A1]*

*"...I used to keep the phone number for the home delivery gas service, but when I needed to buy cooking gas cylinder and tried calling the number, it was no longer in service. At that time, it was quite frustrating..." [A4]*

*"...Sometimes I have to wait until late in the afternoon to get a response from retailers. Since I am not strong enough to handle the cooking gas cylinder myself, I have to wait 3-4 hours for the retailer to deliver a filled cooking gas cylinder to my house. On one occasion, I had to stop cooking because there was no cooking gas supply at home..." [A5]*

The reliance on a single contact number for home delivery services poses significant challenges for household end users. As mentioned by one participant, when the designated contact is busy or unavailable, household end users are left without a reliable means to order their LPG cylinders. It illustrates how these communication difficulties disrupt their daily routines. For instance, the inability to reach a retailer can result in delays in obtaining LPG cylinders, forcing household end users to seek alternative arrangements, such as asking family members to purchase LPG cylinders. This not only adds inconvenience but can also lead to interruptions in cooking and household activities, which is particularly problematic for those who may have physical limitations. Additionally, the delay in response times from retailers further complicates the situation for those unable to handle the cooking gas cylinders themselves, highlighting the need for improved communication and reliability in service provision.

The frustration expressed by participant when they encounter unresponsive or outdated contact information from retailers underscores the importance of maintaining accurate and accessible communication channels. The study emphasizes that customer satisfaction is closely tied to the quality of service provided, and the current system appears to fall short in meeting customer needs. This highlights the necessity for LPG cylinders retailers to establish more robust and reliable communication systems, such

as multiple contact points or a dedicated customer service line, to enhance accessibility and responsiveness.

#### **4.4.2 Poor response during peak time**

As highlighted by several participants, there are significant challenges associated with delayed in LPG cylinders during peak times or festive season. They shared their challenges, emphasizing the difficulties they faced in this regard:

*"...I found the phone number of a gas supplier on Facebook, and the supplier gave me the phone number of his runner who is near my residential area. The delivery service uses a cooking gas lorry, so it takes some time to deliver the cooking gas cylinder to my home. Perhaps he is in another area fulfilling orders that came in before mine..." [A4]*

*"...During festive seasons, it becomes very difficult to obtain home delivery gas services because retailers also take time off to celebrate. Since my residential area is predominantly Malay and the retailers are also Malay, if I run out of gas during the festive season, I have to buy the cooking gas cylinder myself from the retail store..." [A3]*

The statement from participants indicate that delivery delays are a common occurrence, particularly during peak times. The reliance on a limited number of delivery personnel often creates a bottleneck in service delivery. Participants' challenges indicate that when these personnel are occupied with fulfilling prior orders, delays occur, disrupting household routines and causing significant inconvenience.

One participant reveals that cultural practices and seasonal observances play a crucial role in the availability of LPG cylinders services. During festive seasons, when many retailers and delivery personnel take time off to celebrate, the availability of LPG cylinders delivery services diminishes. This cultural synchronization means that multiple household end users may simultaneously require LPG cylinders, leading to increased demand that the current delivery system is ill-equipped to handle. As a result, household end users are often left with no choice but to seek alternative arrangements, such as purchasing LPG cylinders from retail stores, which can be inconvenient and time-consuming.

#### **4.4.3 Pricing discrepancies and customer awareness**

The statements explore several key aspects related to these pricing issues as mentioned by several participants:

*"...I used to pay up to RM 35 per cooking gas cylinder when I bought it from the retail store. At that time, I did not know it was quite expensive compared to the actual price. After that, I bought cooking gas through home delivery service, and the price was only around RM 29..." [A5]*

*"...The controlled price of cooking gas cylinder is only RM 26.60 as set by the government. The retail store in my residential area sells it for up to RM 28 per cylinder. They make extra profit from selling cooking gas cylinders. However, I did not make any report about their selling price. I just stopped buying from them..." [A3]*



One participant's realization of overpaying for LPG cylinders at retail stores highlights a prevalent issue where household end users may not be fully aware of the government-regulated prices. This lack of information can lead to exploitation by retailers who charge more than the controlled price. The mention of the regulated price of RM 26.60 set by the government brings attention to the enforcement of these regulations. The participant's observation that local retailers were selling cylinders for RM 28 suggests a potential violation of price controls, raising important questions about regulatory compliance.

Another participant reveals the findings that discrepancies in pricing can significantly influence household end users behaviour. The participant who stopped purchasing from a retail store due to perceived overpricing demonstrates a shift in customers loyalty based on pricing transparency. This behaviour suggests that household end users are willing to seek alternatives, such as home delivery services, when they perceive better value.

#### **4.4.4 Convenience and willingness to pay**

Participants shared their challenges highlighting how personal circumstances and practical considerations shape their attitudes towards LPG cylinders delivery services and associated costs.

*"...I recently moved to a flat house after getting married. Luckily, there is a grocery store here that offers cooking gas cylinders delivery service to my house. It is very convenient for me. I do not mind the payment, as long as someone is willing to deliver it..." [A6]*

*"...I do not mind the delivery charges imposed by home delivery services runner. For me, if I only have to go to the retail store to buy cooking gas cylinder, it is a waste of fuel, energy, and my time. I am also old..." [A2]*

The participant's experience of moving to a new flat house and discovering a retail store that provides LPG cylinders delivery services illustrates how life changes, such as marriage and relocation, can influence consumer preferences. The willingness to pay for the convenience of having gas delivered directly to their home reflects a broader societal trend where household end users increasingly value time-saving services. This is particularly relevant in urban settings, where busy lifestyles and the demands of modern living make convenience a top priority.

From another participant's perspective further reinforces this notion, as they articulate that the costs associated with delivery are justified when weighed against the time, energy, and fuel expenses incurred by traveling to a retail store. This sentiment is particularly poignant for older household end users, who may face mobility challenges or physical limitations that make trips to the retail store more burdensome.

#### **4.5 Inventory management**

Inventory management is a critical component of any retail operation, particularly in sectors dealing with essential commodities like LPG cylinders. Effective inventory management ensures that retailers can meet customer demand consistently, maintain operational efficiency, and minimize disruptions. The participants in this study highlighted these challenges, providing insight into the difficulties faced by retailers and household end users alike.

*“... According to the license permitted by the ministry, each retail store is only allowed to store up to 10 cooking gas cylinders at any given time. The challenge becomes apparent during weekends or festive seasons when distributors do not come to collect empty cooking gas cylinders and replace them with filled ones because they are on holiday. As a result, we sometimes face shortages of cooking gas cylinders supplies...” [B5]*

*“... The sale of cooking gas cylinders normally follows a trend, with increased sales at the beginning of the month. Regular customers often come to the retail store and complain when the cooking gas cylinders is out of stock. Typically, we will contact the distributor directly when our store runs out of stock. However, this trend tends to decrease during school holidays and mid-month...” [B6]*

*“... I am a retailer who provides home service gas delivery. I do not have a store; all my cooking gas cylinders stock is kept on my truck. Currently, I can sell about 20-30 cylinders a day. But the challenge is that I cannot stock up more than 30 cylinders a day due to limited storage space on my truck...” [B2]*

*“...We only have one cooking gas cylinder, and when it runs out, we are re left without cooking gas cylinders until we can get a refill...”[A4]*

The participants mentioned that licensing regulations limit the storage of LPG cylinders to just ten cylinders at a time highlights a significant constraint in inventory management. This limitation becomes especially problematic during peak demand periods, such as weekends and festive seasons, when distributors may not be available to replenish stocks. The resulting shortages can lead to customer dissatisfaction, as

regular customers may find themselves unable to purchase LPG cylinders when they need it most.

Meanwhile, another participant reveals about the sales trend, with increased demand at the beginning of the month, further emphasizes the need for effective inventory management strategies. Retailers must anticipate these demand fluctuations and ensure that they have adequate stock to meet customer needs. The reliance on direct communication with distributors when stock runs low indicates a reactive rather than proactive approach to inventory management, which can exacerbate shortages and lead to customer complaints.

The participant operating a home delivery service illustrates another dimension of inventory management challenges. With limited storage capacity on their delivery truck, they can only stock a maximum of 30 cylinders daily. This restriction not only limits their ability to meet customer demand but also places them at a competitive disadvantage compared to retailers with more substantial storage capabilities.

From the household end user perspective, the participant's mention of relying on a single LPG cylinder underscores the vulnerability of consumers in the event of supply disruptions. When a household's LPG cylinder runs out, they are left without a cooking gas supply until they can obtain a refill, which can be particularly challenging during periods of high demand or distributor unavailability.

