



POLITECNICO
MILANO 1863

SCUOLA DI INGEGNERIA INDUSTRIALE
E DELL'INFORMAZIONE

Analysis of the Open API services in Europe

TESI DI LAUREA MAGISTRALE IN
MANAGEMENT ENGINEERING
INGEGNERIA GESTIONALE

Author: **Michael Molaro**

Student ID: 993729

Thesis supervisor: Alessandro Perego

Co-advisor: Matteo Ruggieri

Academic Year: 2023-24

Abstract

Open Banking has emerged as a significant development in the financial services industry, facilitated by the use of Application Programming Interfaces (APIs) to enable third-party developers to create applications and services around financial institutions. This evolution has been primarily driven by regulatory initiatives such as the Payment Services Directive 2 (PSD2) in Europe, which mandates banks to open their payment services and customer data to third-party providers (TPPs) under secure and regulated conditions. This thesis seeks to present a comprehensive overview of the Open Banking landscape in Europe.

The primary objectives of Open Banking include enhancing competition, fostering innovation, and improving the quality of financial services available to consumers. This study aims to identify and analyze the key trends followed by third-party providers utilizing Open Banking services across Europe. This involves gaining an understanding of how these entities leverage APIs to offer innovative financial products and services, therefore reshaping traditional banking models.

This thesis examines the broader European context, by comparing seven European countries to see how their financial institutions and TPPs are adopting and implementing Open Banking initiatives. The research addresses pertinent questions such as the trends followed by third-party providers using Open Banking services in Europe, the level of development of Open Banking in Italy compared to other countries, the primary customers of TPPs utilizing Open Banking services, and the future prospects of these services.

The thesis is structured into three main parts. The first part involves a comprehensive literature review to establish a foundational understanding of Open Banking, including an overview of various payment methods and the pivotal role of APIs. This section also explores the historical development of Open Banking, the regulatory framework established by PSD2, and the evolving dynamics of the financial services industry. The second part focuses on data collection and analysis, utilizing a combination of qualitative and quantitative methods to gather insights from various stakeholders within the Open Banking ecosystem. The third part synthesizes these findings, offering a detailed analysis of the current state and future prospects of Open Banking in Europe and Italy.

The research highlights the critical role of PSD2 in promoting Open Banking by setting standards for secure and efficient data sharing between banks and TPPs. However, the implementation of PSD2 has not been without challenges. The thesis discusses the complexities involved in ensuring compliance with regulatory requirements while maintaining operational efficiency and the security of financial data. It also examines the potential socio-economic impacts of Open Banking, including its contribution to financial inclusion and economic growth by fostering innovation and competition within the financial sector.

In conclusion, this thesis not only provides a detailed exploration of the Open Banking landscape in Europe and Italy but also offers strategic recommendations for various stakeholders, including financial institutions, legislators, and TPPs. These recommendations aim to enhance the implementation and adoption of Open Banking, ensuring that it delivers maximum benefits in terms of innovation, consumer protection, and market efficiency. Through this comprehensive analysis, the

thesis contributes valuable insights into the transformative potential of Open Banking in the contemporary financial services industry.

Abstract in Italiano

L'Open Banking rappresenta uno sviluppo significativo nel settore dei servizi finanziari, facilitato dall'uso di Application Programming Interfaces (API) per consentire agli sviluppatori di terze parti di creare applicazioni e servizi aggiuntivi rispetto a quelli offerti dalle istituzioni finanziarie. Questa evoluzione è stata guidata principalmente da iniziative normative come la Payment Services Directive 2 (PSD2) in Europa, che impone alle banche di “aprire” i propri servizi di pagamento e i dati dei clienti a fornitori terzi (TPP) in condizioni di sicurezza e completamente regolamentati. Questa tesi si propone di presentare una panoramica completa del panorama dell'Open Banking in Europa.

Gli obiettivi principali dell'Open Banking sono il rafforzamento della concorrenza, la promozione dell'innovazione e il miglioramento della qualità dei servizi finanziari disponibili per i consumatori. Questo studio mira a identificare e analizzare le tendenze principali seguite dai fornitori terzi che utilizzano i servizi di Open Banking in Europa. Si tratta di comprendere come queste entità sfruttino le API per offrire prodotti e servizi finanziari innovativi, rimodellando così i modelli bancari tradizionali.

La tesi esamina il più ampio contesto europeo, confrontando sette paesi, analizzando le istituzioni finanziarie, i TPP e la capacità di adozione e implementazione di iniziative di Open Banking da parte del paese. La ricerca affronta questioni pertinenti come le tendenze seguite dai fornitori di terze parti che utilizzano i servizi di Open Banking in Europa, il livello di sviluppo dell'Open Banking in Italia rispetto ad altri Paesi, i clienti principali dei TPP che utilizzano i servizi di Open Banking e le prospettive future di questi servizi.

La tesi è strutturata in tre parti principali. La prima parte comprende un'ampia rassegna della letteratura per stabilire una comprensione fondamentale dell'Open Banking, inclusa una panoramica dei vari metodi di pagamento e del ruolo centrale delle API. Questa sezione esplora anche lo sviluppo storico dell'Open Banking, il quadro normativo stabilito dalla PSD2 e le dinamiche in evoluzione del settore dei servizi finanziari. La seconda parte si concentra sulla raccolta e sull'analisi dei dati, utilizzando una combinazione di metodi qualitativi e quantitativi per raccogliere informazioni dai vari stakeholder dell'ecosistema dell'Open Banking. La terza parte sintetizza questi risultati, offrendo un'analisi dettagliata dello stato attuale e delle prospettive future dell'Open Banking in Europa e in Italia.

La ricerca evidenzia il ruolo cruciale della PSD2 nel promuovere l'Open Banking, stabilendo uno standard per una condivisione sicura ed efficiente dei dati tra banche e TPP. Tuttavia, l'attuazione della PSD2 non è stata priva di sfide. Le complessità legate alla necessità di garantire la conformità ai requisiti normativi mantenendo l'efficienza operativa e la sicurezza dei dati finanziari vengono analizzate. Esamina inoltre i potenziali impatti socio-economici dell'Open Banking, compreso il suo contributo all'inclusione finanziaria e alla crescita economica attraverso la promozione dell'innovazione e della concorrenza nel settore finanziario.

In conclusione, questa tesi non solo fornisce un'esplorazione dettagliata del panorama dell'Open Banking in Europa e in Italia, ma offre anche raccomandazioni strategiche per vari stakeholder, tra cui istituzioni finanziarie, legislatori e TPP. Queste raccomandazioni mirano a migliorare l'implementazione e l'adozione dell'Open Banking, assicurando che esso produca i massimi benefici in termini di innovazione, protezione dei consumatori ed efficienza del mercato. Attraverso questa analisi completa, la tesi contribuisce a fornire preziose indicazioni sul potenziale di trasformazione dell'Open Banking nell'industria dei servizi finanziari contemporanea.

Table of Contents

1.	LITERATURE REVIEW	17
1.1.	PAYMENT METHODS OVERVIEW	17
1.2.	API AND OPEN API	19
1.3.	OPEN BANKING	22
1.3.1.	<i>Open banking performance</i>	25
1.4.	THIRD-PARTY PROVIDERS	26
1.4.1.	<i>Account Information Service Provider</i>	26
1.4.2.	<i>Payment Initiation Service Provider</i>	27
1.4.3.	<i>Card Issuers Service Provider</i>	28
1.5.	PSD2 GATEWAY	29
1.6.	EUROPEAN CONTEXT	30
1.6.1.	<i>Normative and Directives</i>	31
1.6.1.1.	PSD2	31
1.6.1.2.	PSD3/PSR	33
1.6.1.3.	FIDA	34
1.6.2.	<i>UK as promoter</i>	36
1.6.3.	<i>Open Banking in Italy</i>	37
2	METHODOLOGY	39
2.1.	OBJECTIVES	39
2.2.	METHODOLOGIES	39
2.2.1.	<i>Literature Review</i>	39
2.2.2.	<i>Data collection for Census</i>	40
2.2.3.	<i>Analysis of the data</i>	43
3	ANALYSIS & RESULTS	47

3.1.	EUROPEAN LEVEL.....	47
3.2.	NATIONAL LEVEL.....	49
3.2.1.	<i>Italy</i>	49
3.2.2.	<i>Germany</i>	52
3.2.3.	<i>France</i>	54
3.2.4.	<i>Spain</i>	57
3.2.5.	<i>Sweden</i>	60
3.2.6.	<i>Netherlands</i>	62
3.2.7.	<i>Poland</i>	65
3.2.8.	<i>European overview</i>	67
3.3.	ENTERPRISE LEVEL.....	70
3.3.1.	<i>Type of player</i>	70
3.3.2.	<i>Customer</i>	73
3.3.3.	<i>The services provided by the AISP and PISP</i>	77
3.3.4.	<i>Other services offered by third-party providers</i>	80
4	CONCLUSION.....	83
4.1.	OPEN BANKING AND OPEN APIS.....	83
4.2.	REGULATIONS.....	84
4.3.	THIRD-PARTY PROVIDERS.....	85
4.3.1.	<i>European level</i>	85
4.3.2.	<i>Enterprise level</i>	86
4.4.	BIG TECHS.....	87
4.5.	SOCIO-ECONOMIC IMPLICATIONS.....	88
4.6.	POSSIBLE RECOMMENDATIONS.....	89
4.6.1.	<i>Recommendations for financial institutions</i>	89
4.6.2.	<i>Recommendations for legislators</i>	89
4.6.3.	<i>Recommendations for Third-party providers</i>	90

4.6.4.	<i>Recommendations for future research</i>	91
5	ACKNOWLEDGMENT	92
6	BIBLIOGRAPHY	93

List of figure

Figure 1: How API works	20
Figure 2: Germany home TPPs.....	42
Figure 3: Home TPPS for each EU member.....	47
Figure 4: Number of TPPs operating in each EU country.....	48
Figure 5: Italy Home TPPs	50
Figure 6: Italy passported TPPs.....	51
Figure 7: Germany Home TPPs	53
Figure 8: Germany passported TPPs	54
Figure 9: France Home TPPs	55
Figure 10: France passported TPPs	57
Figure 11: Spain Home TPPs	58
Figure 12: Spain passported TPPs.....	59
Figure 13: Sweden Home TPPs	61
Figure 14: Sweden passported TPPs	62
Figure 15: The Netherlands Home TPPs	63
Figure 16: The Netherlands passported TPPs	64
Figure 17: Poland Home TPPs	65
Figure 18: Poland passported TPPs.....	67
Figure 19: Passported TPP distribution in Europe	68
Figure 20: Home TPP distribution in Europe.....	68
Figure 21: AISP type of player pie chart.....	71
Figure 22: PISP/AISP type of player pie chart.....	72
Figure 23: Customer distribution pie chart.....	74

Figure 24: AISP customer distribution pie chart	75
Figure 25: PISP/AISP customer distribution pie chart	76
Figure 26: Other services offered by third-party providers pie chart	80
Figure 27: Open banking APIs	83
Figure 28: Directives Timeline	84
Figure 29: Potential GDP impact by 2030 by broad attribution to market participants in the EU	88

List of Tables

Table 1: HSBC account information service performance.....	25
Table 2: HSBC payment service performance	25
Table 3: Nationwide account information service performance	26
Table 4: Nationwide payment service performance	26
Table 5: Italy Home TPPs.....	49
Table 6: Italy passported TPPs	50
Table 7: Italy passported withdrawals	51
Table 8: Germany Home TPPs.....	52
Table 9: Germany passported TPPs	53
Table 10: Germany passported withdrawals	54
Table 11: France Home TPPs.....	55
Table 12: France passported TPPs	56
Table 13: France passported withdrawals	56
Table 14: Spain Home TPPs.....	57

Table 15: Spain passported TPPs	59
Table 16: Spain passported withdrawals	59
Table 17: Sweden Home TPPs.....	60
Table 18: Sweden passported TPPs.....	62
Table 19: Sweden passported withdrawals	62
Table 20: The Netherlands Home TPPs.....	63
Table 21: The Netherlands passported TPPs.....	64
Table 22: The Netherlands passported withdrawals	64
Table 23: Poland Home TPPs	65
Table 24: Poland passported TPPs	66
Table 25: Poland passported withdrawals	66
Table 26: Customer distribution according to the license	75



POLITECNICO
MILANO 1863

SCUOLA DI INGEGNERIA INDUSTRIALE
E DELL'INFORMAZIONE

EXECUTIVE SUMMARY OF THE THESIS

Analysis of the Open API services in Europe

TESI MAGISTRALE IN MANAGEMENT ENGINEERING – INGEGNERIA GESTIONALE

AUTHOR: MICHAEL MOLARO

ADVISOR: ALESSANDRO PEREGO

ACADEMIC YEAR: 2023-2024

1. Introduction

Open Banking has emerged as a significant development in the financial services industry, facilitated by the use of Application Programming Interfaces (APIs) to enable third-party developers to create applications and services around financial institutions. This evolution has been primarily driven by regulatory initiatives such as the Payment Services Directive 2 (PSD2) in Europe, which mandates banks to open their payment services and customer data to third-party providers (TPPs) under secure and regulated conditions. This thesis seeks to present a comprehensive overview of the Open Banking landscape in Europe.

The primary objectives of Open Banking include enhancing competition, fostering innovation, and improving the quality of financial services available to consumers. This study aims to identify and analyze the key trends followed by third-party providers utilizing Open Banking services across Europe.

This thesis examines the broader European context, by comparing seven European countries to see how their financial institutions and TPPs

are adopting and implementing Open Banking initiatives.

2. Literature Review

Traditional methods such as cash and credit or debit cards are contrasted with modern approaches like Account-to-Account (A2A) transactions, Buy Now Pay Later (BNPL) services, digital wallets, and cryptocurrencies. With all these changes, the payment industry has demonstrated great dynamism and innovation in recent years. Amidst all these, open banking shows considerable potential.

Open Banking leverages APIs (Application Programming Interfaces) to enable secure and standardized access to banking data for third-party providers (TPPs). By providing controlled access to customer data, APIs are pivotal in modernizing the financial ecosystem by enabling seamless integration between disparate financial systems, but their significance in Open Banking extends beyond technical facilitation; they also represent a shift towards more transparent, customer-centric financial services where consumers have greater control over their financial data and how it is used.

The introduction of PSD2 by the European Union marked a significant milestone in open banking

evolution, mandating that banks open their payment services and customer data to TPPs under secure and regulated conditions.

PSD2's main goal was to break down the monopolistic control banks had over customer data. By requiring banks to provide API access to TPPs, PSD2 facilitated the entry of new players into the financial services market, thereby increasing consumer choice and fostering a more competitive landscape. PSD2 also establishes the legal foundation for secure and efficient data sharing, setting the stage for the development of a more integrated and competitive financial ecosystem in Europe [1].

This regulatory shift was complemented by advancements in technology, particularly the proliferation of mobile banking and digital financial services, which further accelerated the adoption of Open Banking practices.[2]

Open banking began to transform the way financial services were delivered and banks' business models themselves. New four business model possibilities are possible through the use of open APIs: *Bank-as-a-distributor*, *Bank-as-a-producer*, *Bank-as-a-service*, *Bank-as-an-integrator* [3].

The potential benefits of Open Banking include improved customer service, personalized financial products, and enhanced operational efficiencies. However, the transition also poses significant challenges, such as ensuring data security, maintaining regulatory compliance, and managing the complexities of integrating new technologies.

Third-party providers are integral to the Open Banking ecosystem. The literature identifies three main categories of TPPs: Payment Initiation Service Providers (PISPs), Account Information Service Providers (AISPs), and Card Issuer Service Providers. PISPs facilitate online payments directly from the consumer's bank account, bypassing traditional card networks. AISPs provide consolidated account information from multiple banks, enabling users to manage their finances more effectively. Card Issuer Service Providers offer card-related services through API integrations [4].

Following the PSD2 more regulations are already being planned, such as PSD3 and FIDA. These

forthcoming regulations aim to build on the foundations laid by PSD2, addressing emerging technological advancements and market dynamics. PSD3 is expected to introduce stricter security measures, more robust consumer protection mechanisms, and enhanced standards for API integration and data interoperability.

The FIDA initiative, on the other hand, seeks to create a more comprehensive framework for financial data access, extending beyond payment services to include a broader range of financial products and services and enabling consumers to have greater control over their financial data.

3. Methodologies

The primary objective of this thesis is to provide a comprehensive overview of the Open Banking landscape in Europe. This study aims to identify potential trends and phenomena that may indicate the future direction of the industry in the upcoming years. To achieve this, the thesis seeks to answer several research questions formulated after a thorough literature review. These questions include: What are the trends followed by third-party providers (TPPs) that use Open Banking services in Europe? Who are the main customers of TPPs using Open Banking? How does the future look for these offerings going forward?

This section provides an in-depth look at the processes involved in creating the thesis, which is divided into three distinct parts: literature review, data collection for the census, and synthesis and analysis of findings. Each part employs a rigorous methodology to ensure thorough and comprehensive research

3.1 Literature Review

The literature review was essential in familiarizing with the current state of knowledge on Open Banking. To achieve this, various sources were studied and cited throughout the work. Initially, an overview of payment methods was conducted to better understand the context and position of Open Banking compared to other systems.

The review then delved into the foundation of Open Banking, which is the API and Open API. It was crucial to understand what APIs are, how they work, and the different types that exist, especially open APIs, followed by an examination.

With the necessary background established, the phenomenon of Open Banking was described, tracing its evolution over the years since its inception and also exploring the advantages and challenges that it presents. Furthermore, the literature review explained third-party providers, differentiating between payment initiation service providers, account information service providers, and card issuer service providers, outlining their capabilities and limitations.

The review concluded with a general overview of the Open Banking situation in Europe, including norms and directives from the European Commission. The PSD2 directive was analyzed, followed by discussions on future directives like PSD3/PSR and FIDA. Brief descriptions of the UK and Italy's situations were provided, noting the UK as a promoter of Open Banking, while Italy's situation appeared less positive.

3.2 Data collection for census

Regarding the data collection, data on the presence of third-party providers in various European countries was gathered from the European Banking Authority (EBA) website. The EBA is an independent EU authority with the objective of safeguarding the integrity and robustness of the EU banking sector. The data considered for analysis was updated until the end of 2023. Any changes made after that were not included.

To narrow down the search for institutions, various options had to be selected on the institution search page, such as the national competent authority, the country where the services are provided, and the specific services of interest (payment initiation services and account information services).

Despite some challenges with the website, such as the inability to filter providers acting solely as

Payment Initiation Service Providers or Account Information Service Providers and the inability to select a specific limited period in the past, these issues were addressed through calculations.

3.3 Analysis of the data

The analysis of the census data was crucial to understanding the demographic and socio-economic situation of different European regions. To provide a comprehensive representation, the analysis focused on seven prominent European countries: Italy, Germany, Spain, France, Sweden, Poland, and the Netherlands. These countries were chosen based on their large economies and diverse geographic locations.

The analysis was divided into two main parts. The first part focused on the number of TPPs and their typology in each country, specifically Payment Initiation Service Providers (PISPs), Account Information Service Providers (AISPs), and combined PISP/AISP. The research also tracked the year of authorization for each TPP and noted those from which authorization was withdrawn. It was important to differentiate between domestic TPPs, operating within their home country, and international TPPs, providing services from a different state. This differentiation allowed for a comparative analysis through separate tables for each country.

The second part focused on each TPP considered in the previous part, providing the exact number of TPPs operating in the selected countries. eight variables were considered for each TPP: *the country of origin, the type of player, the type of customer, the Open banking services provided (PISP, AISP or both), the countries serviced, the services provided with the account information license, the services provided with the payment initiation license and other services offered by the company.*

4. Analysis and results

This section offers a thorough analysis of Third-Party Providers (TPPs) participating in open banking in various European countries. The study assesses the expansion, distribution, and categories

of TPPs, as well as their licensing and service offerings under the PSD2 framework. The analysis comprises a review at the national level and a more in-depth examination at the enterprise level, encompassing the various types of players and the customers they serve.

4.1. National level

The growth and distribution of TPPs vary significantly among the countries studied, including Italy, Germany, France, Spain, Sweden, Denmark, Netherlands, and Poland.

- **Italy** has a complex scenario with a low number of home-authorized TPPs but the highest number of passported TPPs. This indicates a significant presence of foreign TPPs operating within the country.
- **Germany** shows early adoption and strong initial growth in TPP numbers, but market saturation and competition have slowed the entry of new TPPs since 2021.
- **France** experienced a robust initial uptake in Open Banking which has since stabilized. The country has a balanced distribution of PISP and AISP licenses.
- **Spain** saw delayed growth due to later PSD2 ratification but has shown progress in standardization and support for Open Banking initiatives.
- **Sweden and the Netherlands** have high digital adoption rates, fostering advanced Open Banking ecosystems. Both countries, however, face market saturation.
- **Poland** has a nascent Open Banking sector with fewer TPPs but significant growth potential driven by regulatory developments and market adoption.

Overall, Italy, Germany, and France exhibit a larger number of TPPs authorized to offer both Payment Initiation Services (PISP) and Account Information Services (AISP). In contrast, Denmark and Poland have fewer home-authorized TPPs but show consistent growth in passported TPPs. This trend reflects the varied regulatory environments and market maturity in adopting open banking solutions across Europe.

The European overview reveals a fragmented landscape in the adoption and implementation of open banking. Each country faces unique challenges, from regulatory hurdles to varying levels of digitalization and standardization issues. The lack of uniform API standards is a significant barrier, causing financial institutions to develop customized APIs, which is both time-consuming and expensive. The introduction of PSD3 and new PSR directives is expected to alleviate these issues. The distribution of TPPs across Europe shows a general preference for account information services (AIS) over payment initiation services (PIS), despite the latter offering significant advantages such as cost-effectiveness and faster transaction confirmations. The lag in PIS adoption is attributed to established domestic alternatives, prohibition on surcharging, and obstacles to using TPPs at points of sale. If these obstacles are overcome, PIS could introduce effective competition and resolve the fragmented market for innovative payment solutions.

4.2. Enterprise level

At the enterprise level, the thesis delves into the characteristics and strategic choices of 257 analyzed TPPs. The analysis covers several aspects: the type of player, type of customer, open banking services provided, and other related services.

Starting from the first one, the TPPs are categorized into different types, including fintech companies, open banking platforms, and businesses focused on accounting and audit services. Fintech companies dominate the landscape, representing more than half of the TPPs. Open banking platforms form the second-largest group, providing solutions to banks and other fintechs, thus standardizing APIs and facilitating broader service integration. Accounting and audit firms, though fewer, leverage open banking primarily for data collection and analysis.

Moving to the customers, The TPPs serve diverse segments:

- **Enterprises:** The largest customer group, encompassing small, medium, and large businesses. These TPPs offer services to enhance business efficiency through open banking technologies.
- **Individual Customers:** Services tailored for individual financial management and improved understanding of personal finances.
- **Financial Institutions:** TPPs provide enhanced solutions such as new APIs and additional financial information services.
- **E-commerce:** Focused on online businesses, offering simpler payment systems and financial management tools.
- **Mixed Customer Bases:** Some TPPs cater to both enterprises and individual customers or financial institutions, providing versatile solutions adaptable to different needs.

The customer distribution analysis shows that over 65% of TPPs provide services to enterprises, reflecting a preference for the broader revenue opportunities offered by business clients. Individual customers form the second-largest group, with TPPs focusing on personalized financial services. Financial institutions occupy a smaller segment, likely due to their preference for developing in-house solutions.

This paragraph outlines the various services offered by TPPs under their AISP and PISP licenses. AISPs primarily focus on financial data aggregation and analysis, providing users with a consolidated view of their financial status. This service is highly beneficial for individuals and businesses looking to manage multiple accounts and gain insights into their financial health. PISPs facilitate payment initiation services, allowing users to make payments directly from their bank accounts without needing intermediaries. This service offers significant advantages such as cost reduction and faster transaction confirmations, improving the efficiency of payment processes for both consumers and businesses. Some TPPs hold both AISP and PISP licenses, enabling them to offer comprehensive financial solutions. These dual-licensed TPPs can provide a seamless experience, integrating account information services with

payment initiation, thereby simplifying financial management for users.

In addition to primary open banking services, many TPPs offer a range of other services to enhance their value proposition. Accounting and auditing services are prominent among these additional offerings. TPPs leverage open banking data to provide comprehensive financial insights and ensure compliance with financial regulations, aiding businesses in maintaining accurate records and meeting audit requirements. IT services, including API management, cybersecurity solutions, and technical support, are also commonly offered by TPPs. These services ensure that the integration and operation of open banking systems are smooth and secure, allowing businesses to focus on their core activities without worrying about technical issues. Financial advisory services are provided by some TPPs, offering personalized financial advice and wealth management services. Leveraging the aggregated financial data obtained through open banking, TPPs can provide tailored recommendations to help individuals and businesses make informed financial decisions, manage their wealth effectively, and plan for the future.

These additional services allow TPPs to differentiate themselves in a competitive market and provide holistic financial solutions to their customers.

5. Conclusion

Open banking has significant socio-economic benefits, including promoting financial inclusion and stimulating economic growth. It improves access to financial services for unbanked and underbanked populations and underserved businesses through fintech solutions like microloans and financial education tools. This approach is projected to boost the EU's GDP by 1-1.5% by 2030, primarily benefiting financial institutions. The growth stems from increased innovation and competition, leading to new fintech startups, job creation, and improved financial efficiency and productivity.

5.1. Recommendations

For financial institutions, it is crucial to invest in advanced cybersecurity measures to protect customer data. Collaborating with fintech startups and third-party providers (TPPs) can foster innovation and enhance the customer experience. Implementing educational programs can empower consumers to manage their finances securely, building trust and engagement with open banking services.

