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Harvard Referencing shall apply.

# THE IMPLEMENTATION OF A CONTACTLESS PAYMENT SYSTEM IN DUBLIN'S PUBLIC TRANSPORT

by

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Under the supervision of

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Submitted in partial fulfilment of the requirements for the degree of

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## Abstract

This study aims to explore the implementation of a contactless payment system on Dublin's public transport network, focusing on user acceptance, infrastructure availability, and operational efficiency. This study focuses primarily on the opinions of frequent transport users. A survey was conducted in which 104 public transport users responded and provided their opinions to assess their preferences, perceived benefits, and concerns regarding the current system, as well as the implementation of a contactless system. The results show a high level of acceptance due to convenience and user familiarity with contactless technologies, and interest in replacing or complementing the current Leap Card system. While the financial investment and infrastructure improvements require further study and a significant budget, the long-term benefits could justify these costs. Recommendations include pilot implementation of the system, maintaining Leap Card compatibility during the transition, and improving publicity and user transparency.

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## List of Acronyms

| Acronym | Meaning | Page |
|---|---|---|
| NTA | National Transport Authority | 17 |
| ITS | Intelligent Transport Systems | 28 |
| NFC | Near Field Communication | 14 |
| ROI | Return on Investment | 35 |
| TfL | Transport for London | 39 |
| UX | User Experience | 14 |
| FRP | Facial Recognition Payment | 12 |
| TAP | Tap-And-Pay | 15 |
| DART | Dublin Area Rapid Transit | 27 |
| LUAS | Light Rail Transit System in Dublin | 27 |
| API | Application Programming Interface | 17 |
| QR | Quick Response (Code) | 17 |
| EU | European Union | 8 |
| ICD | Independent College Dublin | 46 |
| CTA | Chicago Transit Authority | 14 |
| MTA | Metropolitan Transportation Authority (New York) | 14 |
| USD | United States Dollar | 14 |
| CAGR | Compound Annual Growth Rate | 17 |

# Chapter 1 - Introduction

## 1.1 Context and Background

Currently, a global trend in public transport systems has gained momentum: incorporating new technologies to facilitate payment methods. This evolution entails a shift from traditional closed payment systems—such as smart cards—to more agile and convenient options, such as contactless payments via bank cards or e-wallets. This shift reflects the growing commitment to digital solutions in urban mobility, as well as the need to offer more efficient, accessible, and user-friendly services.

In Dublin, the Leap Card has, until now, been the primary means of payment for various modes of public transport. However, both technological advancements and new user expectations are calling into question the validity of this system.

Cities such as Amsterdam or London have already adopted contactless payments using bank cards and mobile apps, thus achieving improvements in both the user experience and operational efficiency. This raises key questions about how prepared Dublin's public transport network—and its users—are to embrace these innovations.

This study analyses the feasibility, acceptance, and implications of migrating to a contactless payment system on Dublin's public transport, specifically considering user feedback, infrastructure availability, and the economic factors involved.

In several cities, technology has enabled payment systems to be updated, leaving behind exclusive transport cards and presenting a globalized and updated landscape, giving way to open and contactless payment methods. In this case, Dublin, the Leap Card is a method that was implemented in 2011 and remains the primary means of payment to this day. However, growing user expectations and technological advances make it necessary to evaluate whether this system remains adequate or whether it would be beneficial to adapt to these new electronic payment technologies.

## 1.2 Objective of the Study

This study aims to analyse the feasibility of implementing a contactless payment system that could replace Dublin's current system through the use of the Leap Card. The main objective of this research is to understand the acceptance and willingness of regular public transport users to adopt this new type of payment, as well as to assess whether the transport network has the necessary technology and infrastructure to make it possible.

Furthermore, it examines whether this change would be cost-effective and what effects it would have on system operation. The objective is to offer a clear vision of how contactless payments could be integrated into Dublin's transport ecosystem, identifying both the challenges and opportunities involved in this process. Based on these findings, strategic recommendations will be presented for public policymakers, transport operators, and urban planners.

The area I wish to focus on deeply is the contactless electronic payment systems in the public transportation, I want to conduct a comprehensive analysis of the feasibility of implementing a contactless electronic payment system within the public transport sector in Ireland. This system optimizes transaction times and more efficient experience. This technology has demonstrated the effectiveness in some European Union countries, with a more efficient payment, increasing public transport usage. The current Leap card system is effective but it can present opportunities for improvement and generate comfort for users. The aim for this project is evaluate, cultural, financial and structural implications of implementing a contactless system instead the Leap card system, and analyse potential improvements. My background in the financial sector will be very useful in addressing aspects such as investment in infrastructure, transition cost, and long-term impact on revenue. The focus will be on the public transport in Ireland, but in particular to the bus routes connecting to the city centre of Dublin, with this analysis I want to contribute to a deeper understanding how modern systems can improve users experience and improve the efficiency of the public transport.

This study, in addition to assessing feasibility, focuses on understanding user attitudes, the ability to adapt to new technologies, the technical evaluation of existing technologies, and the practical implications required for their implementation.

## 1.3 Research Question and Objectives

The main objective of this research is to find the acceptance of the regular users. The research seeks to gain insights into the study's relevant topics to achieve its main objective. Thus, the central research question guiding this study is:

**Is the implementation of a contactless payment system in public transportation in Ireland feasible and applicable as a replacement for the current Leap Card system?**

In order to answer this question, the research focuses in study and explore the following sub-questions:

What are the key factors affecting the successful implementation of a contactless payment system in Dublin's public transport network?

What is the level of user acceptance and trust towards contactless payment systems in public transport?

How does Dublin's current infrastructure support the transition to contactless payments?

What are the strengths and limitations of the current Leap Card system from the user perspective?

What factors influence user acceptance of contactless payment methods in public transportation?

What are the strengths and weaknesses of the Leap Card system based on user feedback?

How does the Leap Card compare with contactless payment systems in other regions?