The contrasting challenges shared by the participant regarding proactive measures taken by some distributors to provide extra LPG cylinders during peak demand periods offers a valuable perspective on inventory management in the LPG supply chain.

*“... However, some distributors provide us with advance or extra cooking gas cylinders to maintain our cooking gas cylinders sales stock when they are on holiday. Usually, during festive seasons, they give us an extra 5 to 10 cylinders to cover our operation...” [B7]*

The participant's observation that distributors supply additional LPG cylinders during festive seasons demonstrates a strategic approach to inventory management. By anticipating higher demand during these periods, distributors can help retailers maintain adequate stock levels, thereby reducing the likelihood of shortages that could lead to customer dissatisfaction. Moreover, this practice of providing extra LPG cylinders can be seen as a collaborative effort between distributors and retailers, which is essential for improving service reliability.

#### **4.6 Operational efficiency**

##### **4.6.1 The unpredictability of delivery timings**

The issue of unpredictable delivery timings for LPG cylinders emerged as a significant concern among participants, highlighting a critical aspect of operational efficiency that directly impacts customer satisfaction. Several participants shared their challenges:

*“...The unpredictability of delivery timings added to the frustration. We never know when the cooking gas cylinder will be delivered; it is always a guessing game...” [A1]*

*“...When I place the order for cooking gas cylinder, the home delivery service runner is always busy. When I finally leave the house for some occasion, the*

*runner calls to deliver the cooking gas cylinder. Although home delivery service is very convenient for me, sometimes it takes a long time. Occasionally, it takes 4 to 5 hours for them to arrive..." [A5]*

The unpredictability of delivery timings not only causes inconvenience but also disrupts the daily routines of household end users. As noted by one participant, the delays can extend to 4 to 5 hours, which can significantly affect their plans and commitments. This inconsistency in service delivery is a major concern, as it contradicts the expectations of household end users who rely on timely deliveries for their cooking needs. The challenges shared by participants indicate a lack of synchronization in the delivery process, where delivery service personnel are often busy or unavailable when household end users are ready to receive their orders.

#### **4.6.2 Increasing demand for home delivery services**

The increasing demand for home delivery services for LPG cooking gas cylinders, as highlighted by participants, reflects a significant trend in consumer behaviour and service expectations in the LPG industry. This situation underscores the growing reliance on home delivery services as a primary means of obtaining LPG cylinders, particularly in a market where convenience is highly valued.

*"...Sometimes, they deliver the cooking gas cylinder to my house within 30 minutes. Sometimes, I receive the cooking gas cylinder the next day because they have other matters. Sometimes, it takes 3 to 4 hours for them to come. I only use my second cooking gas cylinder. But if both are empty, I have to buy from the retail store..." [A1]*

*"...I once had the experience of buying cooking gas on a Sunday. I called the distributor, and he gave me the phone number of the home delivery runner. The runner replied that Sunday is a day off..." [A4]*

Despite the convenience of home delivery services, the reliability of these services is inconsistent. Participants experience a wide range of delivery times, from as quickly as 30 minutes to as long as the next day. This inconsistency often leaves participant with no choice but to rely on their backup LPG cylinders or, in worse cases, purchase from retail stores when both LPG cylinders are empty. The issue is compounded during weekends and holidays, as delivery services personnel may be unavailable. Some participants noted that delivery personnel take days off, which can result in delays and inconvenience, particularly when urgent needs arise.

One participant reveals an outcomes from the retailer's perspective:

*"...Nowadays, I receive a lot of cooking gas cylinders orders. This is because two other home service gas delivery runners have given their customers to me. One of them retired due to old age, and the other one had an accident and broke his shoulder, so he decided to stop selling cooking gas cylinders. Therefore, I have to cover their customers who need cooking gas cylinders..." [B2]*

The participants' challenges indicate a significant increase in demand for home delivery services, particularly due to the retirement and incapacitation of other delivery

personnel. This shift has forced participant to accommodate a larger customer base, as they take on the customers from those who can no longer provide the service.

#### **4.6.3 Lack of delivery vehicles**

The availability and efficiency of delivery vehicles are crucial components in the successful operation of LPG cylinder home delivery services. An outcome from a participant said:

*"...Our customers often ask if we provide home delivery services. For them, it is more convenient. The problem is, my employer does not provide motorcycles for this service. If our employer provided the motorcycles, we could deliver cooking gas to their customers' homes..." [B6]*

The participant notes a growing demand for home delivery among household end users, who prefer this service for its convenience over making trips to retail stores. However, the lack of dedicated delivery vehicles, such as motorcycles, severely limits the ability of service providers to meet this demand effectively.

Moreover, the participant's observation that their employer does not provide motorcycles for delivery services highlights a significant operational gap within the LPG supply chain. This lack of investment in delivery infrastructure not only restricts the retailer's service capabilities but also places them at a competitive disadvantage in a market where convenience is increasingly prioritized by household end users.



#### 4.6.4 Marketing and communication

Effective marketing and communication strategies are essential for the successful distribution of LPG cylinders. Several participants mentioned the outcomes regarding these issues:

*"...Normally, retail stores selling cooking gas cylinders do not provide phone numbers to customers. They just come to the store with an empty gas cylinder and buy a new one. We also do not advertise this service..." [B4]*

*"...Usually, my customers get my phone number through neighbours or acquaintances. Some people share information about my home delivery service through their neighbourhood WhatsApp groups. Sometimes I notice new customers using my home delivery service..." [B2]*

The findings reveal that many retail stores do not actively share their contact information or advertise their services. Household end users typically visit the store in person to exchange empty LPG cylinders for filled ones, as highlighted by one participant who mentioned the lack of phone number dissemination and advertising efforts. This traditional approach limits the potential customer base and fails to leverage modern communication channels.

Conversely, some participants rely on word-of-mouth and community networks to spread information about their services. The participant noted that their household end users often find out about their home delivery service through neighbours or acquaintances, and sometimes through neighbourhood WhatsApp groups. This informal method of communication helps reach new customers, but it is not a comprehensive marketing strategy.

#### 4.7 Distribution challenges

Effective distribution is a crucial aspect of the LPG supply chain, ensuring that cylinders reach household end users in a timely and reliable manner. However, numerous challenges can impede this process, impacting both the operational efficiency of retailers and the satisfaction of household end users. Through participants' challenges, the practical difficulties of delivering LPG cylinders is explored, particularly to high-rise buildings, maintaining cylinder quality, and managing fluctuating customer demand.

*"...I used to offer home delivery for cooking gas cylinders. But now, I have stopped that service. To me, it is quite troublesome. Sometimes, I deliver the cooking gas cylinder to a customer's house, but upon arrival, I find that the cooking gas cylinder is leaking. So, I have to return to my retail store and replace it with a better cylinder..." [B5]*

*"...Sometimes, I receive dirty cooking gas cylinders from the gas distributor. To ensure I do not lose my customers, I clean the cooking gas cylinders by myself and make sure they are clean before distributing them to my customers. I have no choice but to clean the cooking gas cylinders myself because I need to ensure I always have cooking gas cylinders in stock. What is important is that the cooking gas cylinders I receive are not oily, and the bottom is not bent. If they give me such cooking gas cylinders, I will reject them..." [B1]*

*"...I have not delivered to flat houses for over 10 years because I cannot carry heavy cooking gas cylinders up to high-rise houses anymore. I only deliver to landed housing areas upon their orders..." [B3]*

*"...Although I am already 64 years old, I still deliver cooking gas cylinders to flat houses. Some of my customers live on the 4th floor. So far, they have not complained about the delivery and handling charges I have set. Usually, they pay extra because they feel sorry for me. However, for customers ordering from flat house areas, I often tell them that I will only deliver cooking gas cylinder when I am free. This is because it takes time for me to carry the cooking gas cylinder to high floors, considering my age..." [B2]*

*"...Sometimes, I am unable to fulfil all the cooking gas cylinders orders that come in. If customers need it urgently, I will tell them either they have to wait or find another runner..." [B3]*

*"...If I have a lot of orders or I am on leave, sometimes I will subcontract to other home delivery runners. Their willingness to fulfil the cooking gas orders also depends because they also have their own customer base..." [B1]*

Participants face numerous challenges in the distribution of LPG cylinders, affecting both their operational efficiency and customer satisfaction. One significant issue is the physical burden of delivering heavy cooking gas cylinders, particularly to high-rise buildings. One participant have ceased delivering to such locations due to the strenuous nature of the task, while other participant continue despite their age, often receiving extra payment out of customer sympathy. This highlights the need for more practical solutions, such as additional delivery support or alternative methods to alleviate the physical strain on older workers.