Legislators should create a dynamic regulatory framework that adapts to technological changes and new business models. They must prevent monopolies by big tech firms through measures like the “reciprocity clause” and harmonize regulations across borders [6]. Ensuring customer safety with strict data protection laws and awareness campaigns is essential. Supporting innovation by establishing sandboxes for controlled experimentation and providing incentives for research and development in financial technologies is also important.

Third-party providers need to prioritize cybersecurity, comply with regulatory requirements, and enhance customer experience through intuitive interfaces and personalized services. Maintaining consumer trust through transparent communication and robust customer support is vital. Collaborations with other TPPs and financial institutions can create comprehensive financial solutions and provide valuable insights.

Future research should focus on the ongoing evolution of open banking, its integration with other financial technologies, and the socio-economic impacts of these advancements. Regular analysis of consumer behavior, market dynamics, and regulatory changes is essential for adapting strategies to ensure sustainable and secure growth. Open banking, driven by PSD2, represents a significant advancement in the financial sector, offering opportunities for innovation and fostering a more inclusive, efficient, and dynamic financial ecosystem.

6. Bibliography

- [1] European Commission, «Payment services: revised rules to improve consumer protection and competition in electronic payments,» 28 6 2023. [Online]. Available: https://ec.europa.eu/commission/presscorner/detail/en/qanda_23_3544.
- [2] Wordline, «How Open Banking is transforming digital payment,» [Online]. Available: <https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwiejMmwm9CDAXVr0AIHHehpChMQFnoECBYQAQ&url=https%3A%2F%2Fworldline.com%2Fcontent%2Fdam%2Fworldline%2Fglobal%2Fdocuments%2Fwhite-papers%2Fwhite-paper-how-open-banking-is-transforming-o>.
- [3] D. Pennetta e L. Gambarelli, «Banks’ attitude to partnership as an antecedent of Open Banking platforms: structural determinants and effects on performance in the Italian context,» [Online]. Available: <https://iris.unimore.it/retrieve/95d2d57c-7856-4464-bb98-83661fecb159/0223.pdf>.
- [4] GoCardless, «What are open banking providers (AISP & PISP),» 9 2023. [Online]. Available: <https://gocardless.com/guides/posts/what-is-tpp-in-open-banking/>.
- [5] B. N. Alessandro Palmieri, «Open Banking and Competition: An Intricate Relationship,» [Online]. Available: https://ec.europa.eu/programmes/erasmus-plus/project-result-content/88f79a68-d8c7-4fa0-b41b-9f60ee3d13d1/1_-_Materials_on_Open_Banking.pdf.

7. Acknowledgment

I express my gratitude to Professor Perego for granting me the opportunity to work on this thesis project. I am also sincerely thankful to Matteo Ruggieri, whose assistance and support were invaluable from the initial stages right through to the conclusion. Lastly, I would like to extend my thanks to my relatives and friends who have been unwavering in their support throughout this extensive academic journey.

1. Literature Review

1.1. Payment Methods Overview.

In order to contextualize the main focus of this thesis, which is to gain an understanding of services created using the Open API framework, it is essential to provide a summary of the payments industry, current trends, and explain why the Open API is of great importance for digital payments.

In contemporary times, there exists a diverse range of payment methods that span from traditional options, such as the use of **cash** and **credit or debit cards**, to more progressive and innovative approaches. These novel methods encompass payment methods like **Account-to-Account (A2A)** transactions, **Buy Now Pay Later**, **Digital Wallets** and **Cryptocurrencies**. The advent of these new payment solutions has revolutionized the way people transact in the digital age, providing them with more secure, convenient, and flexible options to meet their financial needs.

The payments industry has demonstrated remarkable dynamism in recent years, as evidenced by its ability to weather tumultuous crises. Despite facing challenges such as the COVID-19 pandemic, supply chain disruptions, and geopolitical tensions, the payments sector has continued to lead other industries in terms of innovation. However, the unrelenting pace of disruption has begun to take its toll, exerting pressure on institutions that have been slow to modernize. Consequently, industry leaders must confront this disruption head-on and do so swiftly, as failure to move quickly carries tangible risks.

During the years spanning from 2017 to 2022, the payment industry experienced an impressive 8.3% growth in revenue, totaling an impressive \$1.6 trillion. Predictions also indicate that transaction-related revenue will continue to rise, though at a slightly lower rate of 7.1% until 2027, marking a decrease of 1.9 percentage points from the previous five-year period. This shift is attributed to three main factors. One, retail A2A payments are anticipated to surpass card transactions by 2027 (with a CAGR of 11.7% versus 6.8%), resulting in lower returns. Two, certain markets are experiencing compressed card margins due to heightened competition and regulatory pressures. Finally, as noncash conversion reaches maturity in advanced markets, cashless payments are expected to plateau. [1]

Per the “World Payments Report 2023”, the majority of non-cash transaction volume in 2022 was represented by conventional payment methods, accounting for over 83%, while new payment methods comprised nearly 17%. The report further predicts that by 2027, new payment methods will represent approximately 28% of the total volume, while the share of traditional payments will decrease to about 72% of overall non-cash transaction volumes.

Account-to-account (A2A) payments are direct payment transactions from one account to another. A2A transactions have been a popular payment method for business-to-business (B2B) and person-to-person (P2P) use cases for some time. In recent years, A2A payments have become increasingly prevalent in person-to-business (P2B) transactions. Merchants are attracted to A2A payments due

to their ability to reduce the cost of payment acceptance compared to card payments and to provide instant settlement of funds. Consumers favor A2A payments because of their safety, simplicity, and speed. Some merchants even offer discounts to customers as an incentive to pay with A2A. [2]

According to "the Global Payment Report 2023," A2A payments are disrupting payment value chains. A2A payments have a competitive edge over card payments as they move money between accounts without intermediaries. An expanding adoption of **open banking** and real-time payment networks is transforming A2A payments into a formidable player in the industry, with the potential to replace card payments. Although A2A payments have traditionally leveraged payment rails such as ACH or SCT, they are now also executed over instant payment rails such as RTP and SCT instant, making transactions even faster and more efficient. While A2A payments are well-suited for consumer-to-consumer (C2C) transactions, they are expected to gain similar traction in consumer-to-business (C2B) transactions. [3]

Despite the rise of A2A payments, **credit card** transactions continue to thrive, with transaction values increasing by 6% in e-commerce and 12% at POS YoY from 2021-2022. This growth is attributed to a resurgence in discretionary spending and global travel post-pandemic. These values are expected to continue to rise at a CAGR of 4% through 2026, with consumer preferences for credit at checkout expanding to include card-funded digital wallets, BNPL, and other POS financing options. Therefore, merchants should offer these payment methods to meet the growing demand of consumers. [3]

However, while credit card spending is on the rise, its share of global transaction value is expected to decline through 2026, with a 2% decrease at POS and a 4% decrease in e-commerce. Alternative payment methods are gaining popularity in many parts of the world and taking share from cards. APMs are predicted to grow twice as fast as person-to-merchant payments from 2022 to 2027, making it important for merchants to keep up with changing payment trends.

Digital wallets are currently the most popular payment method both for online purchases and physical transactions. They are expected to maintain their leadership position in the coming years. In fact, their usage at physical points of sale is projected to increase at a compound annual growth rate of 15% between 2022 and 2026.

While APAC remains an outlier with the overwhelming majority of wallet share, digital wallets are now the leading e-com payment method in Europe (having taken the lead in 2021) and North America (where wallets passed credit cards for leading status in 2022). [3]

The use of **cash** in the global economy has been steadily declining, but a completely cashless society remains a distant prospect. This trend is driven by three primary factors. Firstly, governments in emerging economies continue to promote financial inclusion by expanding access to digital payment services. Secondly, the shift towards digital payments has accelerated due to changes in consumer habits, particularly during the COVID-19 pandemic. Finally, merchants are finding it increasingly affordable and convenient to accept mobile payments using QR codes.

However, cash still plays a crucial role in most economies, particularly for point-of-sale (POS) merchants in the majority of markets. The rate of decline in the use of cash has leveled off after accelerating during the peak of the pandemic. Although its share of the total transaction value is

expected to decline in all markets covered until 2026, cash continues to be an essential component of most economies.

It is worth noting that not all countries are embracing this trend towards a cashless society at the same pace. Some countries are promoting this move, while others are attempting to slow down the decline of cash usage, concerned about its effects on certain sections of the population, such as the elderly. Italy is an example of the latter, as legislation has increased the limit for cash transactions to 5000€ from the previous 1000€, thus slowing down the decline of cash usage.

Despite the challenges it faces, consumer interest in alternative credit products continues to be high, as **buy now pay later (BNPL)** enters a so-called "2.0" phase. Some BNPL providers have seen significant reductions in company valuations, and the fundamental principle of offering consumers interest-free credit is being questioned due to rising inflation and interest rates. Regulators in major markets are introducing rules to address concerns about customer welfare to bring BNPL more in line with legacy consumer credit products. [3]

Nevertheless, BNPL continues to show strength, and consumers remain interested in alternative credit, especially during difficult economic times. The total value of BNPL transactions continues to grow, as does its relative share. After a period of dramatic growth from 2018-2021, the BNPL market has entered a phase of sustainable growth as it has become a more mainstream part of credit regulation. The new era of "BNPL 2.0" is characterized by a new class of BNPL providers that includes merchants, Big Techs, banks, card networks, and super apps. There are new regulations that bring BNPL in line with legacy consumer credit products, a more diverse range of repayment terms, including longer terms of up to 12 months, and revolving accounts. There is also increasing transparency of interest and fees for late payments. BNPL is now offered in a wider range of verticals, including vertical-specific BNPL providers, and for goods and services at a more extensive range of price points. [3]

Lastly, **cryptocurrencies** are still hardly used for person-to-business (P2B), consumers are more interested in them as investment vehicles, thanks to their price market volatility. Despite these headwinds, more merchants are discovering the benefits of accepting cryptocurrencies as payment for goods and services: the ability to reach a new customer base, higher average transaction values, faster settlement times and lower transaction fees. For these reasons, our current forecast for cryptocurrencies as a P2B payment method is to rise from \$11.6 billion in e-com spend in 2022 to approximately \$39 billion by 2026, or slightly less than 0.5% of global e-com transaction value. [3]

1.2. API and Open API

After understanding the present scenario in the payments industry, it is important to delve deeper into the concept of **API** (Application Program Interface) in order to understand open banking. An API is a set of programming codes that enables data transmission between software applications, working as an intermediary that allows different applications to communicate with each other. In contrast to a user interface, where the user inputs data and sends it to the application for processing

before receiving the results, the API doesn't interact with the user but processes the data received from one program module and transmits the results back to the other module.

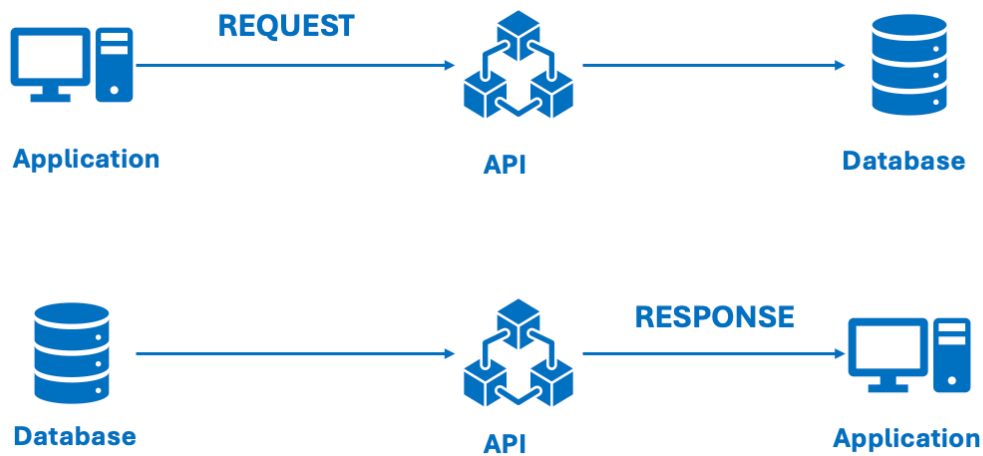


Figure 1: How API works

Application program interfaces consist of two interrelated components:

- **Technical specification** that describes how information is exchanged between programs in the form of a request and a return of the necessary data.
- **software interface** written to that specification and published in some way for use

[4]

When software desires access to the features or abilities provided by an API, it is known as calling it. On the other hand, the software that originates the API is known as publishing it.

API has enhanced the quality and delivery of software and services throughout its existence by reducing development time, expenses, and the risk of errors.

Being a set of rules, an API standardizes how developers write application code and helps to streamline and increase code transparency. This also facilitates collaboration among developers as they build software components with the intent of integrating with APIs.

There are different types of APIs and they can be categorized based on their release policies.

Private APIs are created for internal use by a company's developers to enhance its products and services. Although the interface may be publicly accessible, it remains exclusive to those directly associated with the API publisher.

Partner APIs are shared only with business partners who have signed an agreement with the publisher to share data. They are usually used for software integration between the two parties. In

this way, the provider can benefit from extra revenue streams and, at the same time, can monitor how the exposed digital assets are used.

Public APIs can be either Commercial APIs or Open APIs.

- **Commercial APIs** users must pay subscription fees. Publishers usually offer free trials to let the users evaluate the API before buying the subscription.
- **Open APIs** are those with all features available for use without restrictive terms and conditions. The definition also states that the API description and any related documentation must be openly available and the API can be freely used to create and test applications.

[4]

This thesis focuses on open APIs, which have become increasingly important for the financial sector in Europe since the implementation of the Payment Service Directive 2. This directive requires banks to open their APIs to authorized third-party providers, allowing them to offer new services to consumers and businesses. These services are wide-ranging and can include the following:

- **Data access:** Third-party developers can securely access financial data authorized by banks, such as account information, transaction history, and balances, with the consent of customers.
- **Payment initiation:** APIs enable third-party payment initiation services, allowing users to initiate payments from their bank accounts via third-party applications that integrate with banks' APIs.
- **Account verification:** APIs are used to verify customer credentials, including account ownership and credentials validation, to ensure the accuracy and security of transactions.
- **Product and service integration:** APIs facilitate the integration of financial products and services provided by banks with third-party applications, allowing for a consolidated view of a user's accounts and personalized financial advice.
- **Transaction history:** APIs provide access to transaction history, which can be used for budgeting, financial management, expense classification, and personal financial insights.
- **Consent management:** APIs are used to manage customer consent in open banking systems, allowing customers to control their data and opt in or out of third-party programs.

[5]

To gain a comprehensive understanding of the current trends in Open API services in finance, it is essential to analyze their distribution. By classifying them into specific categories based on their intended purpose, we can identify the most commonly used types of APIs. These categories include

customers, loans, transactions, payments, accounts, investments, infrastructure, cards, insurance, product information, and others, each with unique characteristics. [6]

1.3. Open Banking

As mentioned above, European banks are obliged to open their APIs to third parties. This phenomenon takes the name of **Open Banking**.

Retail banks and traditional real-time bank transfers have maintained a competitive edge by closely guarding their customer data. This has historically allowed banks to maintain control of the customer relationship, creating significant barriers for potential competitors.

Open Banking seeks to challenge this status quo by encouraging innovation and fostering competition, resulting in lower prices, and consumer choice through the use of Open APIs, which can be utilized by authorized third parties to offer innovative financial services. For online businesses, Open Banking presents an opportunity to gain even deeper insights into customer behavior and drive sales growth, as long as they are able to access and properly analyze the necessary data.

[7]

Although it has been in place for some years now, PSD2 and UK Open Banking had an underwhelming impact on both regulators and banks. Regulators are focusing on areas where there is either too much or too little regulation. At the same time, banks have attempted to create value around it, but have struggled to find the right balance for both consumers and traders, leaving in this way this profitable and growing segment that fintech and their investors can easily occupy and find a way to exploit.

Even though the slow pace is quite disappointing, as said before, account-to-account (A2A) is gaining momentum in Europe. Several initiatives have shown that after individuals cross the trust barrier, they can experience the strong user experience of A2A, which is particularly smooth on mobile due to the link with mobile banking apps, resulting in an improvement from typing in card details.

The difference between the two is that card payments involve multiple intermediaries, including card issuers, networks, acquirers, and fraud engines, resulting in high fees for merchants as each intermediary takes a portion of the transaction. On the other hand, A2A payments only involve the fintech company as the intermediary, making it a more direct and potentially cost-effective option.

[8]

Open banking is being driven globally by both industry and central banks with the objective of bringing payments back into the banking system or preventing them from leaving in the first place. The intention behind this is to allow banks to continue being responsible for managing money and handling data and risk.

[9]

Through open banking, the business models of banks can change in several areas:

- **Bank-as-a-distributor:** By making use of open APIs, banks can concentrate on generating revenue from their data. This can be achieved through collaboration with fintech firms, which will provide the necessary technology to provide customers with the most satisfactory user experience.
- **Bank-as-a-producer:** Financial institutions have the ability to modify their value chain by dividing the creation and distribution of financial services. Through the use of APIs, banks can link with other financial service providers and present top-notch offerings to their clients. In cases where the Financial institution is confident in its ability to execute certain products, it will opt to produce them in-house. Alternatively, if the Financial institution lacks expertise in certain areas, they will acquire products from external sources.
- **Bank-as-a-service:** Banks and other financial institutions can offer full banking services to non-banks through the bank-as-a-service model, they neither produce nor distribute financial products, but offer different capabilities to TPPs. These services can include deposit accounts, loans, payments, and compliance-as-a-service, Know your customer (KYC), all utilizing the secure and regulated infrastructure of an established licensed financial institution. This model enables businesses to integrate banking services into their customer offerings seamlessly.
This role has the highest openness degree because banks do not communicate with a limited number of TPPs but may potentially interact with the totality of financial institutions.
- **Bank-as-an-integrator:** banks create and distribute the offering under one brand so that they fully control the whole value chain and the customer experience. This model is characterized by a low openness degree, as banks do not open their boundaries to external parties for partnerships beyond compliance issues.

[10]

The significance of the distribution model is growing for both banks, who are creating a network of third-party applications through open APIs, and for neobanks, who are eager to rapidly expand their range of products by collaborating with external providers.

Banks with advanced digital infrastructure can make money from Open Banking by offering Bank as a Service. In this scenario, Neobanks can be in a better position to adopt and monetize these models than banks that have not yet updated their framework, It is highly likely that they have already transitioned to an API-empowered infrastructure, or require less work to implement it.

Open banking has also been identified by the Euro Banking Association (EBA) as a solution to various issues faced by small and medium-sized enterprises. These enterprises have been difficult to serve with personalized services due to their varying sizes, levels of maturity, and types of activities. However, the use of API through open banking can offer bespoke solutions to SMEs by enabling financial services providers to collaborate for their development.

SMEs have diverse financial requirements, but they can be broadly classified into three categories. Firstly, they need access to funding for operational costs and investments. Secondly, they require financial services to support their daily business activities, such as payment collections and foreign exchange. Lastly, they want financial services that can provide added value, such as better decision-making capabilities. SMEs spend a significant amount of time on non-core activities like banking and accounting, which can be simplified by financial providers through streamlined onboarding processes, faster credit decisions, and services catered to their customers' needs.

Data sharing among banks, third-party providers, and SME customers in open banking can result in a mutually beneficial situation for all parties involved. SMEs can take advantage of multiple bank account views in real-time, receive instant loan application decisions, benefit from automated processing for time and cost savings, and access integrated tools for payments, invoicing, and accounting. Value-added insights and services are also available. Open banking allows financial service providers to collaborate with each other through data, products, and services, depending on their strategy and position.

[8]

For Open Banking to fully start utilizing its benefits, it must first overcome certain obstacles that require cooperation from all parties involved, such as financial institutions, third-party providers, and firms.

One significant challenge facing Open Banking is customer concerns regarding data security. With the growing fear of personal information exploitation, it is essential to establish trust with customers in order for them to grant consent for their banking data to be accessed by third-party providers. Failure to do so could ultimately result in Open Banking's failure.

To overcome this obstacle, all parties involved must implement several measures to ensure customer data is not mishandled. One such way is to communicate transparently with customers regarding which data is being accessed and by whom. This information should be easily accessible to customers, possibly through an online dashboard, and push notifications should be sent when a third party requests access.

Customers must also be granted granular control over their data, allowing them to decide which information can be shared and the ability to deny or revoke access immediately and without difficulty.

While the General Data Protection Regulation (GDPR) has contributed significantly to safeguarding consumer data rights, it is still necessary to educate customers about its implications. Communicating the importance of GDPR compliance for all parties accessing banking data and reminding customers that they own their data and can request its removal at any time can go a long way in reassuring them.

As already written, APIs are essential for open banking as they facilitate data flow between financial institutions, third-party providers, and consumers. However, their importance also makes them a prime target for cyber threats [11]. According to Salt Security's recent "State of API Security Report," 94% of respondents experienced security issues with their production APIs in the past year. Additionally, 31% had a sensitive data exposure or privacy incident within the same period [12].

The introduction of open banking has made APIs an attractive and very lucrative target for bad actors and Salt Labs data supports these findings, showing a 681% increase in API attacks and a 244% increase in unique attackers targeting financial and insurance institutions by mid-2022. [12]

The lack of API standardization is another factor that hinders the adoption of Open banking. While PSD2 mandates the provision of API, there are no specifications on the format or standard in which the information should be presented. This has resulted in a fragmented ecosystem, with some banks adopting their own standards, while others follow those set by the Berlin Group or STET. Despite efforts to create standardization, there are still more than 50 standards in use by thousands of banks across Europe, along with various local offerings in each market. To address this, some aggregators have emerged to provide access to multiple APIs through a single format. Additionally, several players, that provided payment initiation services before Open Banking APIs were available, have a technological advantage over newer entrants. [7]

1.3.1. Open banking performance

In the banking industry, many financial institutions produce quarterly reports that analyze the performance of their open banking channels in comparison to their other digital offerings, such as online and mobile banking applications.

When we consider some of the UK banks such as HSBC, and Nationwide, which were amongst the first to adopt open banking, and take a look at the report for the last quarter of 2023, we can see how open banking has proven to be significantly better compared to other channels.

Taking for example the time it takes to respond to a request for account information and to initiate payments, it is possible to see that in the case of HSBC, the times are:

- Account information service performance:

Month	Open banking performance (ms)	Online banking performance (ms)	Mobile banking performance (ms)
October 2023	579	2234	753
November 2023	690	2375	743
December 2023	587	2330	742

Table 1: HSBC account information service performance

- Payment service performance

Month	Open banking performance (ms)	Online banking performance (ms)	Mobile banking performance (ms)
October 2023	358	2900	1806
November 2023	357	2446	1809
December 2023	346	2360	2855

Table 2: HSBC payment service performance

While for Nationwide the times are:

- Account information service performance:

Month	Open banking performance (ms)	Online banking performance (ms)	Mobile banking performance (ms)
October 2023	283	1824	569
November 2023	299	1847	597
December 2023	285	1812	587

Table 3: Nationwide account information service performance

- Payment service performance:

Month	Open banking performance (ms)	Online banking performance (ms)	Mobile banking performance (ms)
October 2023	332	993	775
November 2023	357	994	777
December 2023	439	978	838

Table 4: Nationwide payment service performance

The analysis reveals that, despite any potential differences between the two banks, open banking proves to be the fastest channel, with a notable gap in some cases, often using less than half of the time required by traditional methods.

1.4. Third-Party Providers

On 13 January 2018, the new European Payment Services Directive (otherwise known as “PSD2”) came into force. The purpose of PSD2 is to promote the development and growth of digital payment services (payments made via apps and mobile sites), making them more efficient, competitive and secure for users.

PSD2 governs new payment services provided by non-banks, known as “third-party providers”, or TPPs.

Regulated Third-Party Providers access your bank account data and initiate payments only with the owner’s consent, which can be revoked anytime to keep the owner in control.

There are different kinds of TPP, and they can fulfill varying roles:

1.4.1. Account Information Service Provider

AISPs (Account Information Services Providers) are businesses that allow users, who have online-accessible accounts, to obtain comprehensive information on the payment services used by their accounts [13].

Access provided to third-party companies, known as Account Information Service Providers (AISPs), is restricted to read-only mode. This means that they can only view the information, but cannot make any changes or movements to the account. To use this service, a company must have an AISP license and rely on regulated companies that offer accounts, known as Account Servicing Payment Service Providers (ASPSPs). These regulated companies can be banks, credit card providers, payment institutions, or building societies [14].

This service can be used, for example, by customers to gain an overview of their financial situation, analyze their spending habits, and understand their future financial needs.

Account Servicing Payment Service Providers (ASPSP) are required to provide their customers, who are users of authorized AISPs in the European Union, with access to payment account information upon request. This allows AISPs to offer information aggregation services for payment accounts held by the ASPSPs to their customers. Customer data and access to payment accounts may only be used by AISPs for purposes authorized by the customer.

1.4.2. Payment Initiation Service Provider

These are companies that offer payment initiation services to users with explicit consent from the client. Acting as intermediaries between the bank and payment account holders, they enable users to initiate payments to third parties, going through an ASPSP accessed online and removing the need for a credit or debit card [13].

The Payment Initiation Service Providers (PISPs) are beneficial for retailers and other businesses that require bank-to-bank payments. Moreover, financial management tools also make use of PISPs to transfer money between accounts automatically. This helps ensure that the user does not incur overdraft fees by shifting money from a savings account into a current account.

PISPs can simplify the payment process for frequent shoppers by allowing businesses to connect directly with their bank accounts. This saves time and effort for customers as they don't need to repeatedly enter payment information manually [14].

In this case, the ASPSP is required to manage payment orders initiated by their customers through qualified PISPs operating in the EU. In contrast, the PISPs can provide initialization services for payment orders to all ASPSPs where customers have payment accounts.

PISPs are also authorized solely to operate the new payment service and are not permitted to handle debtor funds [14].