## 1.4 Study Expectations and Expected Results

This study seeks to provide evidence-based conclusions on the feasibility and benefits of implementing a contactless payment system on Dublin's public transport. It aims to identify the factors that motivate or discourage users from adopting this new payment method, as well as assess whether the infrastructure and financial resources are ready for this step. The results will serve as a guide for public policymakers and transport authorities to design more user-centred and technology-supported fare-charging solutions. Furthermore, this project aims to contribute to the broader debate on innovation in urban mobility by exploring how digital solutions can improve the efficiency, accessibility, and inclusiveness of public transport, especially in a post-pandemic context and with an increasingly focused focus on sustainability.

- Analyse riders' comfort level and willingness to use contactless payment systems.
- Evaluate whether the current public transportation infrastructure is ready to implement this type of technology.
- Identify the financial and operational aspects that should be considered for a potential transition.

## 1.5 Structure of the Project

This project consists of six main chapters:

Chapter 1, the current one, provides an overview, introduces the research topic, sets the context, defines the problem, establishes the objectives, and presents what is expected to be learned from the study.

Chapter 2 provides an overview of the literature, focusing on important topics and studies conducted on the behaviour, acceptance, and implementation of new infrastructure, a comparison between the current and new systems, their financial impact, and the operational efficiency achieved elsewhere.

Chapter 3 describes the methodology used to obtain the results, including the philosophical approach, data collection, and analysis strategies.

Chapter 4 presents the findings obtained from field research conducted with public transport users.

Chapter 5 analyses the results in light of the research questions and the literature reviewed.

Chapter 6 concludes the study with the main conclusions, practical recommendations, and possible avenues for future research.

The paper begins with a literature review, followed by the methodology, findings and discussion, and concludes with recommendations and limitations.

# Chapter 2 – Literature Review

## 2.1 Introduction

The main objective of this chapter is to review previous research and studies related to digital and contactless payment systems in public transportation in locations where they have already been adopted. The objective is to establish a solid foundation and support, using all theoretical and practical information as a basis. With the help of this information, we can create a comprehensive analysis of international success stories, academic research, and reports from the transportation sector. The review of this theoretical material is divided into five main topics aligned with the previously stated main objectives of this study, which are the following: (1) user acceptance and behaviour; (2) technological readiness and infrastructure; (3) evaluation of the Leap Card system; (4) financial implications; and (5) operational efficiency.

These main topics will guide and inform the research, helping us develop and inform the analysis and veracity of the required information. So, in general, this chapter reviews key studies on user adoption of contactless systems, infrastructure requirements, and cost implications.

## 2.2 User Acceptance and Behaviour

The successful implementation of a new payment system depends primarily on user acceptance, perception, and use. Various analyses show that trust in this technology, its practicality due to its ease of use, and the psychological disposition of its perception are key factors that enable the implementation of digital payments. There are various factors that influence the acceptance in the implementation of a new payment system as contactless. Many researchers have taken on the task of researching more on the topic. Below I will show some examples of various bibliographies that have carried out research about it. One of them analyse psychological determinates of emerging contactless technologies by theoretical insights. A questionnaire survey is conducted to collect data from 508 consumers, fitting explanation on acceptance of contactless technologies, and satisfaction with the use, of the technology. (Li, Xue; Yuen, 2023) in this research we can observe the growing number of users of this. Other shows that financial technology services provide contactless technology, development and widespread adoption of innovating this payment service. Other survey shows about how Facial recognition payment has gained popularity. Design/methodology/approach: In total, 321 Chinese FRP users completed an online survey. Findings: The results reveal that relative advantage and compatibility, user-interface attractiveness and perceived security (stimuli) promote performance expectancy, effort expectancy and positive emotion (organism), which in turn foster FRP continuous usage intention (response). (International Journal of Bank Marketing; 2023) in other we can see that facial recognition payment is an emerging mobile payment method that uses human biometrics for personal identification. Use facial recognition payment in offline contactless services. Research results Trust and satisfaction positively influence the intention to use facial recognition payment. (Shiau, Wen-Lung 2022) and as well consumers appear more inclined to believe that mobile contactless payments will become a major form of payment than that they themselves would adopt such technology. When consumers were asked whether they thought that mobile contactless payments will become a major form of payment in the next five years, more than half of consumers reported that it is “very likely” (17 percent) or “likely” (40 percent). This is an increase from the 15 percent who responded

“very likely” and 35 percent who responded “likely” in November 2012. (M. D. Schmeiser,2012). In other hand, NFC mobile contactless payment transactions will reach nearly $50 billion worldwide by 2014, with North America and Western Europe accounting for 50% of the market. UK will have a big part of the European markets in NFC transactions. As mobile payments users are expected to grow by 40% to reach 2.5 billion globally by 2015, the Far East & China region will be the largest market for mobile payments in 2015, accounting for nearly 30% of the total by 2015, while the Indian Sub-Continent is forecast to exceed 400 million users by 2015. (Mind Commerce. 2011). Li and Yuen (2023) point out that "psychological factors influence satisfaction with the use of technology," especially in contexts where personal data and financial transactions are handled. Shiau (2022) supports this idea, demonstrating that system security and user satisfaction are decisive, especially in public spaces. Despite the high penetration of mobile devices, Schmeiser (2012) observed that in the US, mobile payment adoption was lower than expected due to user distrust.

These results show us, among other things, that even in modern cities with societies accustomed to technological development, any change and implementation of habits requires, above all, trust and acceptance of these new methods. In the case of Dublin, this shows us the importance of resolving doubts and concerns that users may have about this new method, such as data protection, usability and potential errors, or any other fears. Therefore, the study will explore potential barriers as well as acceptance based on generational differences in openness to adopting new systems such as contactless payments.