Another challenge is ensuring the quality of the cylinders. Participants frequently encounter issues such as leaking or dirty cylinders from distributors. To maintain

customer trust and satisfaction, the participants take the initiative to clean and inspect cylinders themselves, despite this not being a part of their core responsibilities. This extra step, while necessary, adds to their workload and highlights a gap in quality control at the distributor level.

Additionally, unpredictable demand and logistical issues further complicate distribution. Participants often struggle to meet all customer orders promptly, particularly during peak times or when they are on leave. Some resort to subcontracting other delivery runners, though this is not always a reliable solution due to varying availability and the other runners' existing customer commitments.

#### **4.8 Summary of findings**

The findings indicate several critical challenges within the LPG supply chain in Seremban District, including supply chain inefficiencies, customer service gaps, inventory management issues, operational inefficiencies, and distribution challenges. These problems are likely interconnected, with operational inefficiencies and distribution challenges impacting supply chain management and customer satisfaction. Addressing these issues will require a holistic approach that improves communication, enhances logistical operations, and ensures better inventory control to meet rising customer demands.

Table 4.2  
Summary of findings

|                                                   | A1 | A2 | A3 | A4 | A5 | A6 | A7 | B1 | B2 | B3 | B4 | B5 | B6 | B7 |
|---------------------------------------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| <b>Theme 1: Supply chain management</b>           |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 1.Difficulty in obtaining LPG cylinders           |    | /  | /  | /  | /  |    | /  |    |    |    |    |    |    |    |
| 2.Accepting different brands of LPG cylinders     | /  | /  |    | /; |    |    | /  |    |    |    | /  |    | /  | /  |
| 3.Challenges in empty LPG cylinder return         |    |    |    |    | /  |    |    |    | /  |    |    | /  |    |    |
| <b>Theme 2: Customer service and satisfaction</b> |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 1.Difficulty in contacting LPG cylinder retailers | /  |    |    | /  | /  |    |    |    |    |    |    |    |    |    |
| 2.Poor response during peak time                  |    |    | /  | /  |    |    |    |    |    |    |    |    |    |    |
| 3.Pricing discrepancies and customer awareness    |    |    | /  |    | /  |    |    |    |    |    |    |    |    |    |
| 4.Convenience and willingness to pay              |    |    |    |    |    | /  |    |    |    |    |    |    |    |    |
| <b>Theme 3: Inventory management</b>              |    |    |    | /  |    |    |    |    |    |    |    | /  | /  | /  |
| <b>Theme 4: Operational efficiency</b>            |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 1.The unpredictability of delivery timings        | /  |    |    |    | /  |    |    |    |    |    |    |    |    |    |
| 2.Increasing demand for home delivery services    | /  |    |    |    |    |    |    |    | /  |    | /  |    |    |    |
| 3.Lack of delivery vehicles                       |    |    |    |    |    |    |    |    |    |    |    |    | /  |    |
| 4. Marketing and communication                    |    |    |    |    |    |    |    |    | /  |    | /  |    |    |    |
| <b>Theme 5: Distribution challenges</b>           |    |    |    |    |    |    |    | /  | /  | /  |    | /  |    |    |

## **CHAPTER 5**

### **CONCLUSION AND RECOMMENDATION**

#### **5.1 Introduction**

Chapter 5 summarized the findings discussed in Chapter 4. Implication of the study, limitation and direction for future studies are also discussed.

#### **5.2 Summary of research findings**

The primary aim of this qualitative study was to investigate the challenges associated with the returns, supply, and distribution of LPG cylinders from the viewpoints of household end users and retailers. By examining the underlying reasons for these challenges, this study seeks to shed light on the complexities of LPG cylinder supply chain practices. The chapter starts by detailing the demographics and backgrounds of the participants, providing crucial context for the diverse perspectives revealed during the interviews.

Data were collected through semi-structured interviews with 14 selected participants. The findings revealed several factors influencing the effectiveness of LPG cylinder returns, supply, and distribution practices, including delivery schedules, availability, and the policies of retail stores.

The findings reveal substantial difficulties for household end users in acquiring LPG cylinders, especially due to the limited hours of home delivery services which can be inconvenient and stressful. Participants also highlighted the additional expenses associated with emergency night time deliveries, which can place a burden on

household end user budgets. These extra charges are frequently perceived as unjust, resulting in dissatisfaction and a potential decline in loyalty towards retailers. The issue has been exacerbated by local retail stores discontinuing home delivery services, particularly in suburban areas where the delivery frequency is lower. Consequently, many household end users have become dependent on the infrequent visits of LPG cylinder trucks. Conversely, one participant preferred buying LPG cylinders directly from local retail stores, which stay open until 11 PM. This option offers immediate access to LPG cylinders without the wait associated with delivery services, making it more convenient for those with irregular schedules.

These factors create barriers to timely access to LPG cylinders, leading to inconvenience and dissatisfaction among household end users. The discontinuation of home delivery services by local retail stores further complicates the situation, leaving many household end users vulnerable to supply shortages.

Participants in the study expressed significant challenges related to the exchange and compatibility of LPG cylinders from different brands and sizes. Many reported difficulties when attempting to return or exchange LPG cylinders, as retail stores often only accepted specific brands or sizes. Another participant highlighted the complications arising from inadvertently purchasing a smaller 12kg LPG cylinder instead of the standard 14kg, which limited their options for refilling based on the distributor's stock availability. Conversely, one participant shared a positive experience, noting that their home delivery service accepted different brands of LPG cylinders without additional charges. This flexibility in return policies significantly enhanced customer satisfaction and loyalty, demonstrating that accommodating customer needs can lead to a better overall experience.

The challenges associated with the exchange and compatibility of LPG cylinders underscore the need for improved standardization and flexibility within the LPG supply chain. The challenges shared by participants reveal that the current system can lead to significant inconvenience and frustration, particularly when household end users are unable to easily exchange cylinders at various retail outlets due to brand or size restrictions.

While some retailers demonstrated flexibility in accepting various brands and types of LPG cylinders, others adhered strictly to distributor guidelines, which limited their ability to accept different brands. Some retailers were able to accommodate exchanges for certain brands, but restrictions remained based on distributor relationships and geographic considerations. Additionally, the differences in pricing and sourcing from various distributors further complicated the acceptance of certain cylinder types, indicating a fragmented supply chain.

The inconsistencies in LPG cylinder return policies among retailers underscore the need for a more cohesive and standardized approach within the LPG supply chain. The rigidity exhibited by some retailers, driven by distributor instructions, can lead to customer dissatisfaction and inconvenience, as household end users struggle to exchange cylinders at different retail outlets.

The participant's statement highlights a common sentiment among household end users regarding LPG cylinders: a lack of awareness about the significance of different colours representing various brands. This suggests that many household end users prioritize the availability and functionality of LPG cylinders over brand loyalty.

Participants shared frustrations regarding the inability to sell empty cylinders to local retail stores, often forcing them to seek buyers through social media platforms, which



can be time-consuming and uncertain. Additionally, the requirement to present an original purchase receipt for returning an empty LPG cylinder adds complexity to the process, particularly for those who may have lost their receipts over time. Moreover, the one-to-one exchange policy enforced by distributors, which mandates that household end users exchange an empty LPG cylinder for a full one, complicates the return process further. These challenges collectively indicate a pressing need for a more streamlined and consumer-friendly approach to the return and sale of empty LPG cylinders.

Participants noted difficulties in reaching retailers, often having to depend on a single phone number that may be unavailable or unresponsive. This dependence results in disruptions to daily routines, compelling household end users to find alternative means of acquiring LPG cylinders, which can be particularly difficult for those with physical limitations. Participants expressed frustration over long wait times for responses from retailers, which can result in interruptions to cooking and household activities. The lack of reliable communication channels not only inconveniences household end users but also negatively impacts their overall satisfaction with the service. The findings of this study emphasize the urgent need for LPG cylinder retailers to improve their communication systems to enhance customer satisfaction.