The customer no longer needs to log into their account to arrange a transaction; instead, it's set up automatically like a card payment [15].

PISP providers are independent of any single bank, which means customers can use them regardless of where their current account is located. The payment process is streamlined and simple, and transactions can be easily authenticated using a mobile device or biometric login.

There are multiple benefits for businesses as well. Firstly, PISP providers make payment easier for customers, which can help build brand loyalty and reduce abandoned shopping cart rates. Secondly,

bank transfers require tools like Strong Customer Authentication (SCA) to cut down on fraud. Only the customer can authenticate the transaction without passing any payment details to the merchant or provider. In turn, this reduces your business's liability and risk.

Thirdly, PISP open banking payments are collected and settled on the same day, which is much more efficient than other types of bank payments that can take several days to settle. Payments can even arrive in your merchant account in a matter of seconds. Fourthly, PISP open banking payments prevent chargebacks because the buyer is the one who 'pushes' the payment and makes the request.

Finally, PISP providers offer more transparent and affordable pricing models when compared to traditional payment gateways and banking services. Credit card charges often involve a list of small fees, not to mention the risk of fraud or chargeback costs. Therefore, PISP providers can be a more affordable option for businesses [14].

1.4.3. Card Issuers Service Provider

These are companies that provide payment cards, linked to an online payment account opened with a different bank than the one issuing the card. While CISPs do not hold clients' funds, they can inquire with the bank where the account is held to ensure the funds are available for the intended transaction, but only if the debtor's account can be accessed online and they have given consent to both the ASPSP and CISP.

The response will only be a yes or no, and the CISP cannot view the account balance or keep the reply for any purpose other than processing the payment. [16] This thesis will focus more on the other two kinds of TPPs

The biggest challenge that these TPPs have to overcome is that there are already many alternative payment methods accessing bank payment rails and Buy-now-pay-later schemes serving the European market for digital payments. These schemes have gained consumer trust and acceptance from merchants, which can take a long time to establish. While the UK is a leader in enabling Open Banking payments, there are structural and technical obstacles outside of the UK that hinder payment initiation services (PIS) adoption due to API standard fragmentation and inconsistent availability, as some banks only create APIs to meet regulatory requirements and neglect performance. Open Banking payments also lack the clear rules and servicing backbone that exists for cards, whereas servicing of Open Banking payment fraud or other exceptions continues to be somewhat ambiguous. Adoption of PIS payments remains low with early adoption in verticals such as gaming and crypto exchanges. Although use cases for PIS payments are still developing, the rails for accepting bank APIs for payments are now largely in place via specialized Open Banking fintechs (such as Tink, Token, Truelayer, Yapily and others). In contrast to PIS, account information services (AIS) have gained greater traction. While stymied by the same API quality and availability barriers, they have not faced the same challenges as PIS payments. As an enabler of new business models and being a B2B solution, new fintechs were quick to launch AIS-powered businesses. The integration of TPPs that offer AIS and PIS capabilities is becoming more common in order to enhance existing financial services such as direct debt, as well as to enable new use cases such as BNPL.

[17]

1.5. PSD2 Gateway

Several European countries, including Italy, have endeavored to establish standard technical specifications for dedicated interfaces. To this end, the Berlin Group has developed the **“NextGenPSD2 Framework”** standard. The banking industry has consequently collaborated to define application solutions for the dedicated interface system, which is a critical component of the new payments ecosystem, alongside banks and third parties, which are referred to as **“system platforms”**. A system platform offers itself to third parties as a single access point single access point to the cluster of member banks, offering:

- Common services made available to third parties, including management of technical specifications of interfaces, development support, testing, change management, trouble-ticketing;
- Basic transaction management functions: authentication of TPPs, message checks on APIs, support for authentication procedures strong client authentication procedures, client consent management, monitoring of performance, reporting;
- Network functions: single access point for all member banks (ASPSP) and for TPPs;
- Dual mode for banks: member banks can operate as ASPSP (passive mode) or as OPT (active mode) through common access channels.

Using a system platform, also known as a PSD2 gateway, offers several advantages to stakeholders. Banks can comply with regulations by engaging a specialized operator instead of developing their own structures and expertise. Third parties can access accounts held by multiple intermediaries through a single point of contact for all participating ASPSPs. This rationalizes technical documentation, related support, and testing environments. Additionally, authorities can easily check regulatory compliance, especially when conducting assessments required for the 'fall-back exemption', which examines common elements on the platform, simplifying the verification process for individual ASPSP members of the platform.

ASPSPs provide TPPs with access to the user's payment account by either adapting the already available user interface or providing a dedicated API. The dedicated API may be developed by the ASPSP on a proprietary basis or linked to a system platform. In both cases, the ASPSP must implement a second interface to be used in case the first one is unavailable, which is known as the "fall-back" interface. Alternatively, the ASPSP can request for an exemption from this requirement, which is known as the "fall-back exemption." Therefore, technically speaking, there are five possible distinct types of interfaces available:

- Adjusted user
- Dedicated Proprietary:
 - With Fall-back
 - Fall-back exemption
- Dedicated on Platform:
 - With Fall-back
 - Fall-back exemption

The majority of ASPSPs tend to join system platforms and request an exemption from fall-back. On the other hand, other operators usually opt for solutions based on an adapted, self-developed user interface. [18]

1.6. European Context

Europe has taken an enforced approach for Open Banking, through the implementation of the Payment Service Directive 2 (PSD2). PSD2 is a directive, which means that EU countries must achieve the same outcomes, even if their methods may vary depending on how PSD2 is transposed into national laws. Although the phrase "open banking" is not mentioned in PSD2, it is closely associated with it since it was transposed into UK law as part of the OBIE's activities in January 2018.

In a regulatory-driven approach, the main benefit for banks and TPPs is that screen-scraping is less prevalent than in market-driven countries because the mandate to share data encourages banks to develop API communication solutions.

Screen-scraping, precisely, is the process of collecting screen display data from one application and translating it so that another application can display it. This is normally done to capture data from a legacy application in order to display it using a more modern user interface.

In open banking, this happens when TPPs provide services to customers without having to enter into a contractual agreement with each bank and just "copy" the bank's API.

Additionally, in the case of the European Union, the strong privacy data regulations will not allow screen-scraping, as it would be seen as unlawful access to personal data, and the companies involved would risk hefty fines.

[19]

True to its name, PSD2 replaces the first Payment Services Directive from 2007. As already mentioned, it introduces payment initiation service providers (PISPs) as extensions of payment service providers to facilitate e-commerce credit transfers, and it allows payment service providers to operate as account information service providers (AISPs) that receive customer-permission access to payment account data but do not initiate payments.

In contrast to the rest of the world, open banking in Europe focuses mainly on payment initiation services first and then often follows with account information services.

This inversion does not make much sense when considering the most basic definition of open banking, which is the sharing of customer-permission account data.

However, the strategy of open banking is most effective for businesses that mainly deal with payments and other transactions. According to the Mastercard 2022 New Payments Index, three times the number of consumers around the world prefer using open banking for making payments than for receiving personalized financial insights.

[20]

1.6.1. Normative and Directives

As mentioned previously, Europe has implemented a regulated approach to payment services through the implementation of the PSD2. In the following chapters, a deeper examination will be made of this regulation and its different aspects.

The challenges and problems faced will also be highlighted along with the future regulations that are already being developed to address them.

1.6.1.1. PSD2

Directive 2007/64/CE, also known as PSD, regulates the information requirements, rights, and obligations of payment service users, as well as the prudential requirements for entities qualified to provide these services, known as Payment Service Providers or PSPs. The directive promotes the establishment of uniform rules for the provision of payment services, which in turn has encouraged the creation of an EU internal market for payments.

In 2015, the European Union adopted Directive (EU) 2015/2366, also known as PSD2, which sets out the rules for all retail payments in the EU, whether euro or non-euro, domestic or cross-border. PSD2 aims to address barriers to new types of payment services and improve the level of consumer protection and security. Its goal is to enhance the internal market for payments and enable new players to enter the market.

It aimed to:

- ensure a level playing field between incumbent and new providers of card, internet and mobile payments;
- increase the efficiency, transparency and choice of payment instruments for payment service users (consumers and merchants);
- facilitate the provision of card, internet and mobile payment services across borders within the EU;
- help innovative payment services reach a broader market;
- ensure a high-level protection for payment service users across all Member States.

[21]

All these years, in which this directive has been in force, have shown that often its objectives are conflicting. These aim at strengthening payment transaction security and its associated data, ensuring competition through Open Banking while facilitating innovation, ensuring technological and business model neutrality, and reinforcing consumer protection. In general, the objectives mentioned earlier have already started to take place. The incidence of payment fraud has reached a historically low level. This reduction is noteworthy for both card transactions and credit transfers. It is due to the efficacy and widespread use of strong authentication for remote transactions. This has led to an evolution of fraud scenarios.

Also, Open Banking has been developed effectively, enabling eBA to register or authorize 2,700 payment institutions (PI) and electronic money institutions (eMI), including more than 500 non-bank

Third Party Providers (TPP). However, transforming regulatory requirements into the process and operational efficiency is a real challenge for stakeholders.

In 2022, the European Commission undertook an evaluation of the Payment Services Directive 2 (PSD2), based on feedback from the European Banking Authority (EBA) and targeted public consultation.

The evaluation concluded that PSD2 has achieved varying degrees of success in meeting its objectives. Notably, as highlighted above, the strong customer authentication (SCA) requirement introduced by PSD2 has had a significant positive impact on fraud prevention. Additionally, PSD2 has increased payment efficiency, transparency, and choice for consumers by enabling new payment methods.

However, PSD2 has yet to establish a level playing field for Payment Service Providers (PSPs), particularly non-bank PSPs, who lack direct access to certain key payment systems, necessary to finalize payments.

PSD2's introduction of open banking, which enables secure sharing of financial data between banks and third-party service providers, was a major innovation. While non-bank providers have emerged to offer open banking services, uptake has been mixed, and challenges remain, notably concerning data access by account information service providers and payment initiation service providers.

The primary difficulties faced in the implementation of open banking services are as follows:

- **Firstly**, there are multiple guidelines for PSD2 and subsequent regulations adopted by the European Commission. One of these regulations, RTS SCA/SCC, lays down safety principles that are open to interpretation. To promote consistency in practices, EBA has issued guidelines, but local authorities apply them inconsistently. Open Banking must be ensured within a regulatory framework that is still developing and divergent. Additionally, actors must comply with other regulations, such as GDPR or AML directives, which can sometimes contradict each other.
- Account Servicing Payment Service Providers (ASPSPs) faced a **second** difficulty in providing data access to Third Party Providers (TPPs) in a harmonized and identical way. The regulatory body's technical standards have proven to be insufficient for implementation, leaving TPPs to manage the technical complexities associated with the variety of APIs and accessible data. Although private groups have defined standardized APIs, these standards are at the discretion of ASPSPs and remain heterogeneous.
- The **third** challenge that arises is the open access requirement mandated by PSD2, accompanied by the contentious issue of liability. ASPSPs have dedicated significant resources to modify their IT systems to enable data access and improve security. However, they have not received any monetary compensation and still bear most of the operational responsibility. At the same time, new entrants depend on ASPSPs' capability to furnish high-quality data and their willingness to offer essential features. The absence of well-defined regulations makes it difficult to align the interests of all parties involved.

[8]

1.6.1.2. PSD3/PSR

After conducting the evaluation, the Commission has proposed amendments to PSD2 along with an impact assessment, that will modernize it, taking the name of **PSD3**, and establish, in addition, a **Payment Services Regulation (PSR)**.

PSD3 is an EU Directive that requires adoption into national laws of EU Member States and outlines rules for payment institution authorization. In contrast, PSR is an EU Regulation that applies directly in Member States without the need for national implementation. PSR covers areas such as transparency of conditions, information requirements for payment services, and rights and obligations related to payment service provision and usage, including provisions for Open Banking. By establishing a unified legal framework encompassing all operations within the EEA, the PSR provides Payment Service Providers (PSPs) with a benefit. This leads to a decrease in uncertainty and disparity stemming from national legislation variations among Member States.

The new amendment, more precisely, aims to improve the European payment markets by implementing the following measures:

- **Combat and mitigate payment fraud**, by enabling payment service providers to share fraud-related information between themselves, increasing consumers' awareness, strengthening customer authentication rules, extending refund rights of consumers who fall victim to fraud and making a system for checking the alignment of payees' IBAN numbers with their account names mandatory for all credit transfers.
- **Improve consumer information and rights**, in cases for example where their funds are temporarily blocked, improve transparency on their account statements and provide more transparent information on ATM charges.
- **Further leveling the playing field between banks and non-banks**, in particular by allowing non-bank payment service providers access to all EU payment systems, with appropriate safeguards, and securing those providers' rights to a bank account.
- **Improve the functioning of open banking**, by removing remaining obstacles to providing open banking services and improving customers' control over their payment data, enabling new innovative services to enter the market.
- **Improve the availability of cash in shops and via ATMs**, by allowing retailers to provide cash services to customers without requiring a purchase and clarifying the rules for independent ATM operators.
- **Strengthen harmonization and enforcement**, by enacting most payment rules in a directly applicable regulation and reinforcing provisions on implementation and penalties.
- **Reinforcing the enforcement powers of national competent authorities** and facilitating implementation of the rules clarifying various elements
- **Giving the possibility (but not the obligation) for users to share their data with data users** (e.g., financial institutions or financial technology companies) to obtain new and innovative financial services tailored to market needs.
- **Forcing user data holders (e.g., financial institutions) to make it available to data users**, subject to user authorization and by establishing the necessary technical infrastructures (APIs).

- **Allowing customers to have complete insight and control** (via dashboards) of the access authorization for their data granted to third parties and the purposes for which it is used, in compliance with the **General Data Protection Regulation (GDPR)**, to ensure enhanced personal data protection.
- **Standardizing customer data and technical interfaces required for financial data sharing systems**, with data holders and users becoming members.
- **Clarifying the responsibility of each payment actor** in the event of data breaches and dispute resolution mechanisms.

These amendments aim to *“bring payments and the wider financial sector into the digital age”*, making the payment markets safer and more accessible for consumers and non-bank PSPs.

[22]

1.6.1.3. FIDA

The European Commission has presented a **legislative proposal to develop a framework for financial data access**. This framework will establish clear rights and obligations to manage the sharing of customer data in the financial sector, beyond payment account data. In practice, once approved by the European institutions, this set of rules will lead to the development of more innovative financial products and services for end-users and will stimulate competition in the entire financial sector, thus definitively paving the way for **Open Finance**.

In other words, with the FIDA, the Commission aims to bring the European financial sector even closer to the so-called '**data economy**'. Although this proposal has the potential to be extended to an even broader scope of data, it goes in the right direction to unlock the development of new business cases and innovative solutions for all stakeholders in the value chain.

This builds on the already existing “open banking” provisions introduced by the Payment Services Directive (PSD2). The proposal takes a customer-centric approach. It aims to ensure that all consumers and firms have effective tools to control the use of their financial data. The proposal therefore provides additional tools to **ensure personal data protection** in line with the General Data Protection Regulation (GDPR) and applying the general principles of business-to-business data sharing in line with the Data Act proposal.

The proposal seeks to facilitate customers' right to access their data held by financial institutions (**“data holders”**) through electronic means, without incurring additional costs, and grant them the right to share this data with firms offering innovative services (**“data users”**).

Currently, customers can only grant third-party providers access to their payment accounts data under PSD2. GDPR permits consumers to share their personal data held by financial service providers with third-party providers, but it does not cover non-personal data related to business customers and is only applicable where technically feasible. However, direct electronic access is necessary for data users to provide customers with digital financial services if customers intend to use their data for this purpose. Consequently, the proposal introduces a universal obligation for data holders to make customer data available to data users upon customer request.

This is needed because customers should have the ability to decide who can access their financial data and how it is used. Some customers may want to limit third-party access to their data for personal reasons, while others may want to grant firms access to their data for financial and information services. This proposal establishes a secure data-sharing framework that empowers customers by giving them meaningful and effective control over their data. It also provides additional safeguards in line with data protection rules and rules on digital operational resilience. Furthermore, it ensures that the use of this data by the industry is beneficial to customers.

the proposal adds rules on who is eligible to access customer data to make sure that all data users are subject to authorization and supervision. For firms to be able to access customer data under this proposal, they will either have to be regulated financial firms or be authorized as Financial Information Service Providers (FISPs). FISPs will also be subject to the Digital Operational Resilience Act, which addresses cybersecurity risks. Account Information Service Providers (AISPs) duly authorized under the PSR/PSD3 regime will be eligible to access customer data in line with the modalities set out in this proposal, notably as members of financial data sharing schemes and subject to compensation to data holders.

To enable customer data aggregation and sharing at scale in the financial sector across the EU, standardization of both customer data and their sharing interfaces is necessary. The proposal seeks **to promote standardization** of customer data and access interfaces and ensure that data holders implement these standards while providing high-quality interfaces. This is done by allocating the costs involved in implementing the standards and interfaces between data holders and data users. Moreover, the reuse of data poses risks such as data misuse, financial crime, or fraud, which must be managed. Therefore, the proposal ensures that liability in case of data misuse, financial crime, or fraud is clear and predictable, and liability risks do not act as a disincentive for data holders to provide data. Financial data-sharing schemes must provide a clear liability regime and dispute resolution mechanisms to manage these risks.

The PSD2 regulations introduced open banking provisions that apply to customer data of only one type of product in the financial sector, namely payment accounts. Payment account data will continue to be governed by the existing regulatory framework under PSR/PSD3. This proposal regulates access to customer data for all other types of financial products and services, except life and health/sickness insurance, as well as data related to consumer creditworthiness assessment.

In terms of regulatory approach, this proposal differs from PSR/PSD3. Under PSR/PSD3, data sharing is based on non-contractual access at no cost, while this proposal requires data holders and users to agree on financial data sharing schemes that contain the contractual terms for sharing data. It also **entitles data holders to reasonable compensation** for the costs of making data available, while Data access for customers themselves will be free of charge and any compensation shall not exceed the costs directly attributable to the individual data request. This is in line with the Commission's Data Act proposal.

Unlike PSR/PSD3, this proposal covers only information access services and excludes transaction initiation services, as the latter are not relevant for all types of financial services covered by this proposal.

[21]

1.6.2. UK as promoter

As the European open banking market continues to mature, the growth of newly regulated TPPs has been slowing down. In 2020, the average quarterly growth rate in the EEA was 16%, which dropped to 6% in 2021 and further decreased to 3% in the previous year. As a result, the trend has continued in the first quarter of 2023, with only three new TPPs being added, bringing the total to 356, a growth rate of just under 1%.

The development of PSD2 and Open Banking as disruptive forces in the European payments industry is still an ongoing story. While branded A2A payment schemes that existed before Open Banking are thriving, the results for payment initiation services via Open Banking are less exciting.

The already existing payment schemes and a long list of alternative payment methods accessing bank payment rails as well as rapidly growing BNPL schemes were already able to serve the European market for digital payments adequately.

These schemes have established brand and trust with consumers, along with acceptance by merchants, which in combination can take a decade to build. Open Banking payments are also somewhat awkward to enable and service. Outside the UK (the clear leader in enabling Open Banking payments), structural and technical headwinds hampered PIS adoption due to the fragmentation of API standards, and inconsistent API availability (banks built to fulfill regulatory mandates, neglecting performance), all issues that the new directives try to solve.

For these reasons, the volume of payments remains stubbornly low. In July 2023, it is estimated that only 2% (or less) of European C2B e-commerce payments are via unbranded, Open Banking payments. Achieving readiness for B2B transacting is a critical step for Open Banking payments to achieve their potential.

[9]

In the UK, which has over 200 regulated TPPs, there has been a slight decline in newly regulated entities since mid-2022 due to mergers, acquisitions, and failed business models. The number of regulated TPPs in the UK (including one in Gibraltar) now stands at 201, which is two less than the end of 2022. Consequently, the overall number of TPPs in the EEA and the UK is now 556, one more than at the end of 2022.

[23]

In August 2016, the UK Competition and Markets Authority issued a ruling that mandated the nine largest banks in the United Kingdom provide access to customer account information via open APIs. The directive came into force in 2018, and more banks voluntarily complied. The regulated providers of OB in the United Kingdom are also required to use standards and systems created by Open Banking Limited, a nonprofit mandated especially for the mission.

The key stakeholders in UK financial institutions also have some of the most positive attitudes toward OB (with 68% agreeing that OB is viewed as an opportunity in their organization and 70% having a clear strategy to realize the potential of OB)

It is widely recognized that the UK is leading the way in Open Banking, and many countries in Europe are following its example. Therefore, it is likely that similar trends to those observed in the UK will be seen in Europe in the future.

According to a recent report by the Open Banking Implementation Entity (OBIE), there has been a slight decrease in the number of live-to-market TPPs with active open banking-enabled propositions in the first half of 2023. As of June 2023, there were 151 live-to-market TPPs, which is eight fewer than the number in December 2022. During this period, only one new TPP entered the market, while nine others exited. The reasons for these exits varied, including companies withdrawing from the market or merging with others.

The OBIE report suggests that there has been a decrease in the number of companies providing services that help customers make better financial decisions. As of June 2023, there were only 45 active services, compared to 49 in December 2022. The decline is expected to continue in the future. In contrast, companies offering payment and borrowing services have seen only a minor reduction. While the number of firms providing payment services has remained steady, one less firm supported borrowing in June 2023 than in December 2022, but for this last one, it seems to be a specific problem related to the firm's business model and its lending money.

Feedback indicates that the use of open banking data to support lending decisions for consumers and small businesses continues to expand without any replication of the concerns raised by this firm. [24]

1.6.3. Open Banking in Italy

Even if Italy is one of the European countries with the highest number of Passport-In TPP (135, at the end of Q2 2023), its Open Banking ecosystem is not fully developed.

Daniele Pennetta and Luca Gambarelli tried to explain the reasons behind this situation in their paper titled: **“Banks’ attitude to partnership as an antecedent of Open Banking platforms: structural determinants and effects on performance in the Italian context”**. They considered a sample of 45 Italian banks representing 73% of the domestic banking system in terms of total assets. The study indicates that currently, Italian banks exhibit a low inclination towards partnerships, and they primarily focus on distribution agreements. This behavior is more prevalent in larger banks with more capital, whereas small and medium-sized banks tend to collaborate more with external partners to maximize synergies and compensate for possible limitations in size, resources, and human capital.

This trend can be attributed to the emergence of business models that are less reliant on traditional credit intermediation, which is typical of deposit banks. Moreover, the gradual erosion of territorial barriers has made customers more open to purchasing digital financial services, thereby increasing market competition. Additionally, the findings reveal that banks' positive attitude toward partnership has a favorable impact on their performance, which justifies their involvement in Open Banking ecosystems.

Collaboration with other financial intermediaries like traditional banks, FinTechs, and TechFins can lead to seizing opportunities from sharing information, customers, and innovation. However, to do this, banks must move beyond traditional competitive models and adopt a more collaborative approach. Unfortunately, Italian banks lack a positive attitude towards intra- or extra-group collaboration, prioritizing a self-referential approach to customer satisfaction. Partnerships during the development phase of financial products and services are limited, indicating a limited openness

to external ideas that could stifle innovation and Open Banking ecosystems. Banks appear culturally resistant to partnering with other intermediaries and FinTech firms, with collaborations typically limited to individual products. These behaviors are more common among larger, capitalized banks, while smaller and medium-sized banks optimize synergies and collaborations with external partners to overcome limitations in size, resources, and human capital. This trend is fueled by business models less reliant on traditional credit intermediation, typical of deposit banks, and the diminishing importance of territorial barriers that have made customers more open to purchasing digital financial services.

[10]

2 Methodology

2.1. Objectives

After having conducted the review of the literature on Open banking to understand the context, the next crucial step in this thesis is to define the final goals and objectives that will guide the research. The primary objective of this study is to provide a comprehensive overview of the Open Banking landscape in Europe by the end of 2023. The aim is to identify potential trends and phenomena that may indicate the future direction of the industry in the upcoming years.

This thesis aims to answer several research questions that were formulated at the beginning of the work after having done the literature review. These questions include:

- What are the trends followed by third-party providers that use Open Banking services in Europe?*
- How developed is Open Banking in Italy compared to other countries?*
- Which are the main customers of TPPs that use Open Banking?*
- How does the future look for these offerings going forward?*

2.2. Methodologies

The purpose of this section is to provide a comprehensive overview of the processes involved in creating the thesis. The thesis has been divided into three distinct parts, each with its own set of methodologies, which will be discussed in detail in the following paragraphs. The first part of the thesis focuses on the ***literature review***, which involves an extensive analysis of existing research and literature in the field. The second part of the thesis involved the ***collection of data for the census***. Finally, the third part of the thesis involved the synthesis of findings and the ***analysis of the data***. Each part of the thesis was approached with a rigorous methodology to ensure that the research was thorough and comprehensive.

2.2.1. Literature Review

The literature review was an essential step in becoming familiar with the current state of knowledge on the research topic. To accomplish this, various sources were studied, cited throughout the work, and gathered in the bibliography at the end of the thesis.

As a first step, it was deemed appropriate to conduct an *overview of payment methods* in order to better understand the context and position of open banking in comparison to other systems. The observed methods were the most popular, ranging from traditional methods such as credit and debit cards and cash, to more recent methods such as A2A, digital wallets, Buy Now Pay Later, cryptocurrencies, and of course, Open Banking itself.

The analysis then shifted to the foundation of Open Banking, which is the API and Open API. It was important to understand what they are and why they are crucial for Open Banking. The discussion began with a general description of APIs, including their workings and the different types that exist, such as open API. This was followed by a more detailed look at open API, which included information about the specific services it can offer, like retrieving information such as balances, accounting information, cash flow, and transactions.