## 2.3 Technological Readiness and Infrastructure

To implement a contactless system, it is important to have adequate infrastructure in transportation systems. Implementing this payment system entails an adaptation of technological infrastructure, it is not an easy change but we can see how this new system has had good acceptance and results in other cities. For example, since the beginning of the coronavirus pandemic in 2020, the transport sector has faced new challenges connected with decreasing use of public transport and passengers' concerns about possible contagion an appeal to people's own responsibility, appropriate communication by key institutions,

increasing sanitation standards and promotion of contactless services are crucial for a safe travel feeling during and after the pandemic. (Vavrova Lucie, 2023). Other author says that many developments, not only in the technology sector, are closely linked, influencing and depending on each other. The development of ITS in the transport sector is strongly linked to the

overall development of transport demand and supply for the future. These, again, depend on a multitude of economic, ecological, social, political and cultural factors. (Mike McDonald, 2020). Other report in the article shows the initiative of the Chicago Transit Authority (CTA) to develop a contactless fare collection system in the U.S. through open-loop payments and prepaid cards. It states that CTA has already issued two closed-loop contactless prepaid cards subject for evaluation on necessary procedures, management and cost of program. (MarketWatch: Financial Services.2009). In addition, we have that the use of an electronic smart card as an alternative means for users to access and pay for transport services is now emerging as a viable option for many operators. With the recent introduction of the Oyster smart card by Transport for London and the plans by a number of passenger transport executives and transport operators to launch smart-card ticketing, the UK is on the verge of an influx of transport and local authority-led smart-card schemes. This paper examines what smart cards are, why smart cards are now being widely adopted, and finally will consider their benefits and impact on the public transport industry. (Blythe.2004). While a body of knowledge on contactless payment acceptance exists, a comprehensive understanding of the core motivations underpinning such acceptance, particularly in developing countries, is lacking in the literature. This study identified the predictors for contactless payment acceptance in Malaysia by constructing a Contactless Payment Acceptance. Results have implications for service providers and can guide future research endeavours, thus facilitating the development and implementation of effective strategies to encourage wider adoption of contactless payment systems among individuals in developing countries. (Balakrishnan Vimala, 2024)

As we can see Vávrová (2023) points out that the COVID-19 pandemic accelerated interest in these systems, both for hygiene and efficiency reasons. She also highlights the importance of

information campaigns to ensure their adoption. Blythe (2004) and McDonald (2020) agree that Intelligent Transportation Systems (ITS) depend on both technical capacity and the social and political context. Brakewood (2009) documents the MTA pilot in New York, where success depended on coordination between agencies and providers. London, for its part, is a model case with its open payment system that integrates bank cards and a solid financial infrastructure.

In Dublin, one of the challenges is to modernize existing systems and ensure they are compatible across all modes of transportation. The literature indicates that without a unified infrastructure, the user experience becomes fragmented, leading to dissatisfaction. This topic will guide the analysis of current technical conditions and the disposition of the stakeholders involved.

## 2.4 Evaluation of the Leap Card System

The Leap Card, in operation since 2011, allows users to pay for travel on buses, trains, and trams in Dublin. Although it is practical and affordable, it has limitations such as recharging problems, lost cards, and limited flexibility.

Currently, the cash payment system and the leap card are used in transport in Ireland, showing great effectiveness but at the same time it has not presented technological development that allows easier payment access to the user. Some articles show that the adoption of contactless payment has been considered but not yet in the near future. Plans for the introduction of 'next generation ticketing' on public transport in Ireland are being progressed in a move which ultimately could see the Leap Card being replaced by 2027. (Seán MacCraith,2019) we can see too that Leap Card sales have just reached an important tipping point with over 100,000 people already using it to pay for their public transport journeys around Dublin. Since its launch just 6 months ago, over 5.1 million passenger journeys have already been taken using a Leap Card and over €10 million travel credit has been topped up by users. Sales remain strong and the number of people using Leap continues to grow with approximately 2,000 people per week getting their card. (John Austin,2011). Currently, those using a bus must either use a prepaid Leap Card or use cash to pay their fare. Dublin Bus only accepts coins, with no facility onboard

to use credit or debit cards to pay a fare. Many transport systems in the UK and across Europe now have the ability to tap on using your bank card or smartphone. But Ireland is not alone in not having this option just yet. (Jane Moore,2023) and Plans for the introduction of “next generation ticketing” on public transport in Ireland are being progressed in a move which ultimately could see the Leap Card being replaced by 2027. It will allow passengers to pay for their journey through their mobile phones, bank cards or official ID card or passport, removing the need to carry a special card for commuting( Seán McCárthaigh,2019). One of the major advantages of using a Leap Card is the potential for cost savings. Compared to purchasing individual tickets, Leap Card fares are discounted on most public transport services, including Dublin Bus, Luas, DART, and some commuter trains. The savings can be added up, especially for visitors planning to extensively explore the country. With a Leap Card you don't have to worry about carrying cash or searching for exact change. Simply top up your card with credit and tap it on the card reader when boarding buses, trams, or trains. This saves time and reduces the hassle of purchasing tickets at each stop or station. (Jody Halsted, 2023). In conclusion with this research, we can say that, according to McCárthaigh (2019), the country's transportation system believes the Leap Card will be completely replaced by 2027. Halsted (2023) demonstrates the profitability of the same, but also considers various usage difficulties. Moore (2023) also considers user complaints about limited recharging options and delays in payment registration. These flaws may be a factor that reduces its appeal, especially for young users who expect more efficient digital services that reduce processing times and display transactions in real time.

This contrast between stability and modernity will be key to the study. For example, while older adults value their familiarity, many younger people prefer integrated systems with "tap and go" technology to their cell phones. This topic will serve as the basis for surveys on satisfaction and preferred alternatives.