Participants shared their challenges of delayed deliveries, often attributed to a limited number of delivery personnel who are unable to meet the increased demand. This bottleneck in service delivery disrupts household routines and causes considerable inconvenience for household end users. Cultural practices and seasonal observances further complicate the situation, as many retailers and delivery personnel take time off to celebrate during festive periods. This results in a diminished availability of delivery

services, leaving customers with no choice but to seek alternative arrangements, such as purchasing LPG cylinders directly from retail stores. The combination of high demand and reduced service availability during these times highlights the inadequacies of the current delivery system.

The findings underscore the need for LPG cylinder retailers to enhance their service delivery capabilities, particularly during peak times and festive seasons. The current reliance on a limited number of delivery personnel is insufficient to meet the increased demand, leading to delays and customer dissatisfaction.

One participant noted that they previously paid RM 35 for a cooking gas cylinder at a retail store, only to discover later that the home delivery service offered it for RM 29. This realization underscores a common problem where consumers may not be fully informed about the actual prices set by the government. Participants also pointed out that the controlled price for LPG cylinders is RM 26.60, yet local retailers were selling them for RM 28, indicating potential violations of price regulations. This exploitation of household end users due to a lack of awareness raises concerns about regulatory compliance and the enforcement of pricing controls.

One participant, who recently moved to a flat after getting married, expressed appreciation for a grocery store that offers home delivery of LPG cylinders, emphasizing the convenience it provides. This reflects a growing trend among consumers who prioritize time-saving services, especially in urban environments where busy lifestyles are common. Another participant highlighted that they do not mind paying delivery charges, as the costs are justified when considering the time, energy, and fuel expenses associated with traveling to a retail store.

Participants in the study highlighted several challenges related to inventory management, particularly the constraints imposed by licensing regulations that limit the storage of LPG cylinders to just ten at a time. Retailers noted a sales trend with increased demand at the beginning of the month, which underscores the need for effective inventory management strategies. Additionally, participants operating home delivery services face unique challenges due to limited storage capacity on their trucks, restricting their ability to meet customer demand. From the household end user's perspective, relying on a single LPG cylinder can leave consumers vulnerable to supply disruptions, particularly during high-demand periods. However, some distributors proactively provide extra cylinders during peak times, demonstrating a strategic approach to inventory management that helps retailers maintain adequate stock levels and improve service reliability.

Participants expressed frustration over the inconsistent delivery timings, which often disrupt their daily routines. Meanwhile, there is a notable trend towards greater reliance on home delivery services for LPG cylinders, driven by household end users preferences for convenience. However, the reliability of these services is inconsistent, with delivery times varying widely. Furthermore, participants highlighted that without proper transportation, service providers struggle to deliver LPG cylinders efficiently, limiting their ability to cater to customer needs.

Many retail stores fail to provide household end users with essential contact information, like phone numbers, which hampers customer engagement and convenience. Participants noted that their services are not actively promoted, missing out on opportunities to enhance visibility and attract more household end users. Without proper advertising, potential household end users remain unaware of the

services available, leading to missed growth opportunities. Some retailers have successfully gained new household end users through informal channels, such as word-of-mouth and community networks. While this approach can be effective in reaching new household end users, it lacks the structure and extensive reach of a formal marketing strategy.

Some participants have stopped delivering to such locations due to the strenuous nature of the task, while others, despite their age, continue to do so, often receiving additional payment from sympathetic household end users. Participants frequently receive leaking or dirty LPG cylinders from distributors, which necessitates additional cleaning and inspection efforts on their part. This extra responsibility not only increases their workload but also indicates a lack of quality control at the distributor level, which can jeopardize customer trust. Besides, participants often face difficulties in fulfilling customer orders, particularly during peak demand periods or when they are unavailable. Some resort to subcontracting delivery to other runners, but this solution is inconsistent due to varying availability and existing commitments of those runners.

### **5.3 Research implications**

#### **5.3.1 Theoretical implications**

##### **i. Contribution to supply chain management literature**

This study makes a significant contribution to the supply chain management literature by delving into the relatively under-researched LPG cylinder supply chain. It addresses the unique challenges faced by both household end users and retailers within this sector, offering a detailed analysis of the operational complexities involved in LPG

cylinders returns, supply and distribution. Such a focused examination provides a nuanced understanding that highlights the necessity for specialized strategies tailored to this niche market. For academics and practitioners, this study serves as a critical resource, emphasizing the need to address specific issues unique to the LPG supply chain and underscoring the importance of contextual research in supply chain management.

The qualitative nature of this research provides a valuable contrast to the traditional quantitative studies that dominate supply chain literature. By focusing on the subjective challenges of household end users and retailers, this study enriches the existing body of knowledge with in-depth insights into human factors affecting supply chain dynamics. These qualitative insights offer a deeper understanding of household end users and retailers behaviours, motivations, and challenges, highlighting the importance of considering human elements in supply chain performance enhancement. This integration of qualitative data underscores the value of mixed-method approaches in supply chain research, fostering a more comprehensive understanding of the field.

## **ii. Emergence of new themes**

The qualitative methodology employed in the study allowed for the emergence of critical themes related to communication and stakeholder engagement. These themes are particularly pertinent in the LPG supply chain, where effective communication between retailers and household end users is essential for improving service delivery and customer satisfaction. The findings suggest that enhancing communication channels and fostering stakeholder engagement can significantly improve operational efficiency and customer experiences. This insight provides a valuable direction for

further research into the dynamics of stakeholder relationships, particularly in industries where customer interaction is pivotal.

It also opens avenues for future research to delve deeper into the interactions and influences between different stakeholders within the supply chain. Understanding these dynamics can lead to the development of strategies that promote collaboration and improve overall supply chain performance. Future studies can explore how different stakeholders, including retailers and household end users, interact and impact each other, providing insights into effective stakeholder management and engagement practices.

### **5.3.2 Practical implications**

Based on the current findings, several recommendations can be made to improve the LPG cylinders returns, supply and distribution businesses.

#### **i. Operational efficiency improvements**

Retailers should invest in technology that allows for real-time tracking of inventory levels. This can help prevent stock outs and overstock situations, ensuring that the right amount of LPG cylinders is available to meet customer demand. Advanced systems can also provide predictive analytics to forecast demand based on historical data, seasonal trends, and market conditions, enabling more accurate inventory planning and reducing waste.

To enhance the return process for empty LPG cylinders and improve customer satisfaction, LPG companies should consider implementing several strategic solutions. First, establishing flexible return policies is crucial. By eliminating the requirement for

household end users to present original purchase receipts, companies can significantly simplify the return process. This change would alleviate frustration for household end users who may have lost their receipts, thereby encouraging more household end users to return their empty LPG cylinders without the fear of being turned away.

A streamlined return process should be established, enabling household end users to return empty LPG cylinders at any authorized retailer or distributor location. This could include setting up dedicated drop-off points or kiosks specifically for LPG cylinder returns, making the process more convenient and accessible. By offering multiple return locations, companies can minimize wait times and improve the overall customer experience.

Additionally, it is essential to provide clear guidelines and communication regarding the return process. LPG companies should ensure that household end users have easy access to information about how to return empty LPG cylinders, what documentation (if any) is required, and the specific locations where returns can be made. This information can be disseminated through various channels, including company websites, mobile applications, and in-store signage, ensuring that customers are well-informed and can navigate the return process with ease.

To enhance the LPG cylinder exchange process and improve customer satisfaction in a brand-specific manner, several strategic solutions can be implemented. Establishing dedicated brand-specific exchange centers in high-traffic areas allows household end users to easily swap their empty LPG cylinders for full ones, providing a seamless and efficient experience. By strategically locating these centers, companies can ensure accessibility and minimize the time and effort required for exchanges, fostering

reliability and convenience. Developing standardized exchange procedures across all brand-specific locations is crucial, as it creates clear and consistent guidelines for the exchange process, including cylinder condition, necessary documentation, and expected time frames. This streamlines the process, reducing customer frustration and enhancing the brand's overall perception. Additionally, implementing brand loyalty programs can significantly boost customer satisfaction and retention by rewarding customers for exchanging LPG cylinders within the same brand. Household end users could earn points for each exchange, redeemable for discounts or other benefits, incentivizing repeat business and enhancing their overall experience. Collectively, these strategies create a more efficient and satisfying LPG cylinder exchange process, leading to increased customer loyalty and satisfaction in the competitive LPG cylinders retail market.

## **ii. Extended delivery services**

Extending delivery services is a strategic approach that can significantly enhance customer satisfaction in the LPG cylinder retail market by accommodating the varied schedules of household end users. By offering delivery options during evenings and weekends, retailers can increase the likelihood of successful deliveries, thereby attracting a broader customer base and improving service accessibility.