By now, all the necessary information to comprehend the central aspect of this thesis, which is Open Banking, has been explained. The phenomenon of Open Banking was described, including how it has evolved over the years since its inception. This was followed by an analysis of how banks can modify their business models to capitalize on it. The last part of this section focused on the advantages and challenges that Open Banking can provide and must confront.

As a fourth step, an explanation of third-party providers was given, highlighting the difference between payment initiation service providers, account information service providers, and card issuer service providers. It was also explained what they can and cannot do. Then, the focus was on the PSD2 gateways that are used to establish standard technical specifications for dedicated interfaces to facilitate the use of different APIs by different TPPs.

Lastly, a general overview of the situation in Europe was introduced, including descriptions of the norms and directives of the European Commission. The first directive analyzed was the PSD2, followed by a discussion of the future PSD3/PSR and FIDA. Then, a brief description of both the UK and Italy's situations were given, with the UK considered the promoter of Open Banking, and the situation in Italy unfortunately not as positive.

2.2.2. Data collection for Census

The information on the presence of third-party providers in various European countries was gathered from the payment institution register of the European Banking Authority (EBA) website (<https://euclid.eba.europa.eu/register/pir/disclaimer>).

The EBA is an independent EU authority with the objective of safeguarding the integrity and robustness of the EU banking sector so that it can support the financial stability in Europe.

It should be pointed out that this register is built based on information provided by the single national competent authority of the EEA member states, for this reason, it has no legal significance and confers no rights in law. If an unauthorized institution is inadvertently included in the Register, its legal status is in no way altered; similarly, if an institution has inadvertently been omitted from the Register, the validity of its authorization will not be affected.

The data considered for analysis were updated until the end of 2023. Any changes made after that were not included.

At this point, to narrow down the search and find the desired institutions, the institution search page was used and various options had to be selected:

- **National competent authority:** the name of the competent authority that has authorized/registered the natural or legal person for the provision of payment services
- **Country where the services are provided**
- **The services of interest for the research:** in this case, the services are payment initiation services and account information services
- **Type of status:** there are two options here, current and historic. The last one was used to know in which year the tpps were created.
- **Status:** the status can be authorized/registered/active or withdrawn/In-Active.

As an example of how it worked, let's consider third-party providers (TPPs) in Italy approved in the home member state without including the passported ones. In this case, the **national competent authority** must be the *Bank of Italy*, and *Italy* must be selected as the **country**. Then, to determine the exact number of TPPs that can act as payment initiation service providers (PISPs), account information service providers (AISPs), or both, both *payment initiation* and *account information services* had to be selected as **services of interest**.

For this research, go for *Historic* as the **type of status**, which will allow you to see the number of TPPs for different years. For the first part of the research, select *authorized/registered/active* as the **status** option, and only after that switch to *withdrawn/inactive* to find out the effective number of TPPs that are still operating.

There are a couple of issues with this website. Firstly, it's not possible to filter the providers that act solely as a Payment Initiation Service Provider (PISP) or Account Information Service Provider (AISP). Secondly, it's not possible to select a specific limited period of time in the past. Instead, users can only choose a starting point in the past.

These problems can be solved by doing the following calculations.

In order to address this concern, it is imperative to select both services at the outset and determine the total number of Third-Party Providers (TPPs) that provide at least one of these services. Subsequently, it is necessary to identify the number of TPPs that solely offer Account Information Services (AISPs) and deselect the corresponding option. This will provide a new number that must be subtracted from the previous total. Similarly, for Payment Initiation Services Providers (PISPs), the same procedure must be followed, but deselecting Payment Initiation Services (PIS) instead.

To determine the number of TPPs that can offer both services, it is crucial to subtract the total number of TPPs that solely offer AISP and PISP from the total. This approach enables a comprehensive evaluation of the diffusion of different TPPs.

To tackle the second issue and determine the amount of new TPPs that have been added for each year since 2018, a year-by-year approach is required, starting from the most recent year, which is 2023. Initially, the date 1/1/2023 in the status type option needs to be selected. Subsequently, by

following the procedure outlined in the aforementioned section, the count of TPPs for that year may be ascertained. Then, the date needs to be changed to the preceding year (1/1/2022), and the same process should be repeated to determine the count of different TPPs. However, this time, the number obtained in the year 2023 must be subtracted from the number just obtained. This process must be repeated until the year 2018 is reached, and every time, the count of TPPs that have already been considered must be subtracted from the count just found.

This procedure can be also used to determine the number of TPPs that have been withdrawn or are no longer active, thereby allowing for the calculation of the effective number of providers that are still operating.

To determine the number of TPPs passported and that have been authorized to operate in a particular country, it is necessary to exclude the national competent authority of that country from the list of options while selecting all the others. For instance, to find the number of passported TPPs in Italy, the Bank of Italy must be excluded from the list of options.

After gathering all this necessary data, new tables were created to analyze the distribution of TPPs over the years. The distribution was calculated for both home and passported TPPs. To create these new tables, a simple “SUM” formula was used in Excel on the tables that were created previously. The TPPs that were withdrawn during these years were then subtracted in their respective year. It was possible to create graphs using the new tables, which made it easier to understand the trends during the considered period.

An example is given in the figure below, which will be analyzed in the next chapter of this thesis.

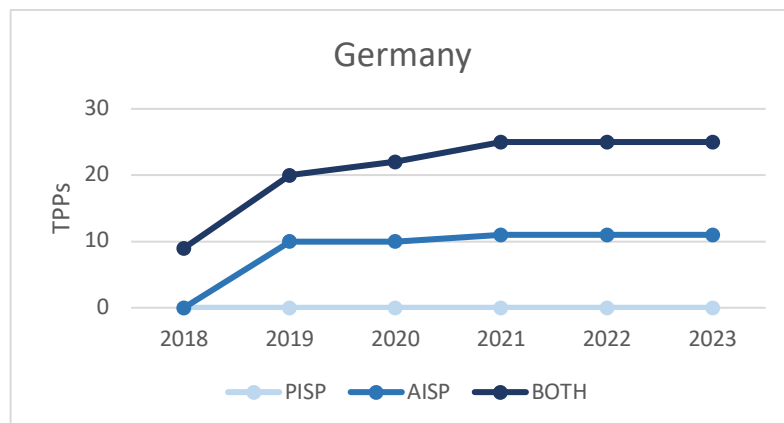


Figure 2: Germany home TPPs

To facilitate a comprehensive understanding of the trends in different zones across Europe, it has been chosen to primarily focus this analysis on seven prominent European countries. These countries are *Italy, Germany, Spain, France, Sweden, Poland* and the *Netherlands*.

Following this scrutiny, it was determined that a more precise interpretation of the data was necessary to discern the typology of customers served by each Third-Party Provider that was considered in the previous inquiry.

To achieve this, a table was compiled which included the following details for each TPP.

- The country of origin*
- The type of player*
- The type of customer*
- The Open banking services provided (PISP, AISP or both)*
- The countries serviced*
- The services provided with the account information license*
- The services provided with the payment initiation license*
- Other services offered by the company*

The information regarding the *country of origin*, the *open banking services provided* and the *countries serviced*, can be found directly on the EBA website. The remaining details required a lot more effort, which involved visiting the website of each TPP individually to figure out all the products they offer and the target customer group. The challenging part was that many of the websites were not available in English or Italian and had to be manually translated. In case the research of the website does not yield the desired outcome of finding the target customer, it will be marked as *no information*.

From this last table, through the use of the function “COUNTIF”, it was found the exact number of AISP, PISP and PISP/AISP that were analyzed during the writing of the thesis. The same function was then used to find the number of TPPs that have customers for all the categories considered (they will be illustrated and explained in the next part of the methodology).

Lastly with the function “COUNTIFS” these data were combined to discover the number of each category of customers there are for each typology of TPP.

Even in this case, several graphs were created to provide a clearer view of the situation.

2.2.3. Analysis of the data

The accurate analysis of the output of the census data is crucial to understand the demographic and socio-economic situation of a country or region. However, analyzing the entire dataset can be overwhelming and time-consuming. Therefore, In order to give an overall representation of the situation in Europe, it was decided to choose a limited number of countries with the largest economies in 2023 (according to “ilSole 24 ore” [25]) and from various regions of Europe.

This approach not only saves time and resources but also ensures the credibility of the sample selected. To achieve this, countries were also divided based on their geographic location. The selected countries were from Southern, Central, and Northern Europe:

- Sud Europe: Italy, Spain*

- *Central Europe*: Germany, France, Poland
- *Nord Europe*: Sweden, Netherlands

These countries were chosen as they represent different cultural, social, and economic backgrounds, and are situated in different geographic locations within Europe. The aforementioned approach enabled the analysis of the output of the census data to be conducted efficiently and effectively. The selected sample is credible and can represent the overall situation in Europe, which can help in making informed decisions based on the demographic and socio-economic situation of the continent.

Then the analysis of the data can be divided into two main parts. The first focuses on the number of TPPs and their typology in each country, specifically Payment Initiation Service Providers (PISP), Account Information Service Providers (AISP), and PISP/AISP. The research also examines the year of authorization for each TPP and tracks those from which authorization was withdrawn.

It is also crucial to emphasize that TPPs can be classified into two main categories: domestic and international. Domestic TPPs operate within their home country, while international TPPs are the ones that provide services from a different state.

To differentiate between them, two tables were created for each country, so that they could be compared.

The second part focuses more on each TPP that was considered in the previous part. This section provides the exact number of TPPs that operate in these countries, as before the same TPP could appear in several states.

As mentioned in the data collection part, for each TPP eight variables were considered: *the country of origin, the type of player, the type of customer, the Open banking services provided (PISP, AISP or both), the countries serviced, the services provided with the account information license, the services provided with the payment initiation license and other services offered by the compan.*

The next paragraph explains why these variables were chosen.

Starting from the **country of origin**, this variable was chosen because by looking at the number of TPPs, it is possible to understand which countries present the best environment to foster this technology and which do not so which are more open to innovation.

To determine which type of firm is benefiting from this technology and whether others could implement it in their business, it is necessary to have a **player** variable that can identify the typology of the firm. Although most firms benefiting from this technology are fintech, it is possible that other types of firms could also benefit from it.

For what concerned the **customer variable**, seven different categories were taken into account. These are:

- **Enterprises**

Third-party providers offer a wide range of products and services to businesses of all sizes, from small and medium enterprises to large corporations. These products can include new payment systems and financial management systems that utilize open banking technologies.

The latter, for example, provides businesses with a comprehensive overview of their financial situation by grouping all their bank accounts together, making it easier to manage their finances.

□ **Individual customer**

In this scenario, the services or products provided are customized to meet the individual needs of a single customer. These services can be of various types but generally aim to enhance the customer's comprehension of their financial condition. Some examples of such products include applications that aid in improving credit scores, digital wallets, budget planners, and more. Many of these products utilize open banking to integrate multiple bank accounts, eliminating the need for customers to monitor several different applications.

□ **Financial Institution**

In this case, the target customers for TPPs are banks or other financial institutions. TPPs can offer expanded solutions to these institutions, such as new APIs for account balances, payment transactions, and additional information about the bank's clients. By utilizing these solutions, banks can empower their customers to pay in any way, at any time, and at any place either in person or online. Additionally, they can handle multiple payment types, schemes, and clearing systems across debit, prepaid, and credit. This has the potential to make significant cost reductions and can be priced on a pay-per-transaction basis. By adopting these solutions, financial institutions can get a holistic view of their customers' entire payment journey, offer new products faster and at a lower cost, access global insights across trends, payments, and behaviors, and compete quickly in the flexible finance market.

□ **E-commerce**

Although they make up a small percentage, some TPPs specialize in offering their services or products to businesses that operate solely online, rather than those with a physical presence. As a result, it was determined that this category should be differentiated from the Enterprise category, which is more focused on physical businesses that may also have an online presence.

□ **Enterprises/Individual customer**

There are certain scenarios in which third-party providers, or TPPs, are able to present solutions that cater to both individual customers and enterprises simultaneously. In these particular situations, the TPPs can offer services that meet the needs of both types of customers, and do so in a manner that is efficient and effective. This type of flexibility can be quite valuable to customers, as it allows them to access the services they need in a way that suits their specific requirements.

□ **Financial Institutions/Enterprises**

In addition to individual customers, some third-party providers (TPPs) can also offer solutions that cater to enterprises and financial institutions together. TPPs can provide efficient and effective services that meet the needs of both types of customers. This can result in cost savings and streamlined processes for businesses, while also ensuring that their specific needs are met.

□ **No information**

This category includes TPPs for which it is impossible to find the website or are untranslatable

These categories will help to understand how Open Banking is mainly being used by the TPPs and which part of the population is being most served by this technology.

The **services**, intended as AISP, PISP or both and not the products offered by specific TPP, are needed to understand if there is any pattern between the TPP typology and the clients being served.

The following two variables (***the services provided with the account information license*** and the ***services provided with the payment initiation license***) are strictly connected with the last one and It was decided to consider both variables to analyze the different services that companies can offer, even if they have the same licenses.

Other services offered variable is to have a more precise understanding of the business in which account information services and payment initiation services are implemented.

The variable ***support services*** can be utilized to identify if some companies are attempting to enhance these services through the integration of new technologies. An example of this is the integration of account information services with artificial intelligence to assist customers with their financial management.

Lastly, the list of ***countries that the TPP serves*** can help determine if it was designed to meet specific demands in a particular country or if it was intended to have a more comprehensive reach across multiple countries.

3 Analysis & Results

This chapter will analyze all the results obtained from the operations conducted in the methodology. It aims to identify patterns and trends that can help understand the phenomenon of Open Banking better. Doing so will shed light on its significance for the financial world and all the countries involved.

Like what happened in the methodology, the analysis will start from each country's perspective and then they will be compared, having in this way a national view of the situation. After this, the analysis will be moved to the TPPs and their customer to have a better understanding of the actual effects of Open Banking at the firm level.

3.1. European Level

As mentioned in the preceding paragraph, this section of the thesis will concentrate on analyzing the trends for each of the countries already listed in the methodology. The objective is to comprehend the causes behind their stance on Open Banking. This will be achieved by examining the number of third-party providers, their types, services, customers and the years in which they were granted authorization to operate.

Starting by looking at Europe as a whole, thanks to the data found on the EBA website, it can be seen that in the European Union, at the end of 2023, there were approximately 310 third-party providers spread among the various European countries in the following way.

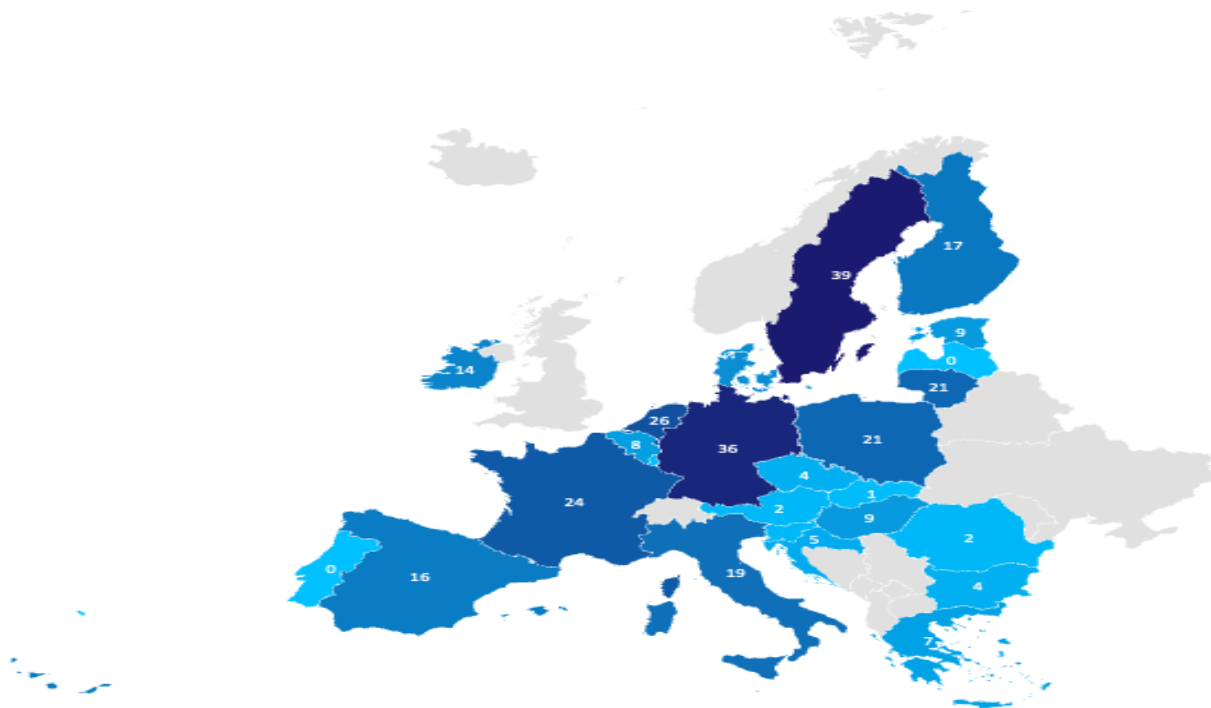


Figure 3: Home TPPs for each EU member

Cyprus, which has eight domestic TPPs, is not shown on this map. However, it must be included as part of the EU.

From the map, it is easy to see that the countries that will be analyzed in the following chapter are also the ones with the higher number of TPPs.

A different European map can be used to instead show how many TPPs are operating in each country, the numbers in this way will be much higher because the same TPP can operate in several countries simultaneously.

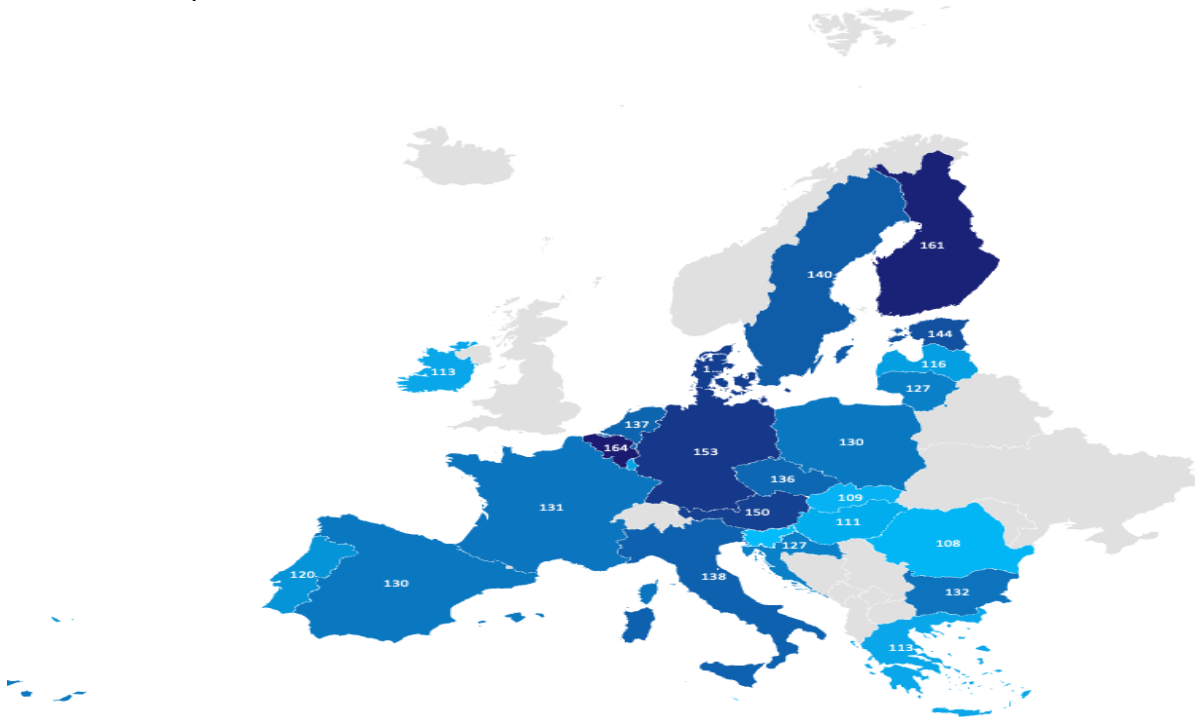


Figure 4: Number of TPPs operating in each EU country

(Cyprus has 125 in this case).

The aforementioned statistic indicates that a country does not need to have a large number of TPPs created within its own borders to offer a significant number of open banking services. The presence of TPPs from other countries can also contribute to a substantial number of open banking services being offered.

Now a closer examination will be done starting from Italy, then moving to Germany, France, Spain, Sweden, Netherlands and, lastly, Poland.

3.2. National Level

3.2.1. Italy

The situation in Italy is quite complex and two-sided. On one hand, the country has only 19 authorized Home third parties that originated from Italy itself and operate within its borders. On the other hand, Italy has the highest number of passported TPPs, among the countries analyzed, authorized to operate in the country, which is 119. Therefore, the total number of TPPs in Italy is 138.

Let's start by examining the data from the home Third-party providers.

Italy	2018	2019	2020	2021	2022	2023		TOTALE
PISP	0	0	0	0	1	0		1
AISP	0	0	2	2	0	0		4
BOTH	3	1	4	3	4	1		16
Withdrawn	0	0	0	1	0	1		2
Totale	3	1	6	4	5	0		19

Table 5: Italy Home TPPs

Table 5 shows the annual number of authorized TPPs from 2018 to 2023

By looking at the table, it can be noticed, first of all, that at the moment the TPPs authorized to do both services (PISP/AISP) are the majority, almost 80% of the total, followed by AISP with a bit more than the 15% and lastly the PISP with just the 5%.

Like many countries in Europe, Italy has very few companies with only a PIS license, many of these, also have an AIS one showing that they offer a combination of both services but payment services represent a small percentage of their overall offering.

The years between 2020 and 2022 were the ones that saw the most number of TPPs authorized, showing that Italy was one of the countries that took advantage of Open Banking later compared to most of the other countries considered.

To examine the trend, it will be better to use the graph of Figure 5 instead.

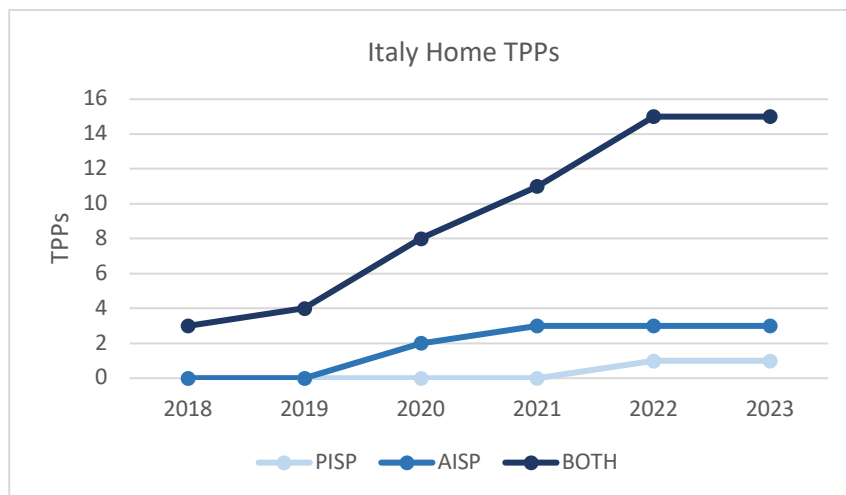


Figure 5: Italy Home TPPs

For many years, since the adoption of the PSD2 regulation, the number of authorized and operative TPPs had a steady growth, but in 2023 it came to a stop due to a TPP that had its authorization withdrawn and in this way counterbalanced the only new application. It will be seen that this phenomenon will be a constant even for the other countries considered.

In the case of Italy, this stop of new TPPs can be caused by several factors:

- *Regulatory environment*: There may be differences in regulatory practices and enforcement within the EU, including Italy, that create barriers for TPPs and hinder their market operations.
- *Lack of standardization*: As mentioned in the literature review, the lack of API standardization leads to a fragmented market where Third-Party Providers must create customized solutions to connect to the various APIs of each Account Servicing Payment Service Provider (ASPSP). This can hinder the growth of TPPs and their presence in countries like Italy. This problem was partially solved by the Berlin Group standard, but its use is still at the discretion of the TPP.
- *Market saturation*: New market entrants may face difficulties due to the presence of established TPPs with successful business models that have already captured a significant share of the market.

As mentioned before, Italy has the highest number of passported TPPs operating in the country from other states, compared to other European countries.

Italy	2018	2019	2020	2021	2022	2023	TOTALE
PISP	2	2	2	1	0	1	8
AISP	6	10	13	7	1	2	39
BOTH	16	28	10	13	8	6	81
Totale	24	40	25	21	9	9	128

Table 6: Italy passported TPPs

withdrawn	2018	2019	2020	2021	2022	2023		TOTALE
PISP	0	0	0	0	0	0		0
AISP	0	0	0	0	0	3		3
BOTH	0	0	0	0	4	2		6
Totale	0	0	0	0	4	5		9

Table 7: Italy passported withdrawals

In this instance, the TPPs with only an AIS license made up a bigger part of the total (30%), indicating a major interest in services that manage accounts, like account aggregating services, from the rest of Europe.

It is worth noting that a majority of the passported TPPs arrived one or two years before the home TPPs in Italy. This could be an indication that the home TPPs did not develop significantly due to market saturation. Many of the services that home TPPs could offer were already being provided by other service providers.