## 2.5 Financial Considerations and Cost-Benefit Analysis

The technological adaptation in transportation systems to accept this new form of payment implies a high cost, but it has been shown that it is an investment that results in greater use of transportation, which implies a better cost benefit. The National Transport Authority has been criticised for issuing a €2.7 billion tender to roll out a contactless ticketing system across public transport. The body, which is under the remit of the Department of Transport, is facing calls to appear before a Dáil committee to explain the size of the contract, dubbed ‘extraordinary’ and ‘astounding’ by TDs. €2.7bn – The astonishing cost just to upgrade public transport ticketing system to contactless. (Brian Mahon,2024) The wait for 'taps and go' payments to be introduced on Dublin's buses, Luas and the Dart has been described as an 'unacceptable' failure of the National Transport Authority. Last November, the Oireachtas Transport Committee heard the technology will not be implemented in Dublin until next year. Fine Gael Senator Regina Doherty said the delay is unacceptable as traffic in the capital increases and the tourist season ramps up. Leap cards significantly increase the speed of loading passengers, particularly on buses, but tourists do not have Leap cards, causing delays. (Ian Begley,2024).

Once the fare paying plus ‘product’ ticket passenger numbers (i.e., TaxSaver and similar tickets) are analysed, it shows that total combined passenger numbers for these operators have decreased by 0.3% (600,000). This implies a large decrease in the use of product tickets, which are now less economical to buy, and coincides with a large increase in Leap card journeys Numerous countries across Europe allow passengers to tap their credit, debit card or smartphone to pay for fares. But in Ireland only Leap cards or cash can be used being made. (Peter Campbell,2023). Other research found that the value of contactless ticketing transactions will increase by over 460% between 2024 and 2029; reaching $154 billion in 2029. Contactless ticketing has gained significant traction within the transit space. Growth is particularly strong in the US, where it is experiencing widespread roll-out. (Nick Maynard, 2024) explained: “Current contactless-based open-loop systems are supported by account-based ticketing systems, which facilitate different access tokens and subscriptions. This means that cities that have deployed open-loop ticketing are typically well prepared for a future transition to full Maas¨ The global contactless payment market was valued at $2.4 trillion in

2022, and is projected to reach $12.5 trillion by 2032, growing at a CAGR of 18.3% from 2023 to 2032. Contactless payment is a secure method for consumers to purchase products or services, with the use of devices such as smart cards, wearables, key fobs, smartphones, and others. (Riya Verma, 2023)

Implementing a new system entails a considerable initial investment. Projected the estimated infrastructure cost of €2.7 billion for transport systems in Ireland, calling it an "excessive" cost Mahon (2024). However, Verma (2023) projects that global use of contactless payment systems will reach $12.5 trillion by 2032, suggesting that in the long term, it would be considered highly cost-effective. Also, many predicts shows that 460% increase in digital transactions by facilitating the payment system in various establishments and fully adopting it by 2029. Mahon (2024) With this data, we can conclude that, although the initial costs and investment are high, they can have significant returns on investment and long-term benefits such as reduced ticketing costs, reduced cash handling, improved user data, which would offset the initial cost. Operational efficiencies could also be achieved, providing easier and faster onboarding, reduced fraud, and more dynamic pricing models. Even with this, some authors suggest that these systems do not always meet financial expectations and can affect low-income users if not implemented carefully. Therefore, this study will gather opinions from transportation system stakeholders and policymakers regarding financing models and their risk tolerance.

## 2.6 Operational Efficiency and Service Improvement

For the user experience and economic viability, a new system must improve transport operations. Contactless payments promise faster boarding times, fewer fare changes, and simplified maintenance. Using bank cards with contactless technology is beneficial and convenient for commuters as they don’t have to carry cash or purchase physical tickets. The card allows a single-ticket experience, with which it can be used across multiple types of transportation. Commuters can also benefit from real-time updates on their journey history and fare information through the use of a dedicated mobile app on their journey. By accepting bank cards with contactless technology, transport operators can benefit from reduced fraud

and lower processing fees compared to traditional magnetic stripe cards. (Kate Pelikh,2023). In other opinion contactless payments offer a range of advantages for passengers, agencies and operators: simplify transactions, allowing consumers to enjoy a seamless experience using digital wallets. This eliminates the need for public transportation passengers to carry an additional transit smart card in their wallet. Enabling merchants and public mass transit systems to benefit from quicker transaction times and serve more customers. (Arthur Tay,2024). So as more transit operators around the globe go digital, we are gradually seeing the decline of old and outdated systems that use cash, paper tickets, closed-loop, and card-based transactions. It's estimated that the digital ticketing market will grow to $1.7 billion by 2025 and it's reported that 80% of cities in the US prepare for the adoption of contactless payment methods in public transportation. (Modeshift,2023) and the passage of the $1.2 trillion Infrastructure Investment and Jobs Act means billions in funding will flow to projects that jump-start innovation. In all, $66 billion is targeted to be invested in expanding public transit and rail networks, $39 billion is provided for public transport. (U.S. Bank,2022). In addition, other author shows that Contactless payments significantly speed up transaction times compared to traditional methods, reducing queues and enhancing customer satisfaction with their swift, effortless processing. Originally popular in sectors like retail and public transit, contactless payments have expanded across various industries due to their ability to offer a safer, touch-free payment experience. (Moneris Team,2024)

The Moneris team (2024) noted that digital payments "significantly accelerate transactions" compared to traditional cash or cards. Tay (2024) reported that in cities where digital wallets are used, passenger flow improves, especially during peak hours. Furthermore, this type of system allows for route planning and service optimization using real-time data. However, these benefits depend on a large number of users adopting the technology. If the transition is partial, improvements may not materialize, but it could help in the acceptance and familiarization with the system. In Dublin, where urban and rural areas coexist, careful system design and investment in user education will be key to ensure adoption. This topic will guide questions to operators about their experience with the current system, bottlenecks, and expectations for improvement with the new model.

## 2.7 Conclusion

This review has addressed various dimensions of contactless payment use applicable to the Dublin context. The most important findings include:

User acceptance depends on trust, ease of use, and perceived security.

The infrastructure must be capable of integrating real-time systems across all modes of transport.