To incentivize retailers to adopt these extended delivery hours, distributors can implement a variety of targeted incentives. Financial bonuses for meeting or exceeding delivery targets can motivate retailers to prioritize this service, while discounted rates on bulk orders can make it financially advantageous for them to operate during extended hours. Additionally, providing priority supply ensures that retailers who



commit to longer delivery times are less likely to face stock shortages, enhancing their reliability.

Collectively, these incentives not only encourage retailers to extend their delivery hours but also foster a stronger partnership between retailers and distributors, ultimately leading to a more efficient and responsive LPG supply chain that meets the needs of modern consumers.

### **iii. On-demand delivery options**

Implementing on-demand delivery options in the LPG cylinder retail market has the potential to significantly transform customer experiences and service efficiency. By adopting a model similar to ride-sharing or food delivery apps, LPG companies can enable household end users to place orders for LPG cylinder delivery through a user-friendly mobile application or website, facilitating prompt service within a few hours. This immediate response capability addresses urgent needs, particularly for household end users who may unexpectedly run out of gas, thereby providing a quick and reliable solution that enhances overall satisfaction. The convenience of on-demand services not only meets the growing consumer demand for instant access to essential products but also fosters customer loyalty, as users appreciate the flexibility and responsiveness of the service.

In addition, allowing household end users to schedule their deliveries in advance can further improve convenience. Implementing an online booking system enables household end users to choose their preferred delivery times, ensuring they are available to receive their LPG cylinders. This scheduling capability not only enhances

customer convenience but also helps retailers manage their operations more efficiently by reducing missed deliveries and optimizing resource allocation.

Furthermore, this innovative approach can attract new household end users who prioritize convenience and efficiency, positioning LPG cylinder providers as modern, customer-centric businesses in a competitive market landscape. By leveraging technology to streamline operations and enhance service delivery, companies can create a more dynamic and responsive LPG supply chain that aligns with contemporary consumer expectations.

#### **iv. Real-time tracking**

Incorporating technology for real-time tracking of LPG cylinders deliveries can significantly improve the customer experience by offering greater transparency and reducing uncertainty. With timely notifications about the delivery status and estimated arrival times, household end users can be relieved of the anxiety often associated with waiting for essential services. This transparency allows customers to plan their activities better, ensuring they are available to receive their deliveries without unnecessary interruptions.

Additionally, implementing a responsive customer service system to handle any queries or issues during the delivery process can greatly enhance customer satisfaction. Quick and efficient communication channels, such as chat support or dedicated hotlines, enable customers to seek assistance promptly, fostering a sense of trust and reliability in the service.

By combining real-time tracking with responsive customer support, companies can create a seamless delivery experience that not only meets but exceeds customer

expectations. This approach leads to increased customer loyalty and positive word-of-mouth for the LPG provider.

#### **v. Pricing of LPG cylinder**

To effectively address the challenges associated with pricing in the LPG retail market, a multifaceted approach is essential to enhance transparency, consumer awareness, and overall satisfaction. First, LPG companies should implement transparent pricing structures that clearly outline all costs related to the purchase of LPG cylinders, including base prices, delivery fees, and any additional charges. This information must be easily accessible through various channels such as company websites, mobile applications, and printed materials, ensuring that consumers can readily understand the total cost of their purchases.

Additionally, consumer education campaigns, in collaboration with government agencies, can play a pivotal role in informing the public about their rights, the regulated prices of LPG cylinder, and the procedures for reporting pricing violations. These campaigns can leverage social media, community workshops, and informational brochures to reach a diverse audience. The development of user-friendly mobile apps that provide real-time pricing information and allow consumers to report discrepancies directly can further empower customers in their purchasing decisions.

Moreover, introducing subscription models that offer fixed pricing for regular deliveries can help household end users manage their budgets more effectively, while loyalty programs can incentivize repeat business by rewarding consistent household end users. Establishing robust monitoring and reporting mechanisms is also crucial; creating anonymous hotlines or online platforms for household end users to report

pricing violations without fear of repercussions can enhance accountability within the industry.

Finally, regulatory bodies should conduct regular audits and compliance checks of LPG retailers to ensure adherence to pricing regulations, proactively identifying and addressing discrepancies before they impact consumers. By implementing these comprehensive strategies, the LPG market can foster a more informed customer base, improve trust and loyalty, and promote fair competition, ultimately leading to enhanced customer satisfaction.

**vi. Better communication strategies**

Multiple communication channels, for instance phone, email, social media should be established by the retailers to ensure household end users can easily reach them with inquiries or concerns. This accessibility can enhance customer trust and satisfaction. Providing clear and consistent communication channels helps prevent misunderstandings and ensures that customers feel supported throughout their purchasing experience.

Besides, retailers should provide household end users with clear and timely information about delivery schedules, pricing changes, and return policies can help manage expectations. Retailers can use newsletters, SMS alerts, or mobile apps to keep customers informed. Transparency in communication builds trust and allows customers to make informed decisions, reducing the likelihood of dissatisfaction due to unexpected changes or delays. Retailers should adopt a proactive approach to communication by reaching out to household end users with updates or reminders about their orders. This can include notifications about delivery times, promotions, or

safety tips related to LPG cylinder usage. Proactive communication helps maintain customer engagement and demonstrates a retailer's attentiveness to customer needs, enhancing the overall customer experience.

**vii. Enhance delivery support**

Enhancing delivery support is essential for boosting the efficiency and effectiveness of LPG cylinders distribution, especially in challenging environments like high-rise buildings. Employing younger delivery personnel can help reduce the physical strain on older workers, ensuring that deliveries are made more quickly and safely. Younger individuals often have greater physical stamina and agility, which can improve their ability to navigate stairs and confined spaces that are common in urban areas. Moreover, integrating mechanical aids, such as dollies or trolleys, into the delivery process can further streamline operations by lessening the manual effort needed to transport heavy cylinders. These tools not only lower the risk of injury for workers but also speed up the delivery process, leading to faster turnaround times and higher customer satisfaction. By adopting these strategies, companies can develop a more effective delivery system that meets consumer demands while supporting the well-being of their delivery staff.

**viii. Improve quality control**

Improved quality control is essential for ensuring the safety and reliability of LPG cylinder distribution, and it begins with distributors implementing stringent quality assurance measures. By conducting regular inspections and maintenance of cylinders, distributors can ensure that all units delivered to retailers are clean, functional, and free from leaks, thereby upholding high safety standards and minimizing the risk of accidents. Additionally, providing comprehensive training for retailers on the proper

inspection and handling of LPG cylinders is crucial. This training equips retailers with the knowledge and skills necessary to identify potential issues, such as leaks or damage, before the LPG cylinders reach household end users. By empowering retailers to take an active role in quality control, the overall service quality is enhanced, leading to increased customer trust and satisfaction. Together, these initiatives foster a culture of safety and accountability within the LPG supply chain, ultimately benefiting both consumers and service providers.

#### **ix. Enhancement of customer service**

Firstly, retailers should prioritize comprehensive training programs for their staff that focus on customer service skills, product knowledge, and problem-solving techniques. Effective training can empower employees to handle customer inquiries and complaints more efficiently, leading to improved customer interactions and satisfaction. This investment in staff development not only enhances service quality but also builds customer loyalty and trust.

Secondly, they can implement structured feedback systems, such as surveys or suggestion boxes, can provide valuable insights into customer experiences. Retailers can analyse this feedback to identify common pain points and areas for improvement, allowing them to adapt their services to better meet customer expectations. Regularly seeking and acting on customer feedback demonstrates a commitment to continuous improvement and responsiveness to customer needs, ultimately leading to higher levels of customer satisfaction and loyalty.