As before, to examine the trends of these passported TPPs another graph will be used:

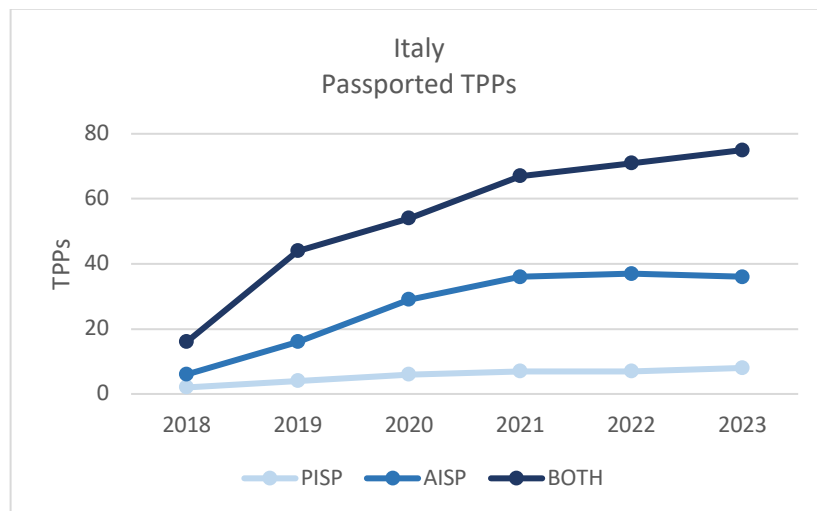


Figure 6: Italy passported TPPs

It can be observed that Italy has a growing trend of third-party providers, which suggests that it is considered by other countries as a place with potential investment opportunities for Open Banking services. Although there has been a relative slowdown in recent years, the trend still indicates that Italy is a favorable destination for investing in this field.

3.2.2. Germany

Germany is the country with the best situation overall, looking at the data, it can be seen that it has 36 home TPPs, only one less than Sweden which is the country with the most, while regarding passported TPPs, it has 117 of them, almost the same as Italy.

The sum between these two brings Germany to 153 TPPs overall, making it the state with the highest number of TPPs in Europe after the UK.

As it was done for Italy, let's look at Table 8 which shows the annual number of authorized TPPs from 2018 to 2023.

Germany	2018	2019	2020	2021	2022	2023	TOTALE
PISP	0	0	0	0	0	0	0
AISP	0	10	0	1	0	0	11
BOTH	9	11	2	3	0	0	25
Totale	9	21	2	4	0	0	36

Table 8: Germany Home TPPs

From this, it immediately stands out that more than half of the TPPs took their authorization in the first two years after the PSD2, while in the following years, very few TPPs were authorized. Having in this way a different approach than Italy, which started being involved more in Open Banking after the first 2 years.

Germany has never had home TPPs with only a PIS license, while the ones with only an AIS license are 30% of the total and the remaining 70% have both licenses.

For this reason, it can be said that the TPPs in Germany were more focused on services for account management and tools to provide valuable financial insights to users and develop innovative financial services that can benefit both enterprises and individuals.

The presence of PIS licenses in only companies that also have an AIS license shows that PIS is only seen as a complementary offer to the account information services.

Looking at the graph in Figure 7, it will be clear that Germany is experiencing a prolonged period of stagnation.

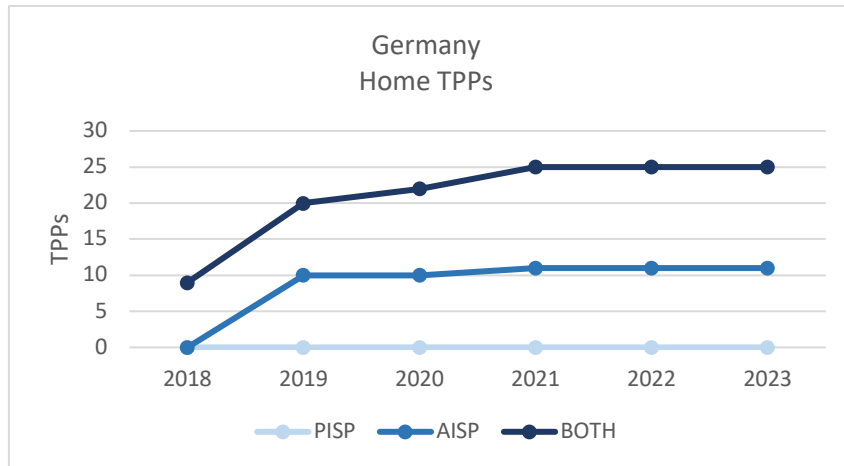


Figure 7: Germany Home TPPs

Since 2021, no new TPPs have entered the market, indicating that even Germany has been affected like Italy by several factors that could have blocked possible new TPPs.

These factors can be:

- *Market saturation*: Like Italy, Germany can be affected by this problem by the fact that in the first years since the introduction of PSD2, there was immediately a big increase of TPPs that got authorized, keeping in consideration also the passported TPPs. Thus, demand would have been immediately satisfied leaving very little room for future entrants.
- *Competition*: Linked to market saturation, because many TPPs entered in the same period, Germany could have been facing fierce competition between these players. This competition may deter new TPP from entering, stopping in this way the growth of the market.

It can be observed that the passported TPPs in Germany and Italy are almost identical. However, it's worth noting that many of the TPPs in Germany became passported ones for Italy, while only a few went in the opposite direction. This suggests that Germany had more passported TPPs from different countries than Italy, making it a more attractive choice for these states to follow.

Germany	2018	2019	2020	2021	2022	2023	TOTALE
PISP	2	2	1	1	0	1	7
AISP	6	9	16	7	2	2	42
BOTH	12	26	13	13	8	6	78
Totale	20	37	30	21	10	9	127

Table 9: Germany passported TPPs

withdrawn	2018	2019	2020	2021	2022	2023	TOTALE
PISP	0	0	0	0	0	0	0
AISP	0	0	0	0	0	3	3
BOTH	0	0	0	0	5	2	7
Totale	0	0	0	0	5	5	10

Table 10: Germany passported withdrawals

The next graph highlights the resemblance between these two countries by following the same trends.

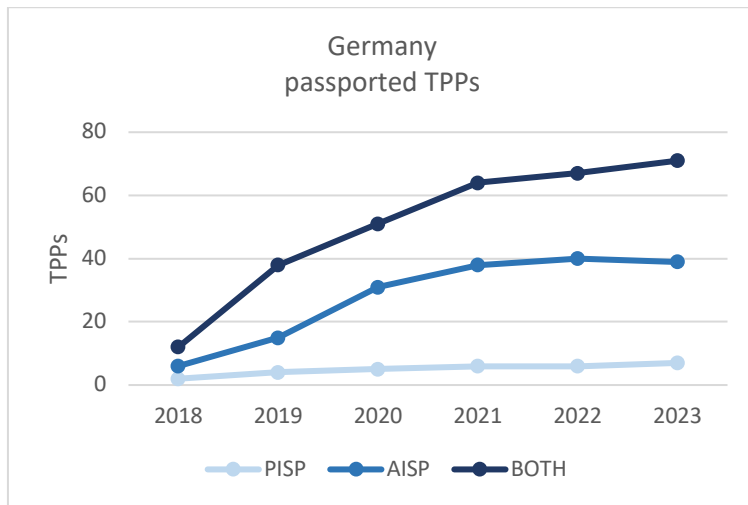


Figure 8: Germany passported TPPs

Therefore, what has already been said about Italy can also be considered true for Germany, if not more so

3.2.3. France

France has 24 domesticated TPPs, 5 more than Italy and 12 less than Germany. It also has 108 passported TPPs, 9 less than Germany, bringing it to a total of 129 TPPs operating within the borders. It could be said that France is in a middle position compared to the two of them.

By looking at Table 11, it seems that France, like Germany, had a strong start that persisted until 2020.

France	2018	2019	2020	2021	2022	2023	TOTAL
PISP	0	1	1	0	0	0	2
AISP	2	2	4	1	0	2	11
BOTH	5	5	1	1	0	2	14
Withdrawn	0	0	0	0	1	2	3
Totale	7	8	6	2	-1	2	24

Table 11: France Home TPPs

Considering that 3 TPPs with the authorization for both licenses were withdrawn, then it is the first analyzed country without a clear predominance of a typology of TPPs, as the companies with both licenses are the same number as those with only the AIS one.

Even in this case, only a couple of TPPs have been authorized to have a PIS license, making clear that there isn't great interest in having it as a stand-alone feature but it is only seen as a complementary offer for the account services.

Analyzing the graph in Figure 9 of the home TPPs, it is possible to see that the lines indicating the various types of TPPs are not as separated as seen from the previous countries. At the end of 2023, the two lines rejoin at the value of 11.

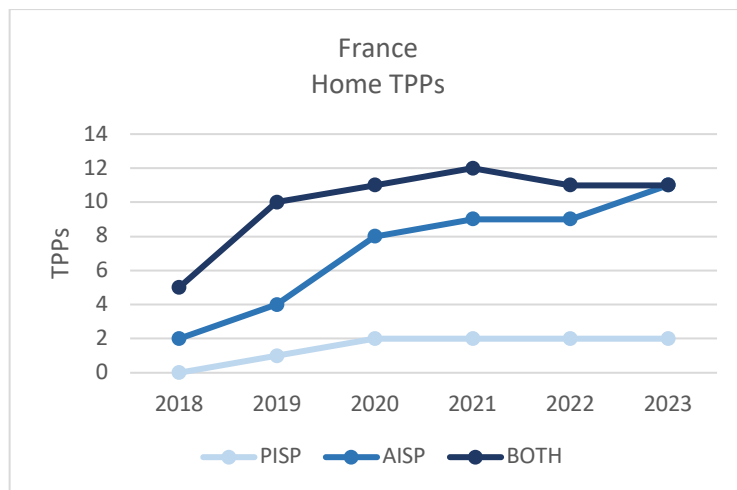


Figure 9: France Home TPPs

In 2022, after a strong start, the number of third-party providers decreased for the first time due to the withdrawal of a company holding both licenses.

The year 2023, instead, was quite eventful in terms of regulations and authorizations. Two new AISPs were authorized, and two new PISP/AISP TPPs were authorized to replace two withdrawals from the same group.

The problems that TPPs in France are facing are similar to those faced by TPPs in other countries, including *competition, market saturation, regulatory environment* and *absence of standardization*. For the last of the issues mentioned above, unlike other countries, France has an established API standard called STET API, which is provided by the country’s Systèmes technologiques d’échange et de traitement. This standard is readily available for use by banks and TPPs operating within France. However, the challenge arises when dealing with other countries that may use different standards such as the Berlin Group or Open Banking UK.

Moving to the passported TPPs, there aren’t substantial differences with the German situation but in the interest of completeness, the tables will be shown below.

France	2018	2019	2020	2021	2022	2023		TOTAL
PISP	2	1	1	1	0	1		6
AISP	4	12	12	6	2	2		38
BOTH	11	26	11	13	8	5		74
Totale	17	39	24	20	10	8		118

Table 12: France passported TPPs

withdrawn	2018	2019	2020	2021	2022	2023		TOTAL
PISP	0	0	0	0	0	0		0
AISP	0	0	0	0	0	3		3
BOTH	0	0	0	0	5	2		7
Totale	0	0	0	0	5	5		10

Table 13: France passported withdrawals

As with the tables, the following graph shows no difference to that of the German passported TPPs, if not only for the slight difference in numbers.

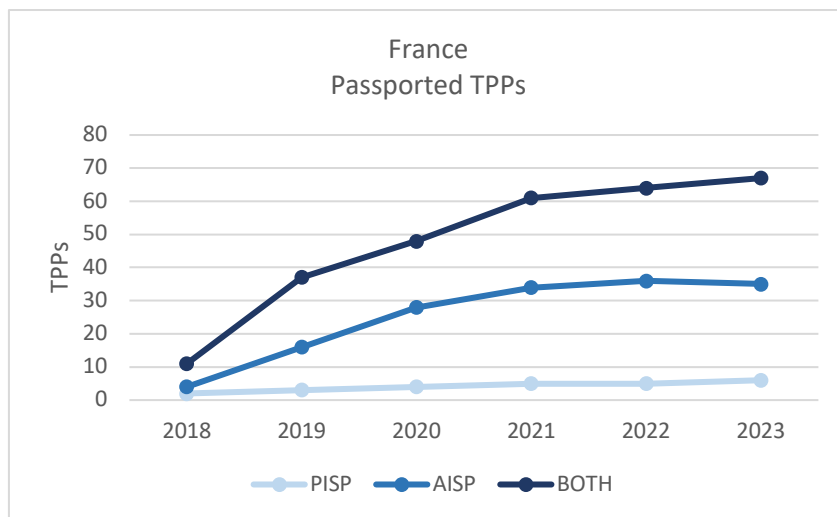


Figure 10: France passported TPPs

These similarities between the different countries will also continue in many of the states that will be analyzed in the following paragraphs. This is due to the fact that many of these TPPs are the same every time because they base their business model on expansion into other nations.

3.2.4. Spain

Spain could be considered the case most similar to Italy, indeed it is characterized by a low number of home TPPs, 16 precisely, and a high number of passported ones 114, only five less than Italy.

Table 14 below shows that, during the first year, there were no authorizations for any typology of TPP. The slow start to Open Banking was due to the fact that Spain was one of the last European members to ratify PSD2, i.e. nine months later since the directive came into force in January 2018.

Spain	2018	2019	2020	2021	2022	2023	TOTAL
PISP	0	1	1	0	0	0	2
AISP	0	0	1	0	3	1	5
BOTH	0	4	3	2	0	0	9
Withdrawn	0	0	0	0	0	0	0
Total	0	5	5	2	3	1	16

Table 14: Spain Home TPPs

Out of all the countries that were analyzed, Spain has the highest percentage of TPPs with only a PIS license, which stands at 12.5%. However, this high percentage is not because Spain has many PISPs,

as a matter of fact, it only has 2 like France. The reason for such a high percentage is simply because the total number of TPPs in Spain is relatively small.

Compared to Italy, which was the country with the most similar route, the number of TPPs with both licenses is much less, only 9 which is equivalent to a bit more than 55%, while in Italy there are 15, representing a bit less than 80%.

However, the number of AISPs at the end of 2023 is more than double that of Italy, emphasizing a major interest in offering only these types of services.

The Spain graph is the first to show a substantial difference from the other countries already examined.

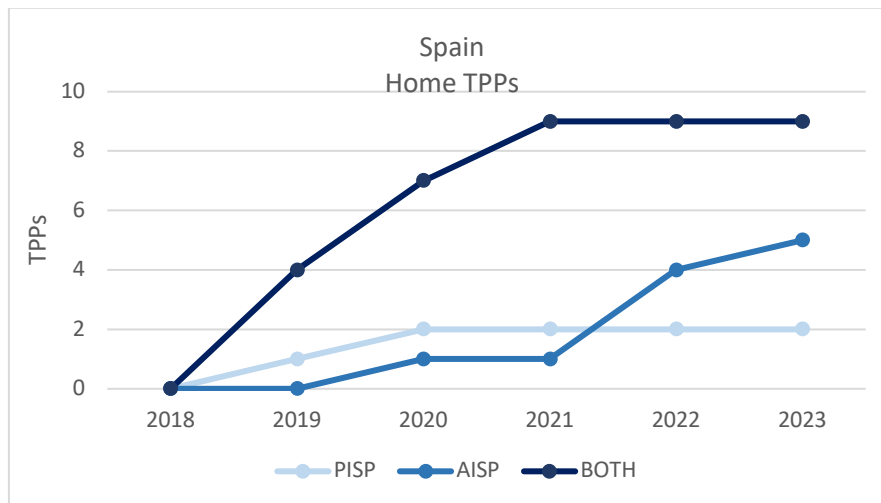


Figure 11: Spain Home TPPs

Differently for other countries, the TPPs that offered only account services were less than the ones that offered payment initiative services for several years (until 2021), to then have a sudden surge in the last 2 years considered.

In the end, Spain has relatively fewer Home TPPs compared to other European countries due to the *slow start* that was already mentioned at the start of this section. Indeed, the ratification of the Payment Services Directive 2 (PSD2), in November 2018, delayed the execution of open banking initiatives in Spain.

Furthermore, the passported TPPs could have taken advantage of this late start by expanding from other countries just after the ratification, having already functioning business models. In this way, the home TPPs could find themselves in the position to enter an already more saturated and competitive market.

Despite all, Spain has shown momentum in supporting and defining international and national standards for open banking. For instance, Spain's national payment system Iberpay was the first domestic interbank infrastructure to incorporate Sepa Credit Transfer Inst, with a high percentage of SEPA participants also being SCT Inst participants as of January 2023.

[20]

Even in this case, the tables for the passported TPPs will be shown but there are not any peculiarities compared to the other countries.

Spain	2018	2019	2020	2021	2022	2023		TOTAL
PISP	2	2	0	1	0	0		5
AISP	6	12	12	7	1	2		40
BOTH	15	27	9	14	8	6		79
Total	23	41	21	22	9	8		124

Table 15: Spain passported TPPs

withdrawn	2018	2019	2020	2021	2022	2023		TOTAL
PISP	0	0	0	0	0	0		0
AISP	0	0	0	0	1	3		4
BOTH	0	0	0	0	4	2		6
Total	0	0	0	0	5	5		10

Table 16: Spain passported withdrawals

Regarding the following graph, the trends for each type of TPP are almost identical to the Italian one, indicating that almost all the TPPs are the same for the two countries. The differences can be due to the home TPPs because Spain has more of them that expand to Italy than vice versa.

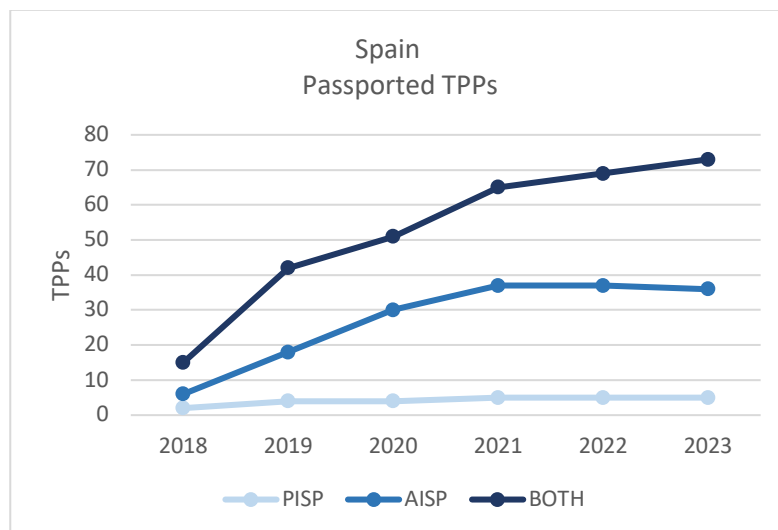


Figure 12: Spain passported TPPs

3.2.5. Sweden

Sweden is now one of the nations that is leading the way in Open banking. Thanks to a regulatory environment that promotes proactive measures, it has become a leading hub for fintech innovation throughout all of Europe.

After the UK and Germany, Sweden has the most developed open banking sector.

In terms of Third-party providers in Sweden, there are 39 Home TPPs, which is the highest number in continental Europe. However, for passported TPPs, Sweden has the lowest number at 101, when compared to other countries considered for this thesis.

In Table 17, it can be observed that Sweden and Spain had a similar start with zero home TPPs in the first year. However, in the following year, Sweden authorized 27 TPPs, which was a significant improvement.

Sweden	2018	2019	2020	2021	2022	2023		TOTAL
PISP	0	1	1	0	0	0		2
AISP	0	14	5	2	1	1		23
BOTH	0	12	3	3	2	1		21
Withdrawn	0	0	0	0	5	2		7
Total	0	27	9	5	-2	0		39

Table 17: Sweden Home TPPs

Currently, the number of AISPs, 19, equals that of the TPPs that have both licenses. This means that, even in this case, open banking is mostly used for account services rather than only payment initiation services.

In 2022, the number of TPPs in Sweden's territory decreased for the first time, because of the withdrawals of 5 of them (1 AISP, 1 PISP and 3 PISP/AISP), while only 3 new authorizations were granted.

The following year, the situation stabilized because 2 new authorizations were granted which offset the withdrawals of 2 already existing TPPs.

The graph in Figure 13 shows that PISP/AISP TPPs had a stronger start than the other typologies until 2021. Over the years the TPPs that specialize in account management or account aggregation services have acquired more importance, while the TPPs offering payment services have suffered a contraction.

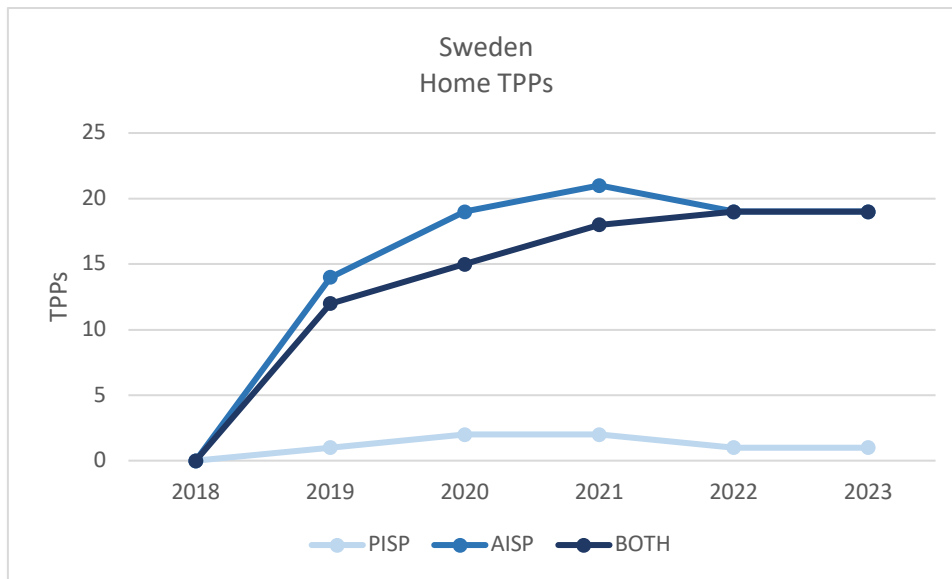


Figure 13: Sweden Home TPPs

Sweden has managed to achieve one of the most advanced open banking ecosystems thanks to several factors. Firstly, the creation of the P27 project, called like this for the 27 million people who live in Sweden, Norway, Finland, and Denmark, in which a group of the major banks of the listed states teamed up to create a pan-Nordic, real-time, cross-border payment infrastructure. This project has played a significant role in fostering the readiness for open banking in Sweden and other countries even if in the end the project ended in failure. The rollout of the P27 phases started in February 2018, but it was withdrawn during 2023 due to a lack of political alignment across too many stakeholders and a lack of critical mass to start up with. [26]

Another important factor is that Sweden is one of Europe's most digitized societies, according to the Mastercard report [20] 84% of 14-76 year-olds were using digital banking in 2021, making the adoption of open banking easier compared to other countries not so used to these technologies, as for example Italy.

For the passported TPPs, Sweden is the lowest among the countries considered, the reason could be the inverse of Italy, meaning that this time could be that the passported TPPs decided to not expand to Sweden because the market was already saturated with the home TPPs and so preferred to expand to other countries.

Sweden	2018	2019	2020	2021	2022	2023		TOTAL
PISP	2	2	1	1	0	0		6
AISP	4	9	10	7	1	2		33
BOTH	12	21	14	11	8	6		72
Total	18	32	25	19	9	8		111

Table 18: Sweden passported TPPs

withdrawn	2018	2019	2020	2021	2022	2023		TOTAL
PISP	0	0	0	0	0	0		0
AISP	0	0	0	0	0	3		3
BOTH	0	0	0	0	5	2		7
Totale	0	0	0	0	5	5		10

Table 19: Sweden passported withdrawals

The graph instead, follows also in this case the trends already analyzed in many of the other countries.

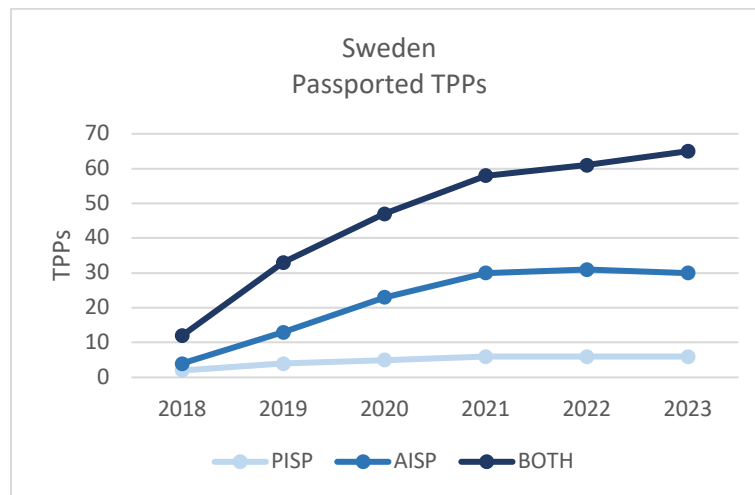


Figure 14: Sweden passported TPPs

3.2.6. Netherlands

The Netherlands is the second and last country in northern Europe taken into consideration. Like Sweden, the Netherlands is a very digitalized country and its citizens are very used to managing their payments through these digitalized means.

For this reason, open banking should be thriving in this country thanks to the natural synergy between real-time payments and open banking.

Let's examine whether a trend similar to Sweden's, which has comparable levels of digitalization, can be observed in the Netherlands compared to countries with lower levels of digitalization, such as Italy, by analyzing the distribution of home TPP.

Netherlands	2018	2019	2020	2021	2022	2023	TOTAL
PISP	0	0	0	0	0	0	0
AISP	0	5	7	2	4	0	18
BOTH	0	6	3	5	0	0	14
Withdrawn	0	0	0	3	0	3	6
Totale	0	11	10	7	4	0	26

Table 20: The Netherlands Home TPPs

Considering the TPPs that had their licenses withdrawn, the Netherlands has the same number of AISPs and PISP/AISP, only 13, at the end of 2023. These numbers are in line with countries like France and Poland but are very far from what Sweden managed to reach.

From the graph below, it is very clear that home TPPs in the Netherlands have a difficult time remaining in the market, both AISP and PISP/AISP.