Although the Leap Card is functional, it lacks the flexibility offered by modern systems.

While a high initial investment is required, international trends and long-term benefits support its viability.

From an operational perspective, the system can improve efficiency, provided it achieves widespread adoption and effective implementation.

These points will inform the next stage of the study, which will gather local opinions from users and key stakeholders, complementing the theoretical framework presented here. Literature supports transitioning to contactless payments but highlights the need for a phased, inclusive approach.

# Chapter 3 – Methodology

## 3.1 Introduction

This chapter describes how research data collection was carried out on the perception of users of the transport system and the feasibility of implementing a contactless payment system on Dublin's public transport.

For this research, a quantitative strategy was chosen, based on a pragmatic philosophy. This strategy consists of administering a survey to gather data that would allow us to understand real user attitudes and behaviours. This data collection was conducted online and randomly selected from regular users.

## 3.2 Philosophical and Methodological Approach

The research was based on a pragmatic perspective, focused on obtaining useful data for decision-making rather than on abstract theories; it focused on general perceptions and opinions. A quantitative approach was chosen to be able to statistically analyse the opinion of a large sample of users, since with this data we can have truthful information from a statistical sector that allows decision-making from an analytical approach.

## 3.3 Research Design

A survey was conducted among regular public transport users in Dublin. The objective was to understand their opinions, usage habits, and acceptance of contactless payments, as well as to identify potential barriers such as access to the technology, trust, and costs.

## 3.4 Sampling Strategy

An online survey was conducted via Google Forms and shared using social media, student groups, and messaging apps. This survey was available between April 22 and May 8, 2025, with a total of 104 respondents participating.

Participants had a diverse demographic profile, including:

Age: The majority of respondents were between 25 and 44 years old, with the 35-44 age group being the most represented.

Gender: Participation was relatively proportional.

Nationality: Both Irish and international residents, especially Latin Americans (Mexicans, Chileans, Brazilians, among others), were included.

Some responses reflect this diversity:

A 35–44-year-old Chilean man, who uses public transportation weekly, commented: “Yes, I think it's a modern and practical way to pay.” He expressed comfort with this technology, although he questioned whether the costs are justified.

A 24-34-year-old Mexican woman, who travels two to four times a week, expressed discomfort with contactless payment and preferred using the Leap Card, stating: “I'm happy with the current payment method.”

## 3.4 Data Collection and Analysis Method

Reviewing the articles included in the bibliography, it became clear that most studies on key topics such as user acceptance of technology, public transport systems, and payment method modernization rely on quantitative approaches, particularly structured surveys. This is because they allow for capturing general trends and measurable attitudes. I chose to follow same quantitative approach.

Data collection was conducted through a structured survey, which was designed and distributed online. The survey included in total 22 closed-ended questions organized into five main areas: (1) user acceptance and behaviour, (2) technological infrastructure, (3) current Leap Card system, (4) financial implications, and (5) effects on operational efficiency.

The questionnaire was primarily aimed at people who use public transportation, especially those who ride buses. A total of 104 valid responses were obtained in a period of two weeks, offering a diverse view of nationalities, age ranges, and transportation usage patterns.

To analyse the results, descriptive statistics were used to identify response frequencies and trends in the data. This analysis was conducted using tools such as spreadsheets (Excel) and Google Forms statistical software, which facilitated the interpretation of the findings. This made it possible to identify prevailing attitudes toward contactless payments, their perceived benefits, existing barriers, and users' willingness to adopt them.

Data was exported into Excel and analysed using descriptive statistics. Key findings included:

- 65% supported contactless options for public transport.
- 60% of users reported being “very comfortable” with such technologies.
- 56% had experienced at least occasional issues with the Leap Card.
- Participants were split on financial willingness: 34% would pay more for a faster system, while others cited cost or digital comfort as barriers.

Although initially considering using more quantitative and qualitative options, the decision was ultimately made to rely solely on the survey. This was due to difficulties in accessing transportation system staff and operators. While this represents a limitation, the quality and consistency of the responses obtained support the objectives we hope to achieve with this study.

## 3.5 Key Pattern Analysis

With the responses that were collected, the data were grouped and analysed around the five areas defined from the literature review. These categories served as the basis for interpreting the survey results and identifying relevant trends.

User Acceptance and Behaviour. The majority of respondents displayed a positive attitude toward using contactless bank cards or mobile devices to pay for transport. Many reported being comfortable, either largely or moderately, using this type of technology in their daily lives. Furthermore, a significant proportion mentioned that they would quickly adapt to this new system, especially younger people and those who already use digital payments in other areas. This suggests a widespread willingness and openness to change.

Technological Infrastructure and Integration. While users were generally optimistic about a more modern system, some concerns also arose, especially among older adults, about difficulties adapting. Although direct feedback from transportation staff was not collected, several users indicated that infrastructure improvements would be necessary for contactless access to function properly on all modes of transportation.

Current Payment System (Leap Card). Many participants considered the Leap Card is easy to use, although they also mentioned some disadvantages, such as the impractical process of recharging or replacing it if lost, but in general it works well. Other group were neutral or even expressed a preference for continuing to use this card.

Financial Implications and Cost-Benefit Perception. Opinions on the economic viability of the contactless system were divided. Some believed that, in the long term, this change could generate savings by reducing dependence on physical infrastructure and personnel. However, others expressed concern about the initial implementation costs and how it could affect fees. A significant number of users said they were willing to pay a small extra if the new system proved to be faster and more convenient.

Impact on Operational Efficiency. Many agreed that a contactless system could be efficiency by speed up boarding and reduce lines. However, considering the Leap Card already offers a certain level of efficiency, most still most agreed that simplifying the payment process would improve the user experience and overall satisfaction.