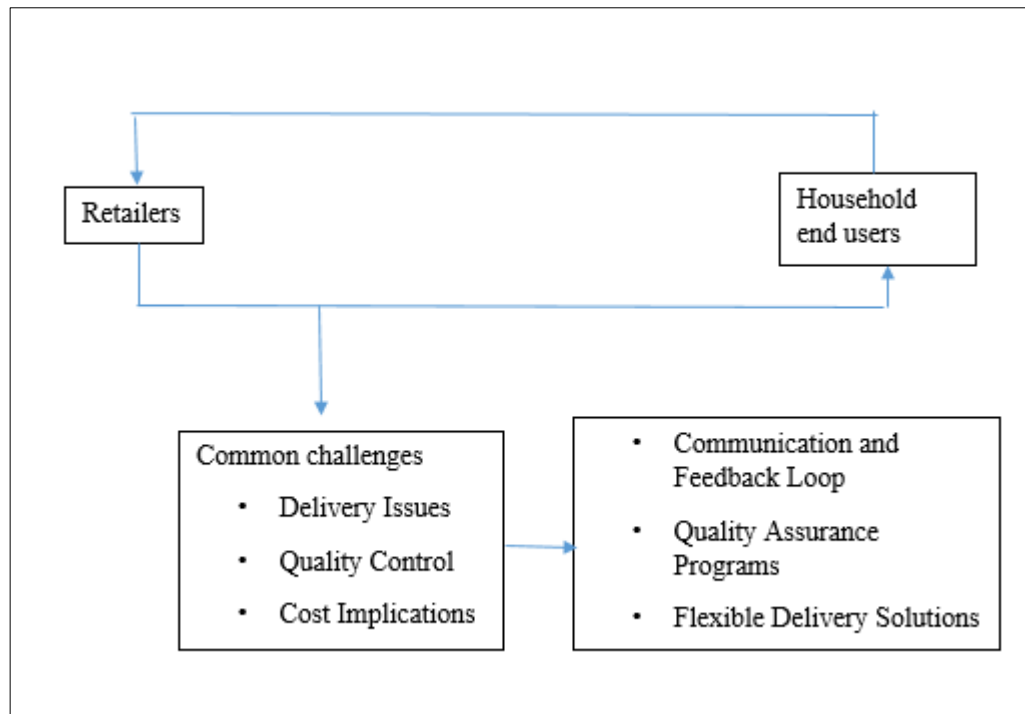


Figure 5.1  
*Proposed framework*

#### 5.4 Limitations of study and direction for future research

This study, like many qualitative research projects, has limitations related to the generalizability of its findings. The sample size was relatively small, focusing on 14 participants from a specific geographic area. Recognizing these limitations sets the stage for future research to expand upon this work. By including a more diverse range of stakeholders from different regions, future studies can yield richer insights and enhance the applicability of the findings across various contexts. This broader approach can help validate the initial findings and provide a more comprehensive understanding of the LPG supply chain dynamics

Moreover, this study primarily captured the perspectives of household end users and retailers. Future research could explore the challenges faced by distributors and policymakers in managing LPG cylinder returns, supply and distribution. This would

provide a more comprehensive understanding of the entire supply chain and identify additional areas for improvement.

Future research could investigate how technological advancements, such as digital platforms for order management, inventory tracking, and customer engagement, impact the LPG supply chain and customer satisfaction. Exploring the role of technology can provide valuable insights into how retailers can leverage innovations to enhance operational efficiency and improve customer experiences. This line of inquiry can contribute to the development of best practices for integrating technology into supply chain operations, fostering greater efficiency and customer satisfaction.

Researchers could also conduct comparative studies across different regions or countries to examine how cultural, economic, and regulatory factors influence customer satisfaction and supply chain dynamics in the LPG cylinders market. Such studies can contribute to a more comprehensive understanding of the global LPG cylinders supply chain, identifying best practices that can be adapted to various contexts. Comparative research can highlight regional differences and commonalities, providing insights into how local factors impact supply chain operations and customer experiences.



## REFERENCES

- Adibah, Kadir, A., & Iskandar, S. (2022). Factors Influencing the Performance of Supply Chain Management in Products Subsidies Liquefied Petroleum Gas (LPG). (S. S. Abdullah, N. R. Zainol, N. Nordin, & N. Nordin, Eds.) *FKP Postgraduate Research Colloquium 2022*. doi:e-ISBN 978-967-25774-3-0
- Alarcón, F., Pellicer, P. C., Perales, D. P., & Recuerda, A. M. (2021). A Reference Model of Reverse Logistics Process for Improving Sustainability in the Supply Chain. *Sustainability*, 13(18), 10383. doi:<https://doi.org/10.3390/su131810383>
- Aldina, C., Lopes, C., & Silva, E. C. (2019). A multi-model methodology for forecasting sales and returns of liquefied petroleum gas cylinders. *Springer-Verlag London Ltd.*, 32(2). doi:10.1007/s00521-020-04713-0
- Ali, A. H., Eid, A., Zalavadia, S., & Barakat, M. R. (2018). The Role Of Sustainability In Reverse Logistics For Returns And Recycling. *Archives of Business Research*, 6(7), 12-33. doi:10.14738/abr.67.4645.
- Alnoor, A., Eneizan, B., Makhamreh, H. Z., & Rahoma, I. A. (2019). The Effect of Reverse Logistics on Sustainable Manufacturing. *International Journal of Academic Research in Accounting, Finance and Management Sciences*, 9(1), 71-79. doi:<http://dx.doi.org/10.6007/IJARAFMS/v9-i1/5768>
- Amutha, D. (2018). Customers Satisfaction Towards LPG in House Hold in Thoothukudi City. doi:<http://dx.doi.org/10.2139/ssrn.3299650>
- Arya, S., & Kumar, S. (2020). E-waste in India at a glance: Current trends, regulations, challenges and management strategies. *Journal of Cleaner Production*, 271. doi:<https://doi.org/10.1016/j.jclepro.2020.122707>

- Asamoah, D., Amoakohene, R., & Adiwokor, E. (2012). Analysis of Liquefied Petroleum Gas (LPG) Shortage in Ghana: A Case of the Ashanti Region. *International Journal of Business Administration*, 3(5). doi:10.5430/ijba.v3n5p89
- Asante, K. P., Asiedu, S. A., Abdulai, M. A., Dalaba, M. A., Carrión, D., & Dickinson, K. L. (2018). Ghana's rural liquefied petroleum gas program scale up: A case study. *Energy for Sustainable Development*, 46, 94-102. doi:https://doi.org/10.1016/j.esd.2018.06.010
- Atnafu, D., & Balda, A. (2018). The impact of inventory management practice on firms' competitiveness and organizational performance: Empirical evidence from micro and small enterprises in Ethiopia. *Cogent Business & Management*, 5(1). doi:https://doi.org/10.1080/23311975.2018.1503219
- Bachiochi, P., & Weiner, S. (2002). *Qualitative data collection and analysis*. London: Blackwell Publishing: Handbook of research methods in industrial and.
- Bag, S., & Gupta, S. (2020). Examining the effect of green human capital availability in adoption of reverse logistics and remanufacturing operations performance. *International Journal of Manpower*, 41(7), 1097-1117. doi:https://doi.org/10.1108/IJM-07-2019-0349
- Bundy, J., Vogel, R., & Zachary, M. (2018). Organization–stakeholder fit: A dynamic theory of cooperation, compromise, and conflict between an organization and its stakeholders. *Strategic Management Journal*, 39(2), 476-501. doi:https://doi.org/10.1002/smj.2736
- Burke, H., Zhang, A., & Wang, J. X. (2023). Integrating product design and supply chain management for a circular economy. *Production Planning & Control*, 34(11), 1097-1113. doi:10.1080/09537287.2021.1983063

- Butler, L., Yigitcanlar, T., & Paz, A. (2021). Barriers and risks of Mobility-as-a-Service (MaaS) adoption in cities: A systematic review of the literature. *109*.
- Cahyaningrum, A., & Simatupang, T. (2013). An agent based model for the subsidized LPG with a closed distribution system. *Business Process Management Journal*, *19* (5). doi:10.1108/BPMJ-10-2012-0108
- Carrasco-Gallego, R., Ponce-Cueto, E., & Rommert, D. (2009). A framework for closed-loop supply chains of reusable articles. *Erasmus University Rotterdam, Econometric Institute, Econometric Institute Report*. Retrieved from <https://repub.eur.nl/pub/16707/EI2009-21.pdf>
- Choong, J. (14 October, 2019). *Poor payment practices, weak enforcement reason behind RM1.71b leakage for cooking gas subsidy*. Retrieved from <https://www.malaymail.com/news/malaysia/2019/10/14/poor-payment-practices-weak-enforcement-reason-behind-rm1.71b-leakage-for-c/1800187>
- Coffey, A., & Atkinson, P. (1996). *Making sense of qualitative data: Complementary research strategies*. Thousand Oak, CA: Sage Publications.
- Dayalamurthy, P. (2024). A Hybrid Approach to Prescribe a Dynamic Operational Location for Stationing a Delivery Truck of LPG Cylinder for Efficient Last Mile Delivery. *14th Annual International Conference on Industrial Engineering and Operations Management Dubai, United Arab Emirates (UAE)*. doi:10.46254/AN14.20240177
- Dhanabhakym, D. M., & Sumathi, T. (2014). A Study on Customers Attitude and Satisfaction towards HP LPG in House Hold, Coimbatore. *The SIJ Transactions on Industrial, Financial & Business Management (IFBM)*, *2* (2).