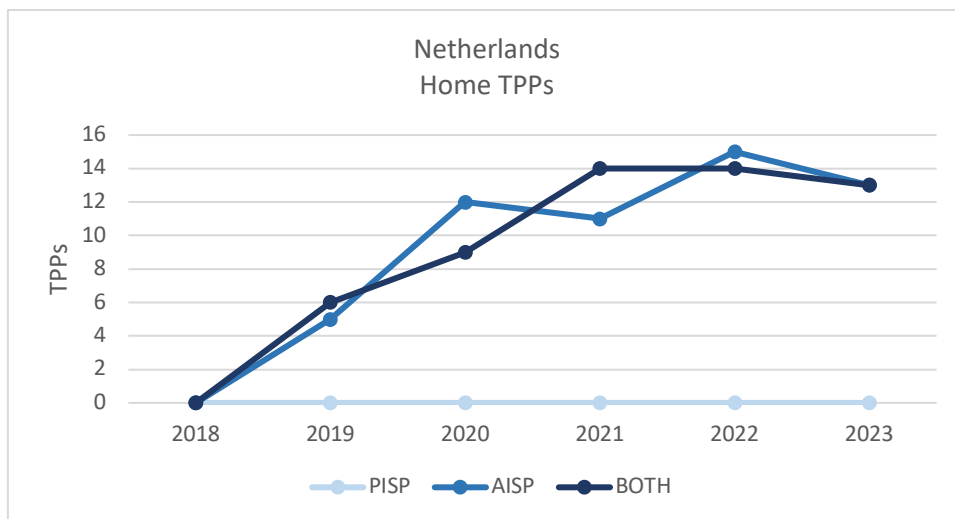


Figure 15: The Netherlands Home TPPs

Open banking in the Netherlands may be hindered by its digitalization, in contrast to Sweden's strength. According to a MasterCard report, open banking has to face a unique payments backdrop in this country.

Currently, the default method for credit transfer is the Dutch Payments Association, covering almost all Dutch payment accounts. In addition, several major Dutch banks have partnered around iDeal, a solution for the management of real-time e-payments for retail. This solution is already widely appreciated by the citizens.

Financial institutions themselves are not highly motivated to invest much in this technology in order to solve the issues that they have to face like API standardization since many of the services that open banking provides already exist without any problem.

Accounting aggregation services, indeed, are already widespread throughout the population and the payments are very efficient both online and offline.

However, it seems that there are still some services for which open banking can become useful according to Dutch citizens, some examples are the ability to manage all subscriptions in one app or Buy Now Pay Later which will benefit from instant credit through open banking.

[20]

Looking at the passported TPPs tables 21 and 22 and the graph in Figure 13, it is possible to see that they follow the same trends and patterns as the other countries.

Netherlands	2018	2019	2020	2021	2022	2023		TOTAL
PISP	2	2	1	1	0	1		7
AISP	4	16	12	7	2	2		43
BOTH	15	23	14	8	8	6		74
Total	21	41	27	16	10	9		124

Table 21: The Netherlands passported TPPs

withdrawn	2018	2019	2020	2021	2022	2023		TOTAL
PISP	0	0	0	0	0	0		0
AISP	0	0	0	0	1	3		4
BOTH	0	0	0	0	6	3		9
Total	0	0	0	0	7	6		13

Table 22: The Netherlands passported withdrawals

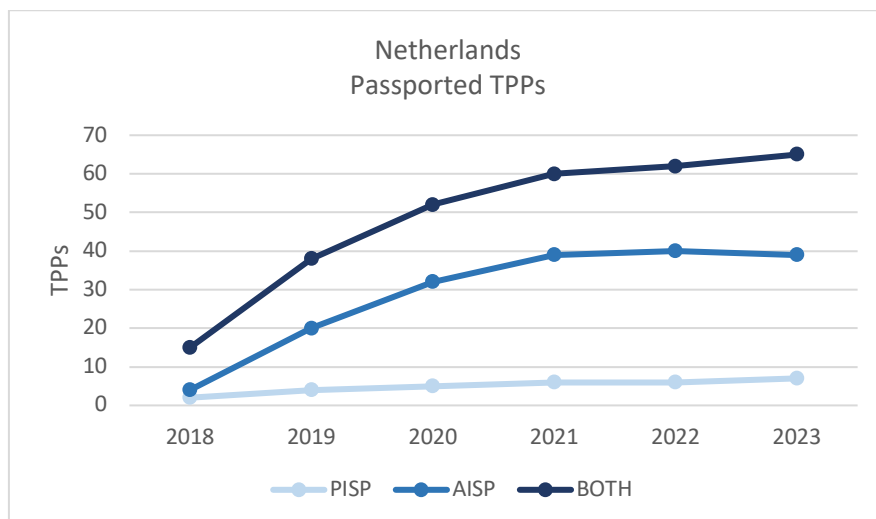


Figure 16: The Netherlands passported TPPs

3.2.7. Poland

Poland is the last country considered in this thesis. It has 21 home TPPs so it is below the average of the countries considered, like Italy and Spain, while for the passported ones, it is really close to the average, with only 2 TPPs less. In total, Poland has 130 operating TPPs within its borders.

Looking at Table 23, it is noticeable a particular situation. There is much more emphasis on the TPPs with an AIS license which represents a bit more than 71%, while the TPPs with both licenses are only 24%.

Poland	2018	2019	2020	2021	2022	2023	TOTAL
PISP	0	0	0	1	0	0	1
AISP	0	0	4	7	2	2	15
BOTH	0	1	0	2	1	1	5
Total	0	1	4	10	3	3	21

Table 23: Poland Home TPPs

This result is in contrast to those seen so far, where many of the TPPs in other countries prefer to have both licenses and their number is usually higher than the AISPs or at best they are close. Indicating, also in this case, that open banking is seen more as a tool for the management of the accounts or personal finances than as a tool of payment.

This trend can be visualized by looking at the graph in Figure 17, where from 2020 the number of AISPs started to gain always more advantages against the other TPPs.

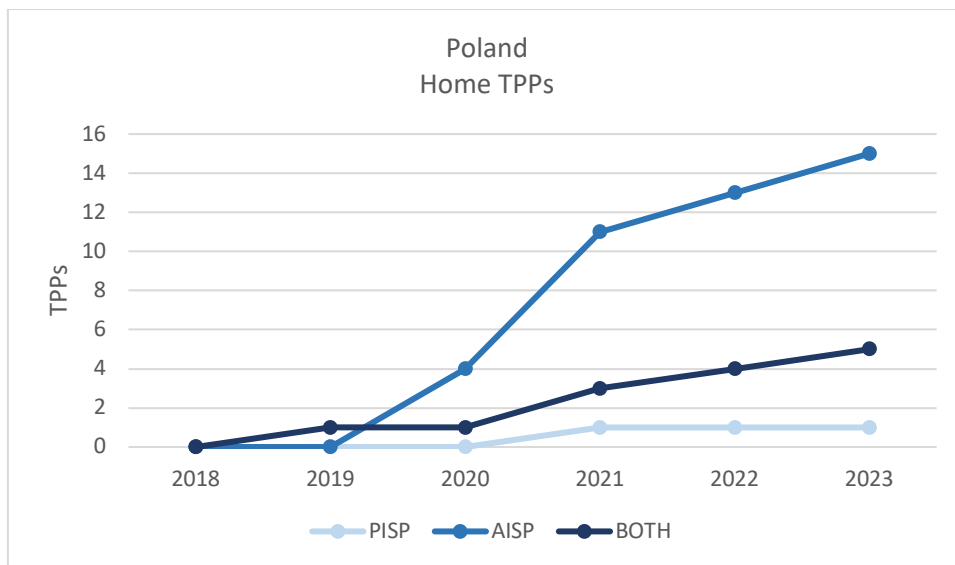


Figure 17: Poland Home TPPs

The fact that Poland already has a popular payment method may explain the low presence of PPTs with PIS licenses. This method takes the name “Blik” and it is a popular mobile payment system that allows users to make secure transactions with their phone or tablet. Through Blik, people can perform online shopping, peer-to-peer payments, and bill payments. All major Polish banks support Blik as a local payment method.

Blik shares many strengths with open banking, particularly its perceived security and ease of use for making payments. In fact, it has become quite popular, with 95% of users having access to it.

[27]

This situation is similar to that in the Netherlands, where citizens and businesses have no incentive to get used to a new payment method, in this case open banking, because they don't need to change what's already working for them.

Regarding the passported TPPs, the table 24 and 25 and the graph in Figure 18 show only minor differences that do not point to anything new in comparison with the other countries.

Poland	2018	2019	2020	2021	2022	2023		TOTAL
PISP	2	1	1	1	0	0		5
AISP	5	9	9	6	1	2		32
BOTH	15	29	13	12	8	5		82
Total	22	39	23	19	9	7		119

Table 24: Poland passported TPPs

withdrawn	2018	2019	2020	2021	2022	2023		TOTAL
PISP	0	0	0	0	0	0		0
AISP	0	0	0	0	1	3		4
BOTH	0	0	0	0	4	2		6
Total	0	0	0	0	5	5		10

Table 25: Poland passported withdrawals

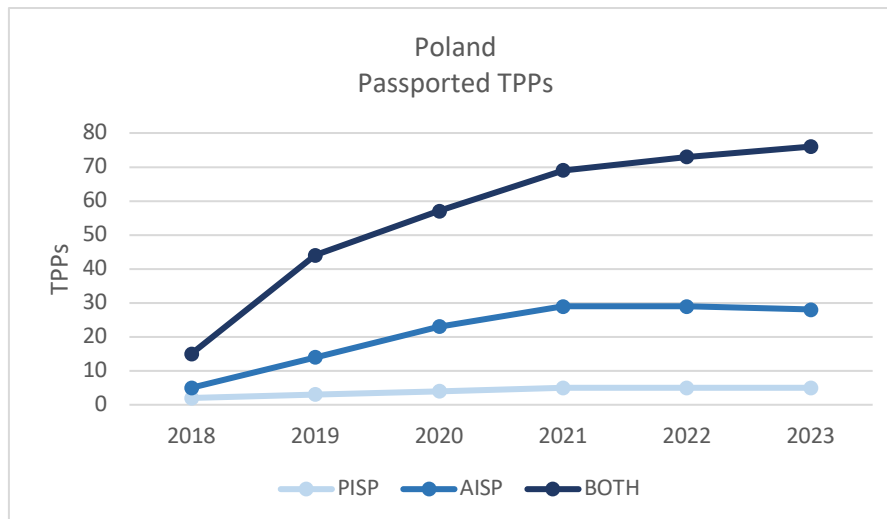


Figure 18: Poland passported TPPs

3.2.8. European overview

Upon assessing the current situation, it appears that Europe is lacking uniformity in its approach to open banking. Each country is facing unique challenges in implementing this technology effectively and efficiently to fully realize its potential benefits. Some countries also had a slower adoption of open banking due to the need to transpose the directive into national law, leading to some variation in how it is applied.

As a result, regulatory challenges were faced by each member state in the EU, such as the need to comply with data protection rules.

Even countries that appear to have similar starting points can find themselves in completely different situations. For example, Sweden and the Netherlands are both highly digitalized countries, but while this represents an advantage for Sweden in implementing new technology, it is a barrier that open banking must overcome in the Netherlands to become a viable payment solution for citizens.

One other problem that is prevalent in all European countries is the lack of standardization of API. The absence of regulations is hindering the growth of open banking as financial institutions have to build customized APIs for each bank, TPP and other entities they want to interface with. This process can be time-consuming and expensive. Fortunately, this issue should be alleviated with the introduction of the PSD3 and new PSR directives.

All the countries considered had a prevalence of TPPs that could perform account information services compared to the ones that could do the payment initiation services.

The figures below will help to highlight this TPP distribution for each country putting them side to side to have a better overview of the situation.

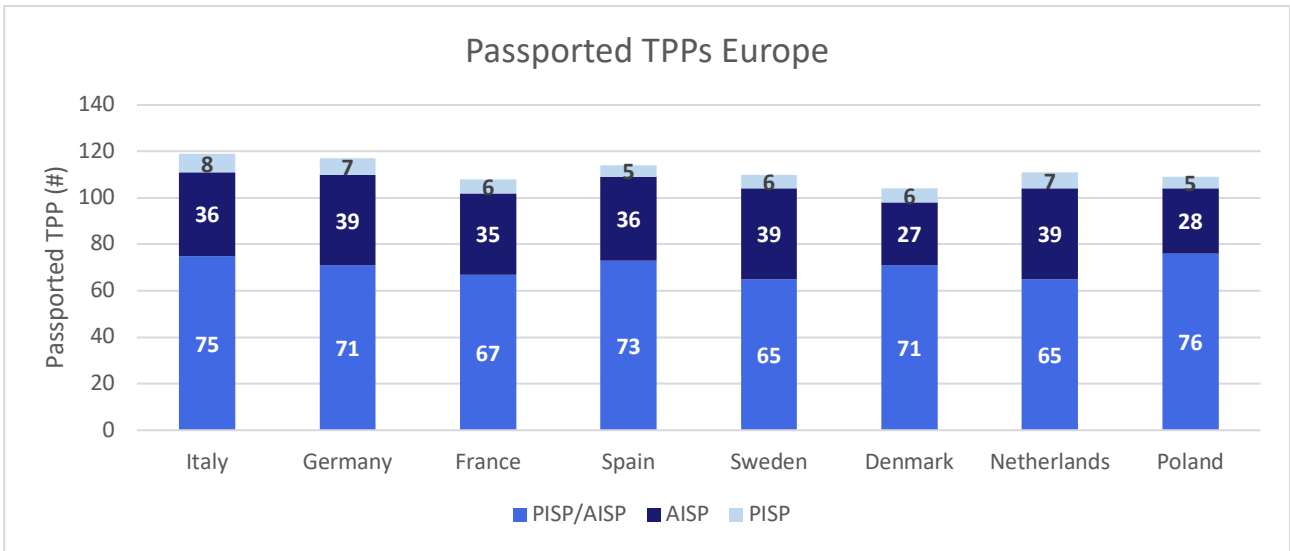


Figure 19: Passported TPP distribution in Europe

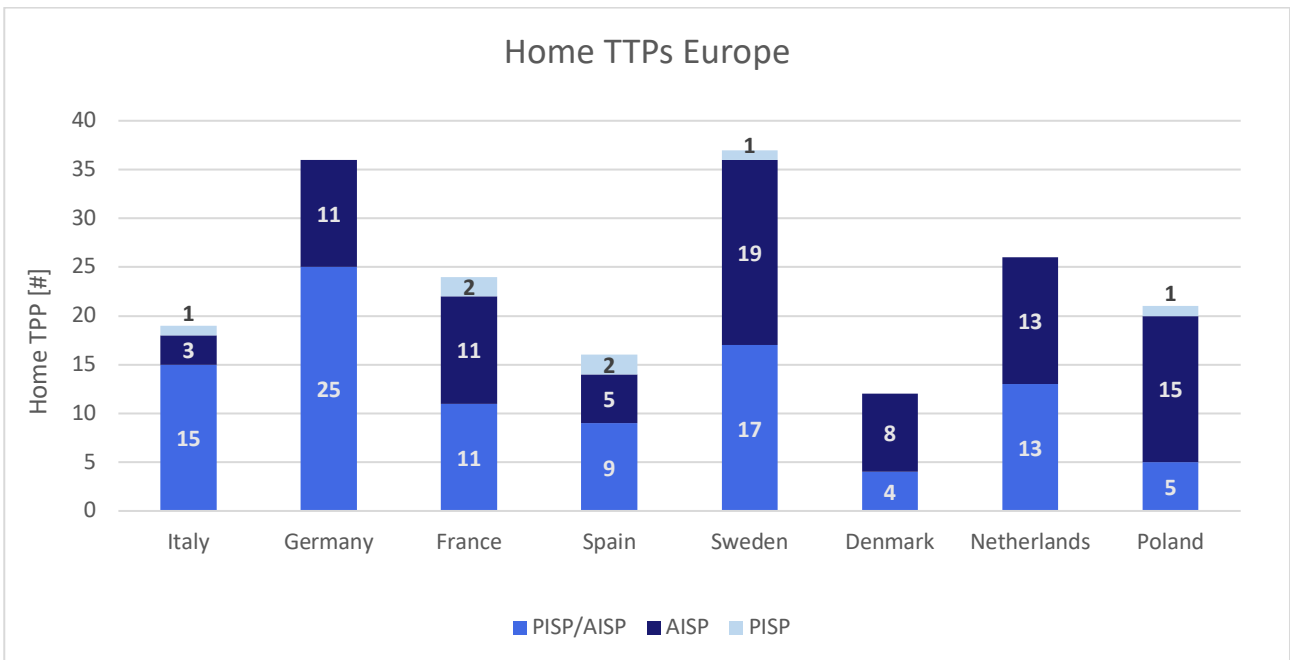


Figure 20: Home TPP distribution in Europe

The current situation is unexpected due to the fact that payment initiation services are deemed to be an advancement over the existing payment methods as they are cost-effective and facilitate cross-border payments. Additionally, they offer faster confirmation of transaction completion to both parties involved. These enhancements are particularly beneficial for merchants, as PSD2-enabled PIS allows them to promptly receive funds at low cost from customers across the European Union.

According to “a study on the application and impact of Directive (EU) 2015/2366 on Payment Services (PSD2)” this lag of PIS compared to AIS can be explained by three different reasons:

- **Established domestically operated alternatives**, because they are hard to compete with given their familiarity with customers and similarly low costs and fast transfers, like in the case of Norway.
- The **prohibition on surcharging**, because without it merchants have limited possibilities to incentivize customers to use the cheaper payment methods.
- **APIs/Obstacles to use TPPs at POS**, for example, people have to get used to a new type of payment service and give consent while using it.

If the obstacles facing PIS can be overcome and it becomes a popular payment method, it has the potential to fulfill several needs. Firstly, it will introduce more effective competition to the current payment methods. Secondly, it will resolve the fragmented market for innovative payment solutions, as these payment options will not be limited by national borders.

[28]

Another possible reason for the slowdown in the growth of authorized TPPs in many European countries in recent years could be the emergence of the **license-as-a-service** proposition.

This proposal allows non-authorized third parties to access and provide Account Information Services and Payment Initiation Services by requesting their customers to give consent to a licensed Third-Party Provider who complies with anti-money laundering regulations and identifies itself while making an API call at an Account Servicing Payment Service Provider (ASPSP). The information will then be transferred to the unlicensed third party.

It is important to consider certain risks when using this type of model. For example, customers may not fully understand which TTP they are giving consent to use their data. Additionally, the unlicensed party that receives the data may not be supervised as a Third-Party Provider under PSD2.

Many companies may prefer to adopt this solution in order to avoid the time-consuming and cost-efficient process of obtaining the authorization required to offer these services, considering also the fact that the difficulty to obtain it varies by country.

3.3. Enterprise Level

From this point, the thesis will shift its focus to a more practical level by examining the choices that businesses have made to try to capitalize on the opportunities presented by open banking. The analysis includes consideration of 257 TPPs operating in the previously analyzed countries.

As explained in the methodology, we analyzed various features of each TPP to gain a comprehensive understanding of the current state and future direction of open banking. These features are:

- The country of origin*
- The type of player*
- The type of customer*
- The Open banking services provided (PISP, AISP or both)*
- The countries serviced*
- The services provided with the account information license*
- The services provided with the payment initiation license*
- Other services offered by the company*

The analysis of the country of origin and the countries serviced will be omitted in this section because it may be redundant considering the previous chapter's analysis.

The first feature that will be analyzed is the *type of player*.

3.3.1. Type of player

A total of 257 companies, comprising 44 different types, have been authorized as third-party providers. These types include expected ones such as fintech or payment institutions, as well as less conventional ones like telemarketing call centers or urban and suburban mobility firms, which mainly use these licenses for sales purposes.

Analyzing first the most popular type, *fintechs* predominantly represent more than half of all 257 firms considered. There are several different kinds of fintech, going from electronic money institutions to fintechs that act as payment institutions or that are authorized only as AISP to fintechs that offer general financial services to help their customers in one way or another, like helping people with their savings and so on.

Open banking platform is the next big group of companies, counting 30 of them, that have got at least one authorization. These companies were separated from the other fintechs for their purpose, indeed they base their business on providing open banking solutions to banks, other fintechs and any companies that are interested in these products to improve their own services.

These firms are also useful for standardizing APIs, because every company that relies on the same open banking platform will have APIs that have the same standard, for example the Berlin Group standard, making it easier to connect between them.

The last kind of firm that seems to be using open banking solutions are businesses focused only on *accounting and audit services*, their numbers are very few relative to the last two previous groups discussed, not keeping in consideration companies that offer these services as additional services. There are about 15 of them in all the companies considered and they are almost equally divided between AISP and PISP/AISP, with none of them having only a PISP license.

In these three groups, almost all the companies have an AISP license and at most the PIS license is found in conjunction with the latter. Between all of them, only 8 of the fintech group are operating with only a PISP license. This data suggests that PISP licenses are exclusively utilized by firms whose operations are based on payment institutions or electronic money institutions. The other companies holding a PISP license operate in diverse sectors outside of finance, utilizing the license to simplify their payment processes for purchasing goods.

For a more precise analysis of the distribution of both AISPs and PISP/AISPs, the utilization of the following pie charts can be particularly insightful.

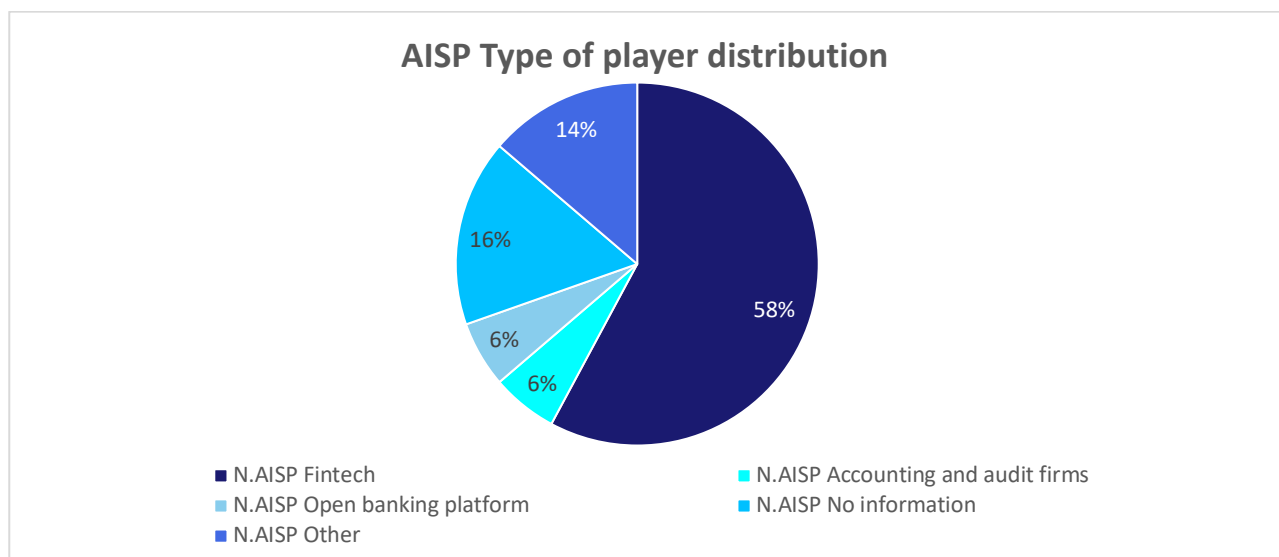


Figure 21: AISP type of player pie chart

Starting from the AISP pie chart (Figure 21), as mentioned above the fintechs represent more than half of the players and are followed, not considering the no information group that was not found by searching on the web, by the group that is called Other.

This group is composed of companies that are not part of the other, an example is a company that has an AISP license to offer HR solutions. The fact that this group of companies is the second largest

shows the possibilities that these licenses offer even to companies that are not directly correlated to the financial sector.

The last place is shared between open banking platforms and accounting and audit firms, which use the AIS license to gather more easily the financial data of their customers.

Moving to the PISP/AISP pie chart (Figure 22), the most substantial difference from Figure 21 is the number of open banking platforms, which is four times more than before. One possible explanation is that companies focusing on providing these services need to obtain both licenses to be more competitive and to appeal to all types of financial institutions. Furthermore, these institutions do not need to be authorized to offer these services. Only the open banking platform needs to be authorized. As a result, they would prefer a platform that allows them to access the majority of services without having to wait for the regulations.

Another key difference is the presence of payment institutions. It seems logical that payment institutions would mainly need the PISP license to offer more payment options to their customers. However, almost all of these payment institutions have also obtained an AISP license. In fact, only one of them is solely a PISP, indicating that they require both licenses to fully leverage open banking technology.