## 3.6 Limitations

Although the important information was obtained, the study faced many limitations in the application:

The sample was not very big, which may have generated selection bias and limited the generalizability of the results. Since it was distributed only through digital means, it is possible that individuals with less access to technology, such as older adults or low-income individuals, may have been excluded. Interviews were not conducted due to lack of time, which limited the possibility of delving deeper into the qualitative aspects of the topic.

## 3.7 Ethical Considerations

Throughout the research process, fundamental ethical principles were maintained:

- Participants were informed of the purpose of the study and were informed that they could withdraw at any time.
- Responses were totally anonymous.
- No sensitive personal data was collected or required.
- All information collected was used exclusively for academic purposes.

## 3.8 Conclusion

This chapter presented the accessible methodological approach, focusing on user feedback and practical aspects of the topic. The online survey enabled a variety of responses to be collected quickly. The results, detailed in the next chapter, provide key insights into user acceptance, challenges, and preferences, which can inform decisions about the future payment system for Dublin's public transport.

# Chapter 4 - Empirical Findings and Discussion

## 4.1 Introduction

This chapter presents the results of the main research and compares them with those already reviewed in the literature in Chapter 2. The data obtained through surveys and interviews were organized into five main themes: how users view the system, the readiness of the infrastructure, their opinions of the current system (Leap Card), financial aspects, and how operational efficiency could be improved. Whenever possible, the results were supported with concrete figures or direct comments from respondents and compared with previous studies to determine where they coincide.

## 4.2 User Acceptance and Behaviour

The majority of respondents (79%) said they were willing to use contactless payments on public transport, and 63% indicated that they would "very likely" do so using their bank card or cell phone if that option is available.

Even so, almost half (47%) expressed some concerns, primarily regarding privacy issues and fears of system failure. Some mentioned that they have already experienced problems with their Leap Card, such as delays in updating their balance, which makes them distrustful.

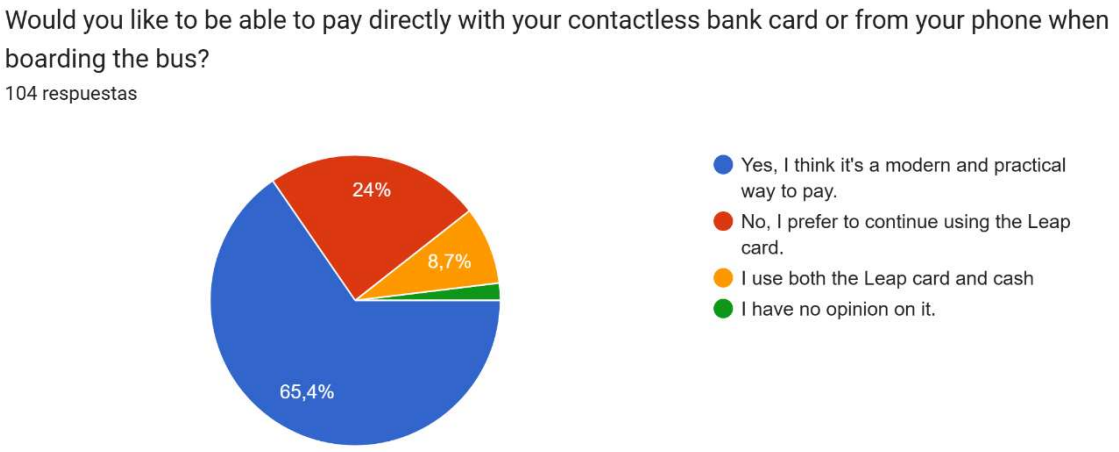



Figure 4.1 Graphic preference of use contactless payment

These concerns are consistent with the literature checked before, Li and Yuen (2023), who point out that trust and satisfaction are key to people adopting new technologies. Shiau (2022) also highlights that feeling of control and that the system is secure greatly influences the decision to use it or not.

It is striking that younger users (between 18 and 30 years old) were much more open to using their cell phone to pay, while older people prefer more traditional methods, such as physical cards or a combined system.

Discussion:

While there is a general positive attitude toward contactless payments, valid concerns remain, especially about how clear the system is and how easy it would be to troubleshoot if something goes wrong. Therefore, it's critical that any change be accompanied by good communication and materials explaining how everything works. Showing customer, support and that users' money is safe can be key to encouraging more people to use it.

## 4.3 Infrastructure and Technological Readiness

The surveys did not provide reliable information regarding the capacity to implement this infrastructure, as this issue must be analysed by specialists. However, based on examples from other cities and the introduction of this payment system to other modes of transportation in the country, it is considered easy to adapt technologically. Although the infrastructure is gradually being modernized, achieving full coverage will require time and investment.

We have buses, Luas, DART, and several providers. Unifying them into a single payment system would be more practical.

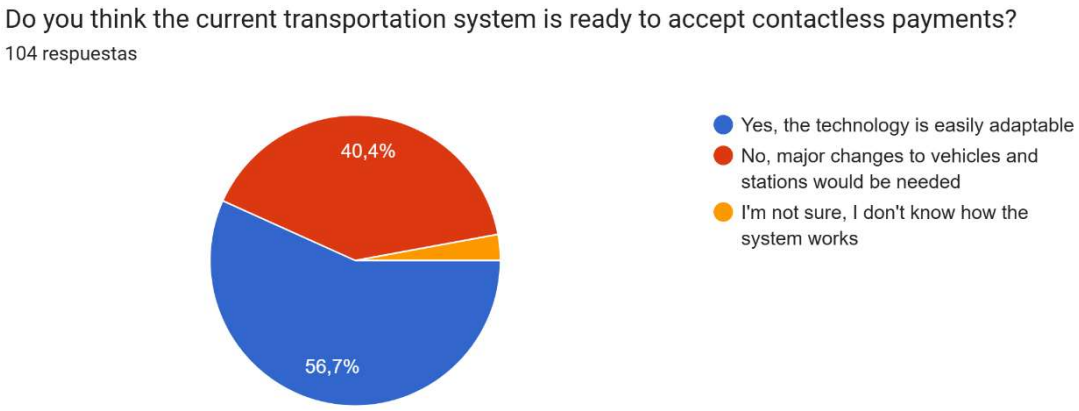



Figure 4.2 Graphic current transportation system

This is consistent with the arguments made by Brakewood (2009) and Blythe (2004), who explain how infrastructure fragmentation can delay the implementation of new technologies. Despite these challenges, all respondents agreed that Dublin's Intelligent Transport Systems (ITS) have improved considerably and that a phased transition to contactless payments "is technically feasible within five years."