- Fontana, A., & Frey, J. (2005). *The interview: From neutral stance to political involvement*. In N.K. Denzin & Y.S. Lincoln (Eds.). Thousand Oaks, CA: The Sage handbook of qualitative research 3rd ed.
- Gentles, S., Charles, C., Ploeg, J., & McKibbin, K. (2015). *Sampling in qualitative* (Vol. 20(11)). The Qualitative Report.
- Golzar, J., Tajik, O., & Noor, S. (n.d.). Convenience Sampling. *I*(2), 72-77. doi:10.22034/ijels.2022.162981
- Hancock, B., Ockeleford, E., & Windridge, K. (2009). *An introduction to qualitative research*. The NIHR Research Design Service for the East Midlands.
- Hazen, B. T., Mollenkopf, D. A., & Wang, Y. (2016). Remanufacturing for the Circular Economy: An Examination of Consumer Switching Behavior. *Business Strategy and the Environment*, 26(4). doi:10.1002/bse.1929
- Hosta, M., & Zabkar, V. (2021). Antecedents of Environmentally and Socially Responsible Sustainable Consumer Behavior. *Journal of Business Ethics*, 171, 273–293. doi:https://doi.org/10.1007/s10551-019-04416-0
- Kara, S., Hauschild, M., Sutherland, J., & McAloone, T. (2022). Closed-loop systems to circular economy: A pathway to environmental sustainability? *CIRP Annals*, 71(2), 505-528. doi:https://doi.org/10.1016/j.cirp.2022.05.008
- Kazemi, N., Modak, N. M., & Govindan, K. (2018). A review of reverse logistics and closed loop supply chain management studies published in IJPR: a bibliometric and content analysis. *International Journal of Production Research*, 57 (1). doi:http://dx.doi.org/10.1080/00207543.2018.1471244
- Khadija, G. (2016). Effect of Reverse Logistics on Operational Performance of Liquefied Petroleum Gas Companies in Kenya. Retrieved from <http://hdl.handle.net/11295/99582>

- Kojima, M. (2011). *The role of liquefied petroleum gas in reducing energy poverty*. (E. I. Series, Ed.) World Bank Group's Oil, Gas, and Mining Unit.
- Lambert, S., Riopel, D., & Abdul-Kader, W. (2011). A reverse logistics decisions conceptual framework. *Computers & Industrial Engineering*, 61(3), 561-581. doi:<https://doi.org/10.1016/j.cie.2011.04.012>
- Lee, K. L., Romzi, P. N., Hanaysha, J. R., Alzoubi, H. M., & Alshurideh, M. (2022). Investigating the impact of benefits and challenges of IOT adoption on supply chain performance and organizational performance: An empirical study in Malaysia. *Uncertain Supply Chain Management*, 10(2), 537-550. doi:<http://dx.doi.org/10.5267/j.uscm.2021.11.009>
- Lopes, C., Correia, A., Silva, E. C., Monteiro, M., & Lopes, R. B. (2020). Inventory models with reverse logistics for assets acquisition in a liquefied petroleum gas company. *Journal of Mathematics in Industry*, 10. doi:10.1186/s13362-020-00078-0.
- Mahendran, A., & Sumathi, T. (2015). Problems and Factors of the Single HP LPG Customers in Coimbatore District. *Golden Research Thoughts*, 4(7).
- Makhanda, G., & Pwaka, O. (2019). The Impact of Liquid Petroleum Gas (Lpg) Supply-Chain Challenges on Rural Healthcare Service Delivery In Zimbabwe. *European Journal of Logistics, Purchasing and Supply Chain Management*, 7(2), 1-23. doi:10.1007/978-3-030-13535-5\_21
- Martin, , M. (1996). *Sampling for qualitative research* (Vol. 13(6)). Family Practice: Oxford University Press 1996,.
- McAlister, M. (2024). Sustaining clean cooking: A system dynamics study of Ghana's rural LPG promotion program. *Energy for Sustainable Development*, 81. doi:<https://doi.org/10.1016/j.esd.2024.101497>

- Mehdiabadi, A., & Yazdi, A. (2023). After-sales indicators in the liquefied petroleum gas industry: a hybrid multi-criteria decision-making approach in an uncertain environment. *International Journal of Oil, Gas and Coal Technology*, 32(4), 392-416. doi:<https://doi.org/10.1504/IJOGCT.2023.129582>
- Momtaz, M., & Tasnim, N. (2019). A Review of Liquefied Petroleum Gas (LPG) as an Alternative Fuel Option and Its Market Scenario in Bangladesh. *Conference: International Conference on Petroleum Engineering (ICPE) 2019*.
- Murdapa, P. S., Karningsih, P. D., & Pujawan, I. N. (2022). System Dynamics Modeling of Multi-Channel Supply Chain System: A Hypothetical LPG Distribution with Disloyal Household Customers. *Indonesian Journal of Information Systems*, 5(1), 1–16. doi:<https://doi.org/10.24002/ijis.v5i1.6025>
- Pathirana, M. (2019). Technology enabled reverse logistics as a means of reducing LPG distribution cost : the case of a LPG supplier in Sri Lanka. *Department of Transport and Logistics Management*. Retrieved from <http://dl.lib.mrt.ac.lk/handle/123/15873>
- Pathrabe, V. (2016). Customer Perspective of LPG in Rural India. doi:<http://dx.doi.org/10.2139/ssrn.2858086>
- Patton, M. Q. (2002). *Qualitative Research and Evaluation Methods (3rd ed.)* (Vol. 5(3)). Thousand Oaks, CA: Sage Publication Inc. doi:<https://doi.org/10.1177/10928102005003006>
- Prahasto, T., Jie, F., & Parton, K. (2010). Indonesian LPG Supply Chain Relationships: A Conceptual Framework. In *8th ANZAM: Managing in challenging times*, 1-17.

- QRCA. (2017). *What is qualitative research?* Retrieved from Qualitative Research Consultants Association: <http://www.qrca.org/?page=whatisqualresearch>
- Ramaprabha, E. (2020). A Study on Problems Faced By the Liquefied Petroleum Gas Customers in Thanjavur District. *Journal of Interdisciplinary Cycle Research*, 12(1), 1793.
- Ranjan, R., & Singh, S. (2023). Switching Towards LPG: Indian Household Perspectives. *Journal of Quantitative Economics*, 21, 417-435. doi:<https://doi.org/10.1007/s40953-023-00337-y>
- Rosalind, E., & Holland, J. (2013). *What is Qualitative Interviewing?* doi:10.5040/9781472545244
- Sapnken, F., & Kibong, M. (n.d.). Analysis of household LPG demand elasticity in Cameroon and policy implications. 9(9), 2023. doi:<https://doi.org/10.1016/j.heliyon.2023.e16471>
- Sari, R. M., Zuhra, N., & Erwin. (2023). Determination of optimal distribution route at the LPG gas cylinder distribution using vehicle routing problem. In *AIP Conference Proceedings*, 2741(1). doi:<https://doi.org/10.1063/5.0131043>
- Sarker, M. (2022). Optimization of Maintenance Management Framework in LPG Cylinder Manufacturing. *Department of Mechanical and Production Engineering, Islamic University of Technology, Gazipur, Bangladesh*.
- Satapathy, S., Mullick, S., & Yadav, V. (2017). Customer satisfaction on Indian domestic gas delivery. *International Journal of Services Sciences*, 6(1), 78-93.
- Shahrizan, N. M., Kadir, S. A., & Ramlee, S. (2022). Factors Influencing the Performance of Supply Chain Management in Products Subsidies Liquefied Petroleum Gas (LPG). *FKP Postgraduate Research Colloquium 2022*. Retrieved from <http://hdl.handle.net/123456789/4515>