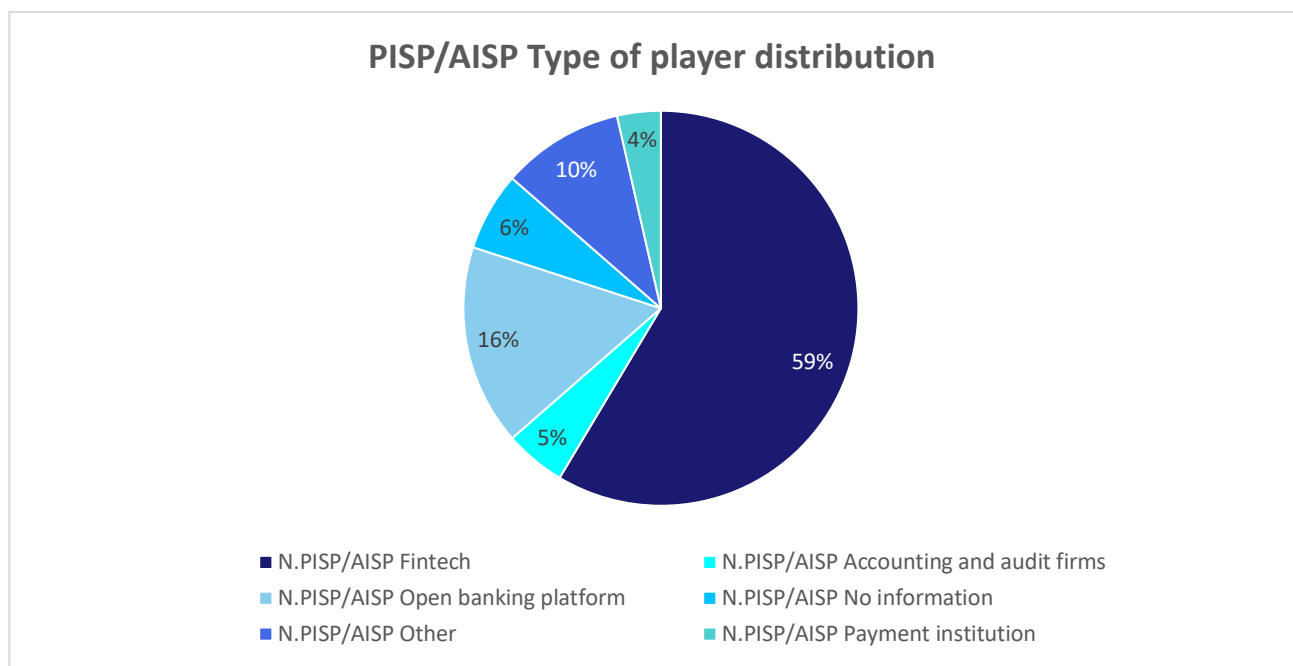


Figure 22: PISP/AISP type of player pie chart

3.3.2. Customer

The focus in this section will move from the type of player to the customers that are served by the third-party providers considered, this will make it possible to understand if open banking services are specifically made mainly for a certain typology of customer or if their different applications can become useful for a wider range of companies.

As written in the methodology, seven different variables were considered:

- Enterprise*
- Individual customer*
- Enterprise/individual customer*
- Financial institution*
- Financial institution/enterprise*
- E-commerce*
- No information*

For each one of them, it will be given a brief explanation since a more complete one can be found in the *analysis of data* section of the Methodologies chapter.

- Enterprises:** The customers, in this case, are entire enterprises of all sizes, from small and medium to large corporations. Typically, third-party providers that want to cater to this category offer services that enable businesses to become more efficient by utilizing open banking technologies.
- Individual customer:** In this scenario, the services or products provided are customized to meet the individual needs of a single customer or to enhance the customer's comprehension of their financial condition.
- Financial Institution:** In this case, the target customers for TPPs are banks or other financial institutions. TPPs can offer expanded solutions to these institutions, such as new APIs for account balances, payment transactions, and additional information about the bank's clients.
- E-commerce:** TPPs can specialize in offering their services or products to businesses that operate solely online, unlike the case of the enterprise category, which is more focused on physical businesses that may also have an online presence.
- Enterprises/Individual customer:** For certain scenarios in which third-party providers, or TPPs, can simultaneously present solutions that cater to individual customers and enterprises.
- Financial Institutions/Enterprises:** In addition to individual customers, some third-party providers (TPPs) can also offer solutions that cater to enterprises and financial institutions together.

- **No information:** This category includes TPPs for which it is impossible to find the website or are untranslatable

First thing, it is possible to analyze the customer distribution for the 257 players using the following pie chart to have a general idea.

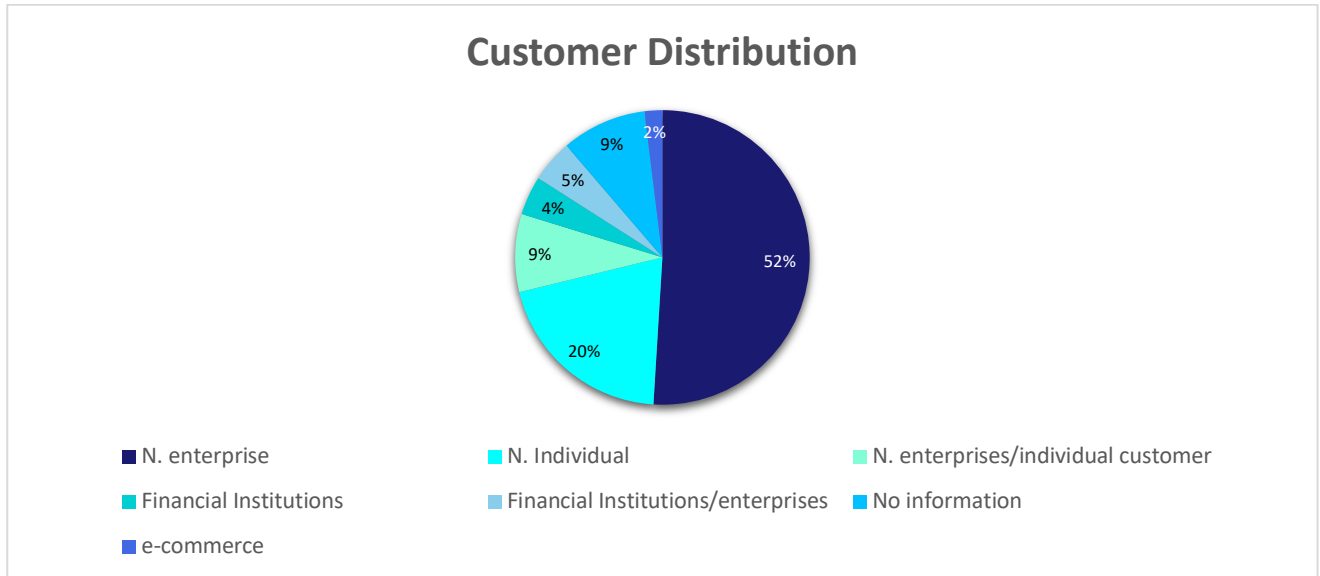


Figure 23: Customer distribution pie chart

Figure 23 shows that a percentage over 65% of TPPs provide services and products for *enterprises*, considering also the ones that have enterprises together with another typology as one of their customers. It seems that TPPs may prefer to sell to enterprises because they can offer a wider variety of products. These products range from financial management systems to simpler, faster payment systems that utilize open banking technologies. So selling to businesses provides TPPs with more revenue opportunities.

Individual customer is the second most populated group, in this case, the TPPs focus on the needs of a single person, usually, enhancing the customer’s comprehension of their financial condition. TPPs could decide to cater to individual customers rather than enterprises because there is a broader customer base since every individual can become a customer, another factor is that the services offered would be less complex than the ones offered to enterprises and lastly, less barrier to entry because acquiring individual customers can be simpler and less expensive than acquiring business clients. Marketing campaigns and customer acquisition strategies can be less complex and more affordable.

Financial institutions as customers instead occupy a relatively small slice of the pie chart, with less than 10% of the total. This may be because they are more likely to develop their own services using open banking rather than seeking out competitors. As mentioned earlier, financial institutions might choose to use open banking services from other companies to avoid the lengthy process and challenges of obtaining authorizations.

In the following table, the distribution of customers will be shown according to the licenses of the third-party provider, similar to how it was done for the types of players.

N. AISP enterprises	44
N.AISP individual customer	25
N.AISP enterprises/individual	6
N.AiSP Financial Institutions	4
N.AISP Financial Institutions/enterprises	4
No information	17
N AISP. e-commerce	2
N. PISP enterprises	5
N.PISP individual customer	3
N.PISP enterprises/individual	4
N.PISP Financial Institutions	2
N.PISP Financial Institutions/enterprises	0
No information	0
N.PISP e-commerce	0
N. PISP/AISP enterprises	82
N.PISP/AISP individual customer	24
N.PISP/AISP enterprises/individual	12
N.PISP/AISP Financial Institutions	4
N.PISP/AISP Financial Institutions/enterprises	8
No information	7
N.PISP/AISP e-commerce	3

Table 26: Customer distribution according to the license

The table does not use percentage values to give an idea of the effective quantity for each category.

With percentages, the difference in magnitude between values would not be clear, for example, the values of PISP's customers are extremely low compared to the other two categories. For this reason, it was considered a better solution to represent them like this.

A more thorough analysis of the PISP's customers will be avoided, again due to the lack of sufficient data for proper considerations.

The AISP customer distribution can be visualized through the use of another pie chart.

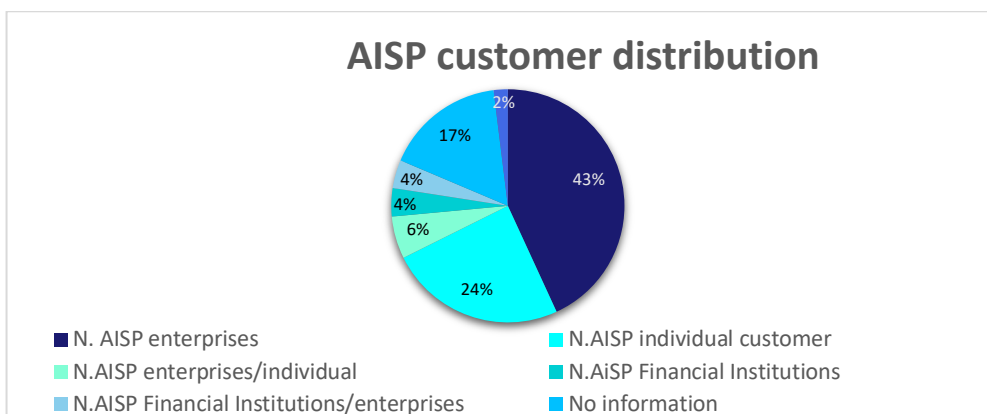


Figure 24: AISP customer distribution pie chart

Through the analysis of the distribution of AISP clients (Figure 24) it is possible to notice that businesses continue to be the preferred type of clients. However, they have ceded some of their dominance to individual clients in this scenario. This is due to the fact that the services offered by the Account Information Service license can provide perfect solutions to enhance and simplify the financial lives of individual consumers.

There are plenty of examples of these services that will be discussed in the following chapter in more detail. In summary, many of these allow customers to manage their finances more easily by consolidating all their bank accounts in a single application, providing advice on savings in some cases with the use of machine learning, or informing the customer about their creditworthiness without having to go to the bank.

So TPPs can exploit the fact that in Europe many people have a low or medium financial knowledge [29] so there is a need for products that can improve this situation. Having all this information easily accessible, indeed, can increase clients' independence regarding financial affairs, without the need for help from outside sources, but helping them make the right choice for their situation, increasing their economic well-being.

Moving now to the next pie chart (Figure 25) about PISP/AISP customer distribution

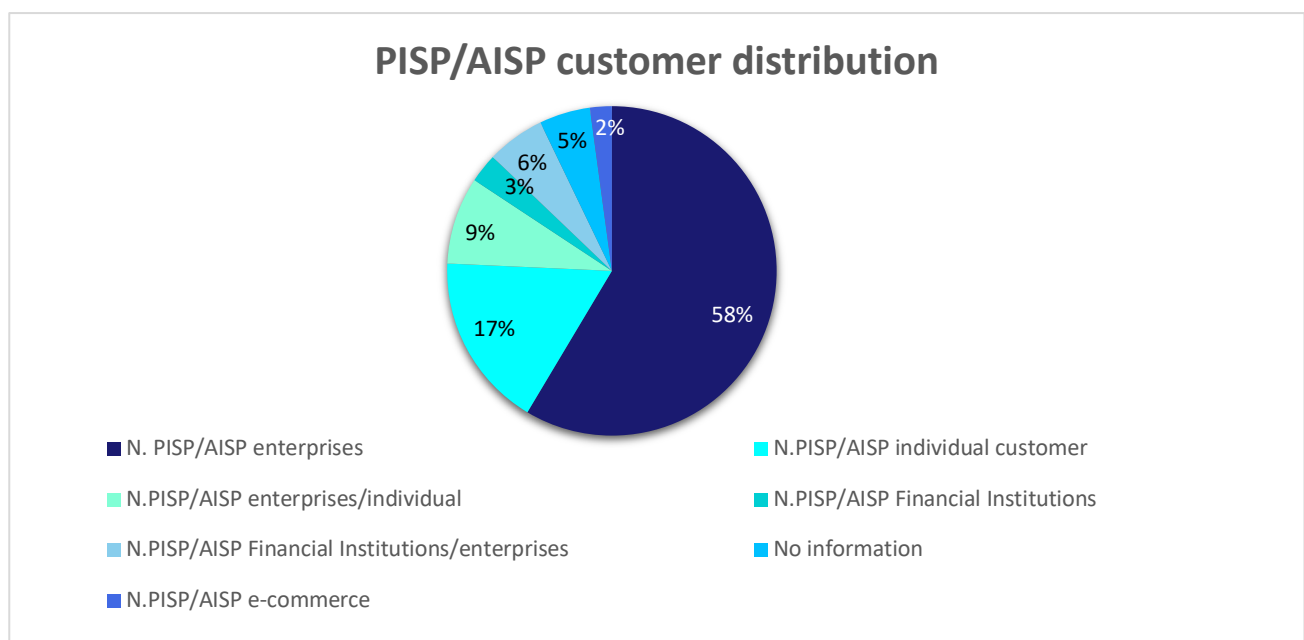


Figure 25: PISP/AISP customer distribution pie chart

This time, the number of enterprise customers has exceeded 70% of the total. This increase is likely due to the PISP license, which allows TPPs to offer all businesses a faster and more cost-effective alternative payment method. For this reason, their product can cater to a great number of this type

of customers. The AISP license can be used complementarily to the PISP license to provide businesses with additional transaction information and verify their clients' IBAN.

In the end, enterprises may find that Third-Party Providers holding dual licenses offer significant benefits for improving both payment methods and optimizing financial management. This is due to the wider range of services available in a single integrated platform.

3.3.3. The services provided by the AISP and PISP

After having already seen the type of players and the customers, the analysis will focus on the *services offered by the TPPs*, starting specifically with those provided by the *AISPs* and then by the *PISPs*.

An explanation of these account information services alone would not be very useful, so the clients they are aimed at will be indicated by dividing them only into corporate and individual clients since it has been seen that they are the main target audiences. Doing in this way will allow to see the differences between the demand of each customer category.

When considering third-party providers with other firms as customers, their more requested services can be grouped into four main distinct categories:

- Financial support and management*
- Services for the aggregation of all the financial data, with a dashboard to view balances, transactions and movements*
- Creditworthiness APIs to make real-time credit decision*
- Account owner verification services and IBAN verification*

The first one of these requested services is related to *financial support and management*. In this case, TPPs can offer to create or improve a company's budget, improve financial activities related to revenue and costs, or establish and implement a company's financial control system. In this scenario, APIs are utilized to connect TPPs with their clients, enabling the former to access the most up-to-date data for providing optimal assistance.

The next three types of services in high demand from companies present a substantial difference from the ones already explained. The earlier services were solutions offered by TPPs that directly impacted the client company, such as various financial or management services to improve the processes inside the company. On the other hand, the next set of solutions involves offering additional services to the clients of the companies themselves. TPPs enable companies to offer services, again through the use of APIs, that they would not have otherwise been able to offer to

their customers. An example of this, that will be analyzed in the next paragraph is the use of APIs to determine a customer's creditworthiness for a loan.

When analyzing the other most requested services, it is possible to see a significant demand from companies for services that enable them to *easily monitor all their financial data and track their transactions and various movements* or use these solutions on their own customers. The capabilities, obtained from using these APIs, can be exploited by companies to enhance their processes and derive additional value from the accessible information.

As already mentioned, the capability of *determining a customer's creditworthiness* is a much sought-after solution for companies. With the use of APIs which are in some cases integrated with artificial intelligence algorithms and managed by machine learning engines, enterprises can view the financial data and analyze their customers' spending behaviors. They can then use this information to quickly determine whether to grant loans to customers and decide on the maximum sustainable installment. All this process would take place in a few minutes while using standard means could take even months in some cases.

The last solution in high demand for enterprises is services for *verifying account ownership and IBAN verification* which can also be very useful for onboarding services. The utilization of APIs to access real-time bank data facilitates the streamlining of customer identification processes during service onboarding for businesses. This approach ensures the verification of customer accounts, leading to an enhancement in overall service quality and a reduction in abandonment rates. However, these verification tools can be utilized by the company not only during onboarding processes but also for a variety of other situations, such as during payments.

Having seen which are the most requested services by companies, one can move to compare and see if there are any differences with the solutions offered to individual customers.

Even in this case, the services can be grouped in the same categories already seen except for the account verification service which would not be very useful for the individual consumer:

- Financial support and management*
- Services for the aggregation of all the financial data*
- Creditworthiness APIs to make real-time credit decision*

One important difference that must be highlighted is that the authorized TPPs offer these services directly to the final customer, the individual customer in this case, so there is not the situation like before where the TPPs would sell the possibility of using their open banking services for the use of other companies.

Financial management and support services are the most predominant of the solutions chosen by the TPPs to provide to individual clients. TPPs can provide their clients with advice for better management of their financial products, such as pensions, life insurance, credit and retirement. The use of APIs allows TPPs to create customized plans for each client based on their goals as well. It can help with smart savings or aid in investment decisions by taking into account the amount of funds available and the client's desired risk.

Often these services are already integrated with various *bank account aggregation solutions*, which, similar to those targeted to businesses, are used to easily provide an overall view without having to check each account separately.

Lastly, the *credit rating solutions* are the same as explained above, but in this case, customers can use this type of service to get an idea for themselves if they have to take a loan without having to go to the bank.

As mentioned earlier, these are just some of the most popular account information services and not an exhaustive list. Some TPPs may use this license for purposes other than those listed above. However, since these are unique cases, they were considered outliers and therefore not included. For example, a TPP might use the license to gather data and create a digital ID.

Turning to *payment initiation services*, there is a great variety among the solutions offered by the various TPPs. Enterprises use these services to offer to their end-consumers frictionless immediate or variable recurring payments via account-to-account (A2A), without interrupting the flow with the application they are in and without having to log on to their home banking.

The payment process is composed of four steps:

- 1) Payment initiation request:** In the initial payment phase (payment initiation), the end customer chooses the 'Payment from Account' service (payment initiation PIS or Account to Account A2A).
- 2) Bank selection and service acceptance:** The user is selected to a web page where they select their bank, accept the terms and conditions of services and the privacy policy.
- 3) Payment processing:** The end customer authorizes the transaction through Strong Customer Authentication (SCA), with a process similar to that used for online card purchases, then the TPPs sends the receipt and transmits the outcome of the payment to the company.
- 4) Crediting and payment irrevocability:** The credit transfer is credited in real time, in case of an instant SEPA credit transfer, or within two working days, in case of an ordinary SEPA credit transfer. In both instances, the credit transfer is irrevocable, guaranteeing the beneficiary the certainty of receipt of the funds.

[15]

Many Third-Party Providers also provide the option to receive payments using a link, which can be sent through email or SMS, or QR code. With this method, the customer doesn't need to enter any details (such as IBAN, amount, or description) because everything is already pre-filled. This makes it one of the safest payment methods available.

3.3.4. Other services offered by third-party providers

While looking at the possible solutions that authorized TPPs offered through the use of open banking, special attention was paid to the industry and the related services in which the company operates. The purpose of this analysis is to determine whether having the licenses required to become an authorized TPP can be of use not only by financial sector companies but also by other types of businesses that could benefit from the data provided through open banking for their products or operations.

Having to consider more than 250 companies, it was decided to categorize them based on the similarity of services offered and areas of expertise. The main groups that were identified, excluding companies for which couldn't be found enough information, are listed below in order of size, with the largest group listed first and the others following.

- Financial services not related to Open Banking*
- Accounting, audit and invoicing services*
- Other services*
- IT services*
- Services related to the digital ID and its verification*

The pie chart below provides an overview of the sizes of the various groups being considered.

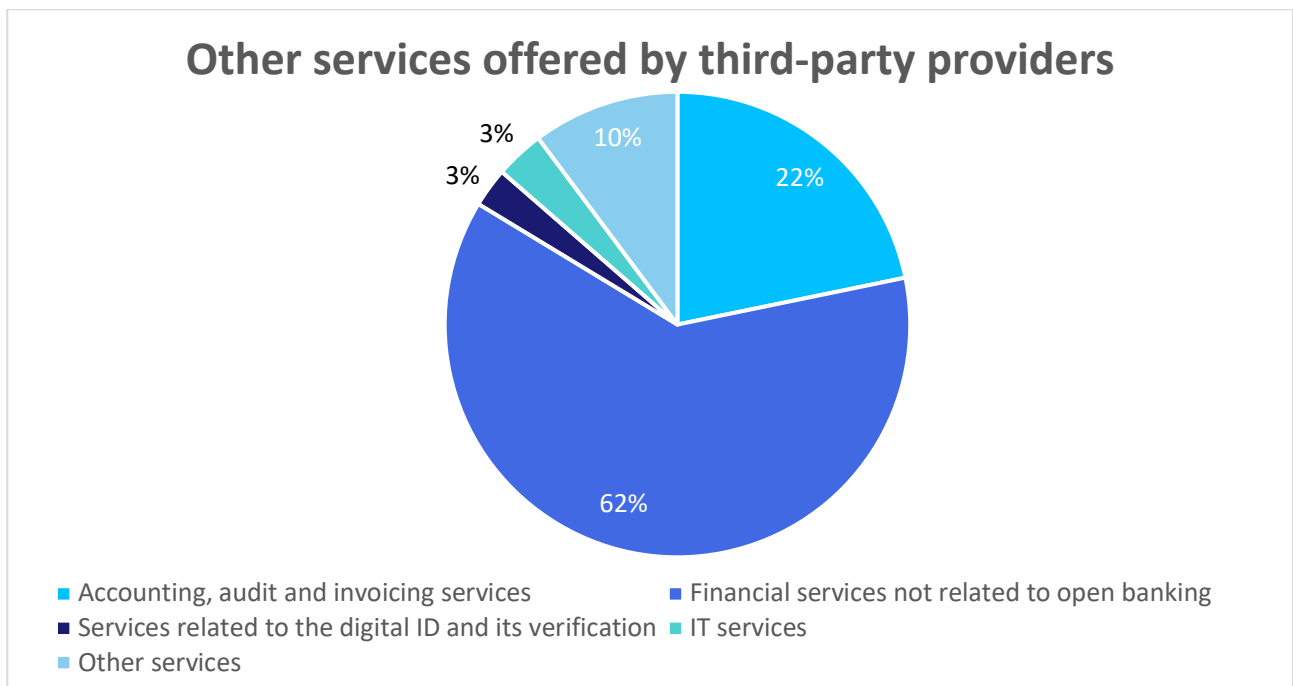


Figure 26: Other services offered by third-party providers pie chart

It's no surprise that the majority of companies offering open banking services are in the financial sector, as open banking is fundamentally a financial service and complements well with other financial services. As was already seen, some of these TPPs have open banking as the main focus of their business but several of the companies considered specialize in areas like cryptocurrencies or investment/lending services, and they use open banking only to offer customers additional options for transferring money between accounts or utilizing their data. In these instances, open banking solutions are not the primary focus of the company's business and it is used only as a means to an end. Another prime example of its utilization as a secondary tool is in the case of authorized companies that issue credit or debit cards to their clients and offer services for managing them and all open banking services references are almost impossible to find on their sites.

The following significant group comprises businesses that predominantly utilize AIS licenses to offer clients services that simplify administrative and audit tasks, as well as accounting services. In this context, open banking is leveraged to gather customers' financial data, facilitating more efficient and precise service provision and management. Open banking enables these TPPs to concentrate on delivering and improving more suitable services, rather than expending resources on data collection. Grouped in this category were also considered companies that would also use the PIS license together with the AIS one to help their clients manage invoice payments by staying always up to date.

The third group, corresponding to 10% of the total, is unique among the other groups as it comprises licensed companies that are not categorized based on the similarity of their operational functions but it is quite the opposite. It encompasses companies that are completely dissimilar from each other and from diverse sectors but at the same time, they are different from all the companies that are part of the other groups. The companies considered here are not related in any way to the world of finance and it is precisely the fact that they seem out of place and their utilization of open banking services allowed them all to be included in the same group. This category includes transportation, mobility, telecommunications and even those operating in the energy sector. In this context, open banking is primarily utilized for customers to conveniently pay various bills or subscriptions directly from their bank accounts.

For the last two groups, not too many words can be spent as they are quite specific and together correspond to only 6 percent of the companies.

Starting with companies that provide exclusively IT services, it can be inferred that they have sought permission to broaden their product offerings by integrating APIs to utilize open banking services effectively. This allows them to offer these services to financial institutions, consequently expanding their customer base.

The last group comprises companies engaged in digital identity creation and verification. In this scenario, licenses may have been necessary to streamline the process of gathering data from diverse customers.

This section will end with a brief acknowledgment.

Upon analyzing the services offered by various companies, it becomes evident that some are in the process of integrating open banking services with artificial intelligence and machine learning. The vast amount of data made available by open banking services serves as a valuable tool for training and enhancing artificial intelligence, thereby enabling more precise and probable predictions. Companies that provide these dual services, particularly those involved in financial management, can ensure that customers receive increasingly personalized alerts and advice tailored to their individual situations, aiding them in effectively achieving their financial goals.

4 Conclusion

This section will present and discuss the various points made in this paper, with possible recommendations for the various actors.

4.1. Open banking and Open APIs

The examination of Open Banking and APIs within the financial sector has highlighted several critical aspects for comprehending the evolution of the contemporary banking and financial landscape. By reading this thesis, it is possible to understand that the adoption of Open Banking, facilitated by the Payment Services Directive 2 (PSD2), can be an important stepping stone to improving the delivery and utilization of financial services, promoting enhanced transparency, innovation, and competitiveness.