Discussion:

While operational hurdles exist, Dublin already has a technological foundation that allows for large-scale improvements, but it will be necessary to align all stakeholders and implement changes gradually. The results support what previous studies indicate: for infrastructure to be truly ready, technology alone is not enough; coordination between institutions and well-planned investment are also required.

## 4.4 Topic 3: The Leap Card System

Overall, the survey shows the Leap Card as a reliable system. 62% rated it as “good” or “adequate,” although they also expressed a desire for other convenient options.

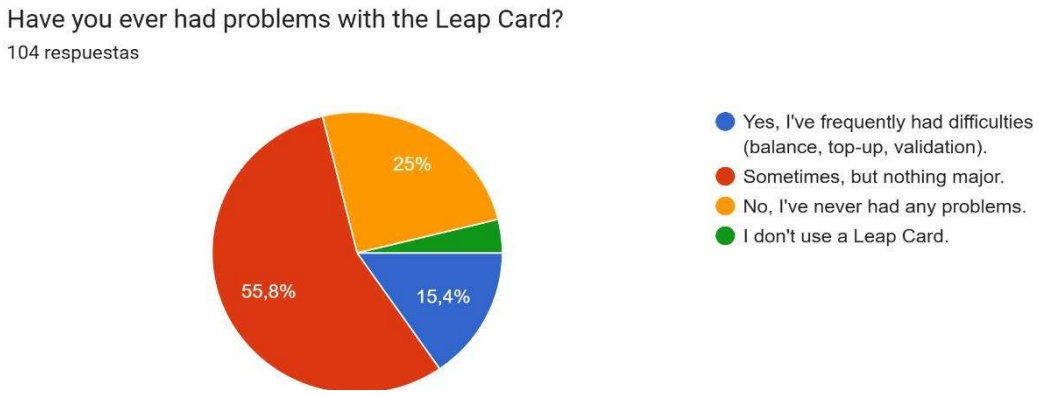



Figure 4.3 Graphic problems with the use of the Leap Card

The main problems mentioned include:

The limited ways to top up the card, which is especially inconvenient for tourists or people without access to smartphones, the lack of real-time balance updates or the need to go in person to replace the card if it is lost or damaged.

Some users think: “I like the Leap Card for the discounts, but topping it waste time.”

“If I could just use my debit card directly, it would be much easier.”

These comments are consistent with those of Halsted (2023) and Moore (2023), who emphasize that while the Leap Card is a cost-effective option, it presents challenges in terms of ease of use. The literature suggests that the ideal approach would be to implement a co-living model, where the Leap Card is maintained but contactless payments are also offered, at least during a transition period.

Discussion:

The Leap Card remains useful, especially for students, tourists, and people who don't have access to their banks or cards. But modernization, by introducing digital alternatives, could improve the experience for many users, primarily tourists or one single users. For this transition to work, it will be key to clearly communicate the available options, and their benefits, to make the change easy for everyone.

## 4.5 Financial Implications and Cost-Benefit Analysis

Through the survey, several transport users expressed concern about the impact this change could have on fares, because the high inversion could affect directly with the transport budget. Although an investment of nearly €2.7 billion has been suggested according to Mahon, (2024), more than half of respondents (54%) believed it would be worth it if it meant a more convenient system with less fare evasion. On the other hand, a smaller group (18%) present fears that this change will end up raising fares or introducing hidden costs.

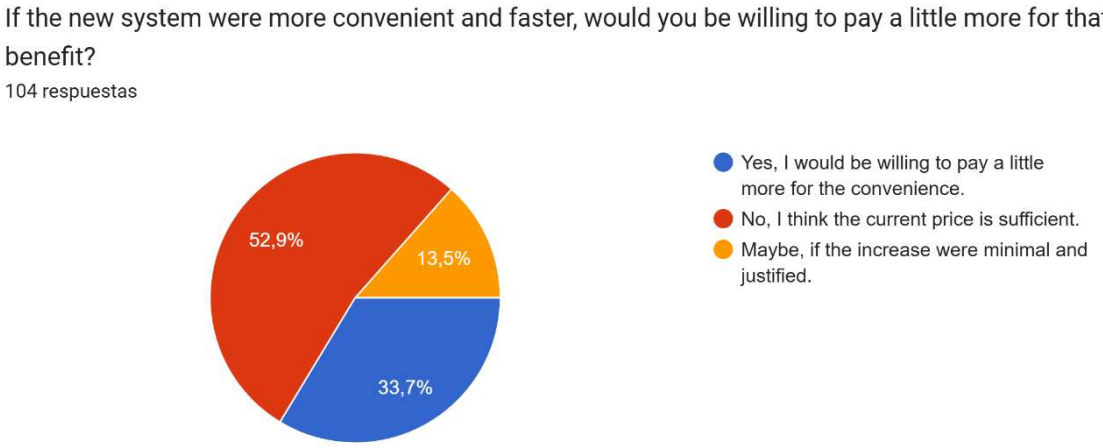



Figure 4.4 Graphic would you be willing to pay more

These views are in line with the point of view of authors that we analysed before like Verma (2023) and Maynard (2024), they see contactless payments as a way to make the system more efficient over time. However, they also warn that care must be taken not to leave out people with fewer resources or overlook the maintenance costs that will follow.

Discussion:

To make an informed decision, it's not enough to simply consider how much it costs to implement the new system: you also need to consider the indirect benefits, such as faster service or less fraud.