- Silverman, D. (2013). *Doing Qualitative Research: A Practical Handbook*. Thousand Oaks: Sage Publications Ltd.
- Sri Yogi, K. (2015). Performance evaluation of reverse logistics: A case of LPG agency. *Cogent Business and Management*, 2(1), 1-17. doi:<https://doi.org/10.1080/23311975.2015.1063229>
- Sriyogi, K. (2013). Reverse Logistics: A Comparative Study of LPG Agency's in Urban and Rural Area. *The IUP Journal of Supply Chain Management*, 9(2), 33-51. doi:10.1080/23311975.2015.1063229
- Susmitha, P., Arun, P., & Sharma, M. (2021). A Study on Safety and Operational Procedures for Filling of Cylinders in an LPG Bottling Plant as Per OISD-144. *Advances in Sustainable Development*, 29–39.
- Syahrudin, A., & Gaffar, A. (2023). Comparison of LPG Bottle Distribution Cost using North West Corner and Least Cost Methods (Case Study at PT ABC in Samarinda). *Proceedings of the International Conference on Sustainable Engineering, Infrastructure and Development*. doi:<http://dx.doi.org/10.4108/eai.23-11-2022.2339153>
- Tighazoui, A., Sadok, T., Sauvey, C., & Sauer, N. (2019). Optimal design of a manufacturing-remanufacturing-transport system within a reverse logistics chain. *The International Journal of Advanced Manufacturing Technology*, 101, 1773–1791. doi:<https://doi.org/10.1007/s00170-018-2945-2>
- Vahlne, N. (2017). On LPG usage in rural Vietnamese households. *Development Engineering*, 2, 1-11. doi:<https://doi.org/10.1016/j.deveng.2016.12.003>
- Vinayagamoorthy, A., Sankar, C., & Sangeetha, M. (2012). A Study on Service Quality Perception of Domestic LPG. *JOURNAL OF RESEARCH IN COMMERCE & MANAGEMENT*, 1(10), 134-148.



- Vural, C., & Aktepe, Ç. (2022). Why do some sustainable urban logistics innovations fail? The case of collection and delivery points. *Research in Transportation Business & Management*, 45. doi:<https://doi.org/10.1016/j.rtbm.2021.100690>
- Waqas, M., Dong, Q.-L., Ahmad, N., Zhu, Y., & Nadeem, M. (2018). Critical Barriers to Implementation of Reverse Logistics in the Manufacturing Industry: A Case Study of a Developing Country. *Sustainability*, 10 (11), 4202. doi:<https://doi.org/10.3390/su10114202>
- Wijeratne, I., Kumara, U., & Karunarathna, S. (2020). Productivity Improvement of Cylinder Filling Plant by Semi-Telescopic Conveyor for Loading Filled Liquefied Petroleum Gas (LPG) Cylinders for Transportation and Distribution. *EasyChair Preprint no 3568*.
- Yuen, K. F., & Thai, V. V. (2017). The influence of supply chain integration on operational performance: A comparison between product and service supply chains. *The International Journal of Logistics Management*, 28(2), 444-463. doi:<https://doi.org/10.1108/IJLM-12-2015-0241>

## Appendix A

### INTERVIEW QUESTION

| HOUSEHOLD END USERS |                                                                                                                                                                     |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Num.                | Questions                                                                                                                                                           |
| 1.                  | Are you still using gas cylinders for cooking, or have you switched to an electric stove?                                                                           |
| 2.                  | How many gas cylinders do you have at home?                                                                                                                         |
| 3.                  | How do you return empty gas cylinders and purchase new filled ones?                                                                                                 |
| 4.                  | Do you have only one retailer's phone number or more than one?                                                                                                      |
| 5.                  | Is it difficult to get the retailer's phone number in your area?                                                                                                    |
| 6.                  | How do you buy and return gas cylinders through the retailer?                                                                                                       |
| 7.                  | How long does it take for the retailer to deliver the gas cylinder?                                                                                                 |
| 8.                  | Do you think this service facilitates the return and purchase process?                                                                                              |
| 9.                  | Is there an additional charge for delivery services?                                                                                                                |
| 10.                 | Is it difficult to buy and return gas cylinders at night, on weekends, public holidays, or during festive seasons?                                                  |
| 11.                 | Are the delivery personnel willing to deliver gas cylinders to flats?                                                                                               |
| 12.                 | How often does the gas cylinder truck pass through your residential area?<br>Is it difficult to get this service?                                                   |
| 13.                 | Are you aware that gas cylinder brands can only be exchanged with the same brand?                                                                                   |
| 14.                 | Do the shops in your residential area accept only the same brand or do they accept other brands as well? Is there an additional charge when returning the cylinder? |
| 15.                 | How satisfied are you with the customer service provided by the gas cylinder retailer?                                                                              |
| 16.                 | Have there been any situations where the quality of the LPG cylinder was an issue during delivery?                                                                  |
| 17.                 | What do you do to manage your gas cylinder usage when there is a delay?                                                                                             |
| 18.                 | Does purchasing and returning gas cylinders yourself cause back pain?                                                                                               |
| 19.                 | Have you ever returned an empty gas cylinder only for reasons such as moving house? Was the return process easy?                                                    |
| 20.                 | What steps do you think can be taken to improve the experience of using gas cylinders in your residence?                                                            |
| 21.                 | What are the main factors influencing your choice to use gas cylinders for cooking compared to alternatives like electric or solar?                                 |

## Appendix B

| RETAILERS |                                                                                                                                                      |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| Num.      | Questions                                                                                                                                            |
| 1.        | What is the most effective form of communication between you and your customers?                                                                     |
| 2.        | Do you do marketing to inform customers of your shop's phone number?                                                                                 |
| 3.        | How do you deliver gas cylinders to customers?                                                                                                       |
| 4.        | Do you have a truck? How often do you enter residential areas?                                                                                       |
| 5.        | What are your business hours?                                                                                                                        |
| 6.        | Typically, how long does it take to deliver gas cylinders after receiving an order?                                                                  |
| 7.        | Do you deliver to flats? Is there an additional charge?                                                                                              |
| 8.        | Typically, is the delivery charge calculated based on the distance from the shop to the customer's house?                                            |
| 9.        | Do you accept empty gas cylinders from other brands? If so, is there an additional charge?                                                           |
| 10.       | Do you accept empty gas cylinders and refund deposits to customers?                                                                                  |
| 11.       | Have you ever received complaints or reported issues from customers, such as dirty cylinders, rust, or leaks? What do you usually do in those cases? |
| 12.       | What technology or systems do you use to manage gas cylinders in your shop? Or is it only manual?                                                    |
| 13.       | How do you ensure that the supply of gas cylinders in your shop is always sufficient?                                                                |
| 14.       | What steps do you take to avoid stock shortages, especially during festive seasons or peak times?                                                    |
| 15.       | What are the main challenges you face in managing the supply of gas cylinders from distributors to retailers?                                        |
| 16.       | How do you ensure that LPG deliveries to customers are made within the specified time?                                                               |

## Appendix C



**OTHMAN YEOP ABDULLAH GRADUATE SCHOOL OF BUSINESS**  
Universiti Utara Malaysia  
06010 UUM SINTOK  
KEDAH DARUL AMAN  
MALAYSIA



Tel. 604-028 7130/7122/7110/7121/7124/7158  
Laman web (Web): <http://pusat2.um.edu.my/>

**UUM/COB/P-40**  
27 June 2024

### TO WHOM IT MAY CONCERN

Dear Sir/Madam,

### DATA COLLECTION

**COURSE : RESEARCH PAPER**  
**COURSE CODE : BPMZ69912**  
**LECTURER : DR. WADI KHALID BIN ANUAR**

This is to certify that the following is a postgraduate student from UUM College of Business, Universiti Utara Malaysia. She is pursuing the above-mentioned course which requires her to undertake an academic study and prepare an assignment. The details are as follows:

| NO. | NAME                           | MATRIC NO. |
|-----|--------------------------------|------------|
| 1.  | SITI HUMAIRA NAGIAH BINTI AZMI | 832268     |

In this regard, I hope that you could kindly provide her with assistance and cooperation so that she can successfully complete the assignment given. All the information gathered will be strictly used for academic purposes only.

Your cooperation and assistance are very much appreciated.

Thank you.

"MALAYSIA MADANI"  
"BERKHIDMAT UNTUK NEGARA"  
"KEDAH SEJAHTERA - NIKMAT UNTUK SEMUA"  
"ILMU BUDI BAKTI"

Upholding the principles of trust and integrity

**NURUL NADIAH RUSLE**  
Assistant Registrar  
for Dean  
Othman Yeop Abdullah Graduate School of Business

c.c.- Student's File (832268)

Universiti Pengurusan Terkemuka  
The Eminent Management University