In the introduction of this thesis, it was mentioned that open banking has enabled many new companies and enterprises to enter the financial sector, which previously was complicated and challenging to both enter and compete in due to the dominance of banks and large financial institutions. These firms, which take the name of third-party providers, have the possibility to introduce new and more innovative services to enhance customer experience and increase the accessibility and efficiency of banking operations.

To work, open banking needs the use of an application programming interface, the so-called API. In particular Open APIs which have all features available for use without restrictive terms and conditions. The process of an Open API operation can also be schematized in Figure 27 below.

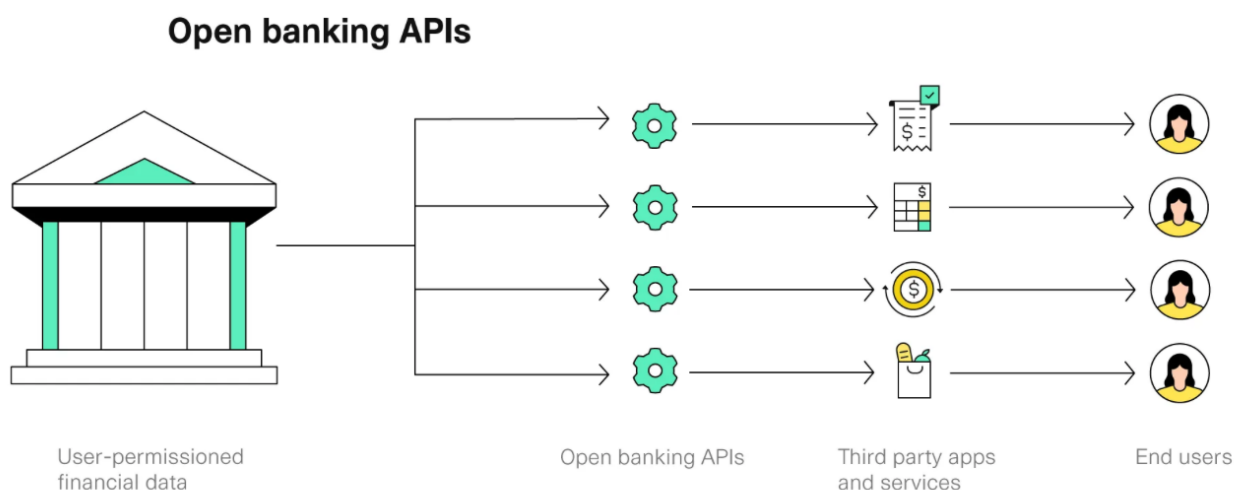


Figure 27: Open banking APIs

It's important to remember that APIs are essential for sharing sensitive information, but it's crucial to be extremely careful when managing this aspect to prevent breaches and fraud. Hackers can exploit any vulnerabilities to gain unauthorized access to this data. Thus, it is imperative for financial institutions to make substantial investments in advanced cybersecurity measures, such as encryption, intrusion detection systems, and regular security audits, to deter unauthorized access and cyber-attacks.

Concerning this problem, there is also the concern about data privacy for consumers, who must trust that all their private information will be handled only for authorized purposes. For this reason, the adoption of the General Data Protection Regulation (GDPR) in Europe reflects the imperative for financial institutions and Third-Party Providers to uphold data protection and privacy standards. This requires processing data lawfully, transparently, and for specified legitimate purposes. Moreover, customers should have the right to request deletion of their data.

4.2. Regulations

Linking to the last paragraph of the previous section, another key point in this thesis is the discussion of the regulations that currently exist and will be introduced in Europe. Open banking in Europe has followed a regulated approach. As the regulatory environment continues to develop, it can be quite challenging to stay compliant with the various national and international standards. Financial institutions are required to invest in regulatory technology (RegTech) solutions to automate compliance processes, monitor regulatory changes, and ensure that all operations adhere to legal requirements. This helps to reduce the risk of non-compliance and associated penalties. The PSD2 directive, which has facilitated the emergence of open banking in Europe, regulates the information requirements, rights, and obligations of users of payment services. It also establishes prudential requirements for entities licensed to provide such services, known as Payment Service Providers or PSPs.

Despite achieving several goals, PSD2 still has some unresolved challenges. As a result, it is set to be replaced by PSD3 and PSR, which aim to further enhance European payment markets. PSD3 focuses on outlining rules for payment institution authorization, The Payment Services Regulation encompasses various aspects, including the transparency of conditions, information requirements related to payment services, and the rights and obligations associated with both the provision and usage of payment services.

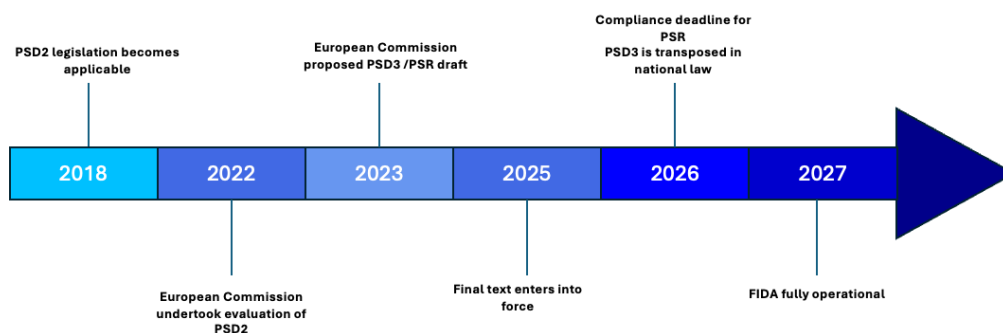


Figure 28: Directives Timeline

In addition to these, there is also FIDA, which aims to expand open banking into what is called open finance. This development will bring the European financial sector closer to the so-called “data economy.”

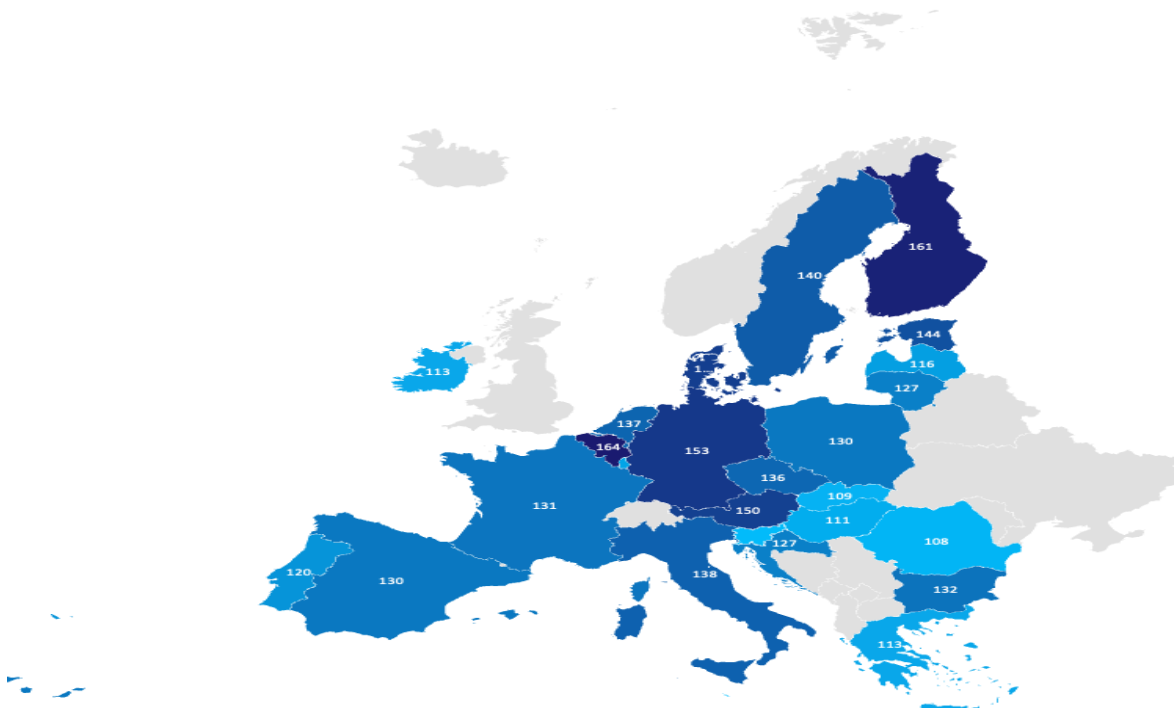
4.3. Third-party providers

Moving then to the analysis of third-party providers (TPPs) in Europe reveals significant diversity in their distribution and operations. This analysis was conducted because TPPs play a crucial role in the open banking ecosystem, utilizing APIs to offer enhanced services and financial products as already mentioned earlier.

4.3.1. European level

The distribution of TPPs throughout Europe is heterogeneous, with countries demonstrating disparate levels of adoption and integration. Economically significant countries such as Germany, France, and Italy exhibit a higher prevalence of TPPs, suggesting a conducive environment for technological innovation within the financial sector in these regions. Furthermore, these countries possess more sophisticated financial infrastructures and regulatory frameworks that facilitate the development and proliferation of TPPs.

As was already shown in the next figure.



An interesting trend in the operations of Third-Party Providers (TPPs) is that they often start by focusing on their domestic markets to establish a strong local presence and comply with national regulations.

However, there is a growing movement towards international expansion, with TPPs trying to extend their services to multiple European countries rather than further increasing their presence in the local one by offering increasingly innovative or original services. This propensity to geographic diversification is made a bit easier by the attempted harmonization of regulations under PSD2, which provides a unified framework for TPP operations across the EU.

From the analysis made on the TPPs in the seven countries considered as a sample (Italy, Germany, France, Spain, Sweden, Denmark, Netherlands and Poland), it is clear that each state has its own way of implementing open banking, creating a lack of uniformity.

This is not only due to how the directives are transposed into national law, but also depends on the culture of the population, their familiarity with digital services, and the needs that open banking can allow to fulfill more efficiently.

In comparison to the early years of PSD2 implementation, there are fewer authorized Third-Party Providers (TPPs) in Europe. This could be due to various reasons, such as intense competition with established TPPs and market saturation. Another substantial consideration is the offering of "license as a service," which allows non-authorized third parties to access and deliver Account Information Services and Payment Initiation Services. This process involves obtaining consent from their customers to utilize a licensed Third-Party Provider that adheres to anti-money laundering regulations and authenticates itself when initiating an API call to an Account Servicing Payment Service Provider (ASPSP). Subsequently, the information is transferred to the unlicensed third party. Using this system, many companies can avoid the hardship of being authorized and save all the time it requires.

4.3.2. Enterprise level

In the course of this thesis, a comprehensive analysis was conducted on 257 Third-Party Providers to discern the classification of firms they belong to, the customers they cater to, and the primary services they provide. As expected, the preponderance of TPPs comprises fintech entities, offering a wide spectrum of financial services. Subsequently, open banking platforms feature prominently, these entities are oriented towards furnishing open banking solutions to other firms and financial institutions, and consequently aiding in API standardization. Lastly, a subset of TPPs leverages AISP licenses to deliver audit and accounting services, thereby enhancing the operational efficiency of the companies availing their services and diminishing errors.

The primary customer base for most Third-Party Providers comprises enterprises. These enterprises are able to avail a wider variety of open banking products to enhance their business management. This includes the use of financial management tools and the integration of faster payment systems. Subsequently, individual clients represent the second most-served customer segment by TPPs. For these clients, the services offered typically revolve around improving personal finance, such as facilitating the acquisition of credit scores for loan applications and aggregating all bank accounts in the same place.

The provided services can be categorized into four main groups: Financial management and support, aggregation of financial data, creditworthiness APIs, and account owner verification. Financial management aids companies in enhancing their financial activities and overseeing their finances. For individual clients, it provides personalized assistance and advice to improve their financial circumstances.

Aggregation services are instrumental in monitoring financial data and transactional activities. For companies, this allows for the extraction of valuable insights into customer behavior, while individual clients benefit from a comprehensive overview of their various bank accounts.

Creditworthiness services assist companies in determining the reliability of clients for expedited loan approvals. Lastly, account owner verification facilitates the streamlined identification process for customers during onboarding, consequently reducing abandonment rates.

In the end, despite the assortment of local and international opportunities available, Third-Party Providers encounter a host of challenges. One such challenge involves navigating intricate and ever-changing regulatory frameworks unique to each operating country. Additionally, TPPs face the task of establishing and upholding consumer trust, as many individuals may harbor reservations about divulging their financial information. Mitigating these concerns and cultivating confidence in the new Open Banking system can be achieved through heightened consumer awareness and educational campaigns outlining the system's advantages and safety measures. Transparent communication and the provision of easily understandable information can play pivotal roles in assuaging consumer apprehensions and nurturing trust in Open Banking services. All of this together with the already mentioned robust cybersecurity measures.

4.4. Big techs

The potential for Third-Party Providers in Europe appears promising, with expectations of sustained growth and ongoing innovation. Suppose the services and products offered are made in conjunction with technological advancements, such as artificial intelligence and machine learning, like some TPPs started doing already. In that case, developing more personalized and efficient financial services will always make open banking more popular. Furthermore, heightened collaboration between traditional banks and TPPs is poised to bolster an integrated and comprehensive financial ecosystem.

Doing this, open banking has the potential to diminish the dominance of big banks; however, there is the possibility that this power may be transferred to major technology firms ("Big Techs"). This transfer of power could potentially disadvantage emerging business entities. Big Techs operate differently than traditional Fintech companies, as they prioritize the monetization of existing core

businesses and aim to provide holistic customer service, rather than solely focusing on the provision of financial services. This dynamic could have counterproductive effects on competition, as it has the potential to exacerbate Fintech's disruptive impact. [31]

These big tech companies can utilize their capabilities to gather large amounts of data from non-financial activities of their customers, and analyze this data using artificial intelligence and machine learning methods. In addition, they benefit from economies of scale and scope and have a loyal customer base, strong reputation, and well-established brands, which allows them to potentially dominate certain segments of the retail banking industry. [31]

A solution for this issue could be the introduction of a “reciprocity clause” which should grant financial institutions access to the data owned by these Big techs, in this way, also banks can offer more efficient digital payment services. [31]

4.5. Socio-economic implications

Implementing open banking brings far-reaching socio-economic implications. For starters, it promotes financial inclusion by facilitating access to numerous financial services, including the most advanced ones. In this way, it can help to effectively address the banking needs of unbanked, underbanked populations and businesses that were traditionally underserved by the financial industry, through the provision of banking services via fintech solutions. This can include the facilitation of microloans, the development of financial education tools and the provision of budgeting applications that cater specifically to underserved communities.

Another important effect of open banking implementation is the fact that can play a pivotal role in stimulating economic growth in the states where it is used thanks to being a promoter of innovation and competition. In the EU, the use of open financial data is estimated to increase the GDP by 1-1.5% by 2030. Financial institutes would gain the largest share of value compared to individuals and micro, small and medium-sized enterprises. [32]

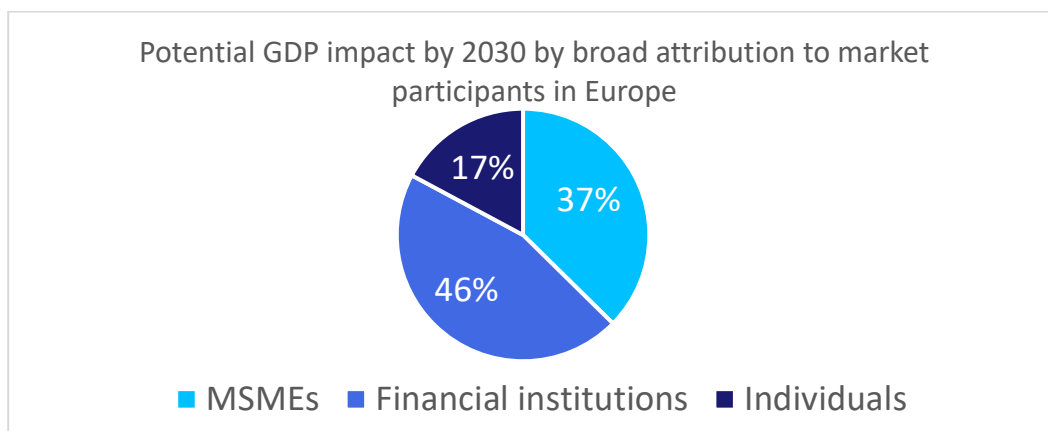


Figure 29: Potential GDP impact by 2030 by broad attribution to market participants in the EU

[32]

The emergence of new fintech startups leads to the generation of employment opportunities while providing services that improve financial efficiency and enhance productivity for both businesses and consumers. This ultimately contributes to the establishment of a more dynamic and resilient financial ecosystem.

4.6. Possible recommendations

In the course of this thesis, numerous points have been discussed and corresponding suggestions were put forward. This section aims to consolidate all recommendations for the key actors in open banking, ensuring easy accessibility and visibility.

4.6.1. Recommendations for financial institutions

For financial institutions, the principal recommendation, emphasized repetitively, is to allocate substantial resources to security measures and technological advancements aimed at safeguarding customer data. This entails the adoption of state-of-the-art cybersecurity protocols, including robust encryption, intrusion detection systems, and regular security audits to proactively assess and mitigate potential risks. While this necessitates a significant financial commitment, it is imperative for financial institutions to stay ahead of emerging threats.

To offset these investments, financial institutions are advised to place an increased emphasis on collaborating with fintech start-ups and Third-Party Providers to foster innovation within the sector. By engaging with these entities, banks can take advantage of their greater flexibility and adaptability to ensure a sustained competitive edge by leveraging innovative financial products and services, thereby enhancing the overall customer experience, stimulating growth, and preempting potential client attrition to emerging players, such as Big Tech firms.

Furthermore, financial institutions can bolster consumer trust by instituting educational programs aimed at empowering individuals to navigate their finances securely in an increasingly digitalized era. By implementing such initiatives, consumers can augment their confidence and actively engage with open banking services.

4.6.2. Recommendations for legislators

Legislators are tasked with establishing a dynamic regulatory framework that can effectively respond to the swift evolution of technology and potential new business models. It is imperative that this framework is regularly updated to address emerging industry practices that have the potential to disrupt the financial sector.

In the realm of big tech, legislators must exercise prudence to prevent the creation of monopolies due to the excessive empowerment of these entities. The strategic implementation of the “reciprocity clause” can serve as a viable solution to maintain equilibrium between big tech and other entities, thus preventing the dominance of one over the other.

Of paramount importance is the ongoing endeavor to harmonize regulations across borders, facilitating the international expansion of open banking services. These regulations should encompass unified data protection standards and operational guidelines. Furthermore, guidelines to standardize APIs can effectively mitigate compatibility issues between credit institutions and third-party providers.

Similarly, akin to financial institutions, ensuring customer safety is paramount, necessitating the strict enforcement and continual updating of data protection laws. Compliance checks should be rigorously implemented to ensure adherence to all pertinent regulations. Additionally, awareness campaigns are essential to inform customers of their rights under open banking regulations, emphasizing the advantageous facets of this system.

Furthermore, legislators are obliged to continue supporting innovation by instituting sandboxes, which provide an environment for fintech companies and financial institutions to conduct controlled experimentation without incurring substantial risks. Moreover, providing incentives or grants for the research and development of new financial technologies can significantly bolster innovation, particularly concerning the efficacy and security of open banking services.

4.6.3. Recommendations for Third-party providers

In parallel with financial institutions, Third-Party Providers must prioritize investment in cybersecurity measures to safeguard consumer data. TPPS must uphold full compliance with regulatory requirements in order to continue offering open banking services, and to remain adaptable in response to any regulatory modifications.

Emphasizing the enhancement of the customer experience should be an important focus for TPPs, necessitating the development of highly intuitive and user-friendly interfaces for financial applications. Additionally, the strategic integration of advanced technologies such as AI and machine learning can empower TPPs to deliver personalized financial services tailored to each customer's unique needs, thereby elevating customer satisfaction and fostering long-term loyalty.

Central to the longevity of TPPs in the financial landscape is the maintenance of consumer trust, which hinges on transparent communication regarding data usage, security protocols, and the potential advantages of the services rendered. Establishing a robust and responsive customer support system is crucial in addressing consumer concerns, thereby nurturing a relationship of reliability that further bolsters trust.

Furthermore, TPPs stand to gain significant advantages by engaging in collaborative endeavors with both their counterparts and established financial institutions. Such collaborations have the potential

to yield more comprehensive and integrated financial solutions, while also offering an invaluable opportunity for TPPs to glean insights from the wealth of experience held by established institutions within the sector.

4.6.4. Recommendations for future research

This thesis offers a comprehensive portrayal of Open Banking and its implications, providing valuable insights and recommendations for the future of the financial sector. It is imperative to acknowledge that the field of Open Banking is in a state of continual evolution, necessitating ongoing research and data analysis to gain a complete understanding of the impact of these transformations and to provide direction for the strategic decisions of financial institutions and policymakers.

Future research endeavors should give precedence to emerging trends, such as the integration of Open Banking with other financial technologies (FinTech) and the potential socio-economic impacts of these advancements. Consistent analysis of consumer behavior, market dynamics, and regulatory changes will be pivotal in adapting strategies to ensure the sustainable and secure growth of Open Banking.

In conclusion, the paradigm shift brought about by Open Banking, driven by PSD2, signifies a noteworthy leap forward for the financial sector. By addressing the associated risks and capitalizing on the opportunities for innovation and growth, financial institutions, legislators, and TPPs can contribute to cultivating a more inclusive, efficient, and dynamic financial ecosystem.

5 Acknowledgment

I would like to take this opportunity to express my deep appreciation to all those who supported me during the completion of this academic work. Firstly, I express my gratitude to Professor Perego for granting me the opportunity to work on this thesis project. I am also sincerely thankful to Matteo Ruggieri, whose assistance and support were invaluable from the initial stages right through to the conclusion. Lastly, I would like to extend my thanks to my relatives and friends who have been unwavering in their support throughout this extensive academic journey.

6 Bibliography

- [1] Boston consulting group, "Investor Scrutiny Provokes a Moment of Truth," 2023. [Online]. Available: <https://web-assets.bcg.com/9a/d6/e8645fa2482eb2f2aceb7085a7c5/bcg-global-payments-report-2023-sep-2023.pdf>.
- [2] Capgemini, "Where is the cash?," 2023. [Online]. Available: <https://www.capgemini.com/gb-en/insights/research-library/world-payments-report/>.
- [3] FIS, "Global Payment report," 2023. [Online]. Available: <https://www.fisglobal.com/en/global-payments-report?>.
- [4] AltexSoft, "What is an API: Definition, Types, Specifications, Documentation," 21 11 2022. [Online]. Available: <https://www.altexsoft.com/blog/what-is-api-definition-types-specifications-documentation/>.
- [5] A. S. X. o'g'li, "World Economics and Finance Bulletin," pp. 193-194, 2023.
- [6] L. Gąsioriewicz and J. Monkiewicz, The Digital Revolution in Banking, Insurance and Capital Markets.
- [7] Wordline, "How Open Banking is transforming digital payment," [Online]. Available: <https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwiejMmwm9CDAxVr0AIHHehpChMQFnoECBYQAQ&url=https%3A%2F%2Fworldline.com%2Fcontent%2Fdam%2Fworldline%2Fglobal%2Fdocuments%2Fwhite-papers%2Fwhite-paper-how-open-banking-is-transforming-o>.
- [8] The Paypers, "Report 2022: The Enablers of Open Banking, Open Finance, and Open Data," 2022. [Online]. Available: <https://thepayers.com/reports/report-2022-the-enablers-of-open-banking-open-finance-and-open-data/r1258969>.
- [9] The Paypers, "The Global Overview of Payments Providers 2023," [Online]. Available: <https://thepayers.com/reports/the-global-overview-of-payments-providers-2023/r1263055>.
- [10] D. Pennetta and L. Gambarelli, "Banks' attitude to partnership as an antecedent of Open Banking platforms: structural determinants and effects on performance in the Italian context," [Online]. Available: <https://iris.unimore.it/retrieve/95d2d57c-7856-4464-bb98-83661fecb159/0223.pdf>.
- [11] Zendata, "Data Privacy in Open Banking," [Online]. Available: <https://www.zendata.dev/post/data-privacy-in-open-banking>. [Accessed 5 01 2024].
- [12] SALT, "State of API Security Report Q1 2023," [Online]. Available: <https://content.salt.security/state-api-report>. [Accessed 2023].
- [13] fabrick, "PISP, AISP e CISP: gli operatori terzi (TPP) introdotti dalla PSD2," 31 5 2023. [Online]. Available: <https://www.fabrick.com/it-it/insight/blog/pisp-aisp-cisp/>.
- [14] GoCardless, "What are open banking providers (AISP & PISP)," 9 2023. [Online]. Available: <https://gocardless.com/guides/posts/what-is-tpp-in-open-banking/>.

- [15] Fabrick, "PISP – Payment Initiation," [Online]. Available: <https://www.fabrick.com/en-gb/product/pisp/>.
- [16] Mediobanca, "PSD2," [Online]. Available: <https://www.mediobancapb.com/en/psd2>.
- [17] The Paypers, "Who's Who in Payments Report 2022," 5 2022. [Online]. Available: <https://thepayers.com/reports/whos-who-in-payments-report-2022/r1256479>.
- [18] R. Pellitteri, R. Parrini, C. Cafarotti and B. A. De Vendictis, "Open Banking in the payment system: infrastructural evolution, innovation and security, supervisory and oversight practices," 03 2023. [Online]. Available: <https://www.bancaditalia.it/pubblicazioni/mercati-infrastrutture-e-sistemi-di-pagamento/questioni-istituzionali/2023-031/index.html?com.dotmarketing.htmlpage.language=1>.
- [19] PYMNTS, "Open Banking Series