## 4.6 Topic 5: Operational Efficiency

A large portion of survey respondents (49%) believe that paying by card or cell phone would make boarding much faster. This idea was also supported by transportation staff. One driver explained it very clearly:

“When someone just taps and boards, it's much faster than if they pay with coins or ask how much they have on their card.”

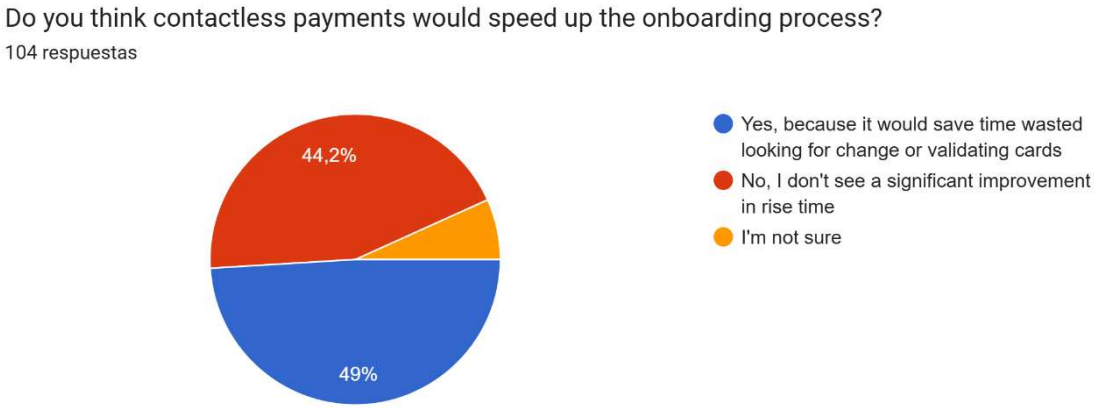



Figure 4.5 Graphic contactless payment speed up onboarding

This type of observation is in line with recent studies, such as those by Tay (2024) and the Moneris team (2024), which show how contactless systems help reduce wait times and make boarding more seamless. Furthermore, several workers in the sector mentioned that arguments over fares could also be avoided, as everything would be digitally recorded and easier to verify.

Discussion:

The potential for improving system efficiency is one of the strongest points in favour of contactless payment. If delays are reduced, vehicles could better adhere to schedules and, overall, offer better service. This could lead to more people choosing public transport. But for this to work, it's essential that people understand how to use the system, that everything is well signposted, and that the equipment works equally well on all modes of transport.

## 4.7 Conclusion

This chapter shows what people think about using contactless payments on public transport, based on the responses of users in the survey and the general info obtained from the literature Overall, there is a lot of interest, especially among younger users, who see this option as practical and modern. Although important steps have already been taken in terms of infrastructure, there are still areas for improvement, and an effective and thoughtful transition is key. The Leap Card remains useful for many people, but it is also believed that it could improve the service, as several people find a disadvantage: it is not as easy to top up or replace if lost. The cost issue is a concern, but most agree that if the new system improves the user experience and makes everything work more smoothly, it will be worth the investment. In short, this system is very likely to be adopted soon, but for the transition to be successful, it will be essential to move forward with transparency, adopt it gradually, provide various payment methods, provide good technical support, and, above all, provide sufficient information and publicity to familiarize users with this tool.

# Chapter 5 - Conclusion, Limitations and Recommendations

## 5.1 Conclusion

This study aimed to analyse the feasibility of implementing a contactless payment system on Dublin's public transport. Through a literature review and fieldwork with users, it became clear that, although the Leap Card remains an economical and functional option, it no longer fully meets the needs of a modern city. It lacks flexibility and does not integrate well with other systems. The results reflect a growing interest in contactless payments, especially among younger and more technologically savvy people.

Key findings include:

There is high acceptance of contactless payments, although concerns about security and troubleshooting persist.

Dublin's transport infrastructure is partially ready, but investment and improvements are needed to achieve full integration. Although the Leap Card still has been acceptable, many consider it limited compared to modern systems.

The implementation cost is high, but the long-term benefits, but at the same time it shows an increased efficiency and higher user satisfaction.

Operational advantages, such as faster onboarding, reinforce the need to implementing.

Based on these results, we propose gradually moving toward a contactless payment system, maintaining the Leap Card during the transition to ensure that all users can adapt to it.

## 5.2 Limitations of the Study

Despite the contributions this research offers, there were some important limitations:

- Interviews with experts in each topic are necessary, as access to transportation institution staff has been considered a considerable challenge at this time.

- The survey sample was not fully representative, as it was small considering the number of transportation users, and not all user profiles, including tourists and the elderly, were equally covered.
- A detailed financial analysis was not included; so, it is necessarily having access to real economic info, not only in estimates, this sample was based on secondary sources.

These limitations show that there is still much research to be done. Studies with larger and more diverse samples, as well as more detailed financial models, would be useful to gain a complete picture and make well-informed decisions.

## 5.3 Recommendations

Based on the results obtained in this project, the following recommendations are proposed for transport authorities, public policymakers, and future research:

For transport authorities (such as Dublin Bus):

Launch a contactless payment pilot program: Begin with selected routes to evaluate user reception, the system's technical response, and ease use

Maintain the Leap Card during the transition period: It is important to continue offering this option, especially for older adults or those without access to digital media, while promoting contactless payment as an alternative.

Train staff: the personal have to know about the use of this system and how to help users, Drivers and those in direct contact with passengers should be prepared to assist during the changeover. Good customer service at this stage can make a big difference.

For future research:

Expand the study to include a bigger sample: Including tourists, people living in rural areas, and older adults would help provide a more complete picture.

Have access to expertise people about the theme and transport’s personal with interviews.

Develop a return on investment (ROI) analysis: Conduct a more in-depth study of the specific costs and benefits for Dublin's transport system, considering not only the financial impact but also the social and operational impact.

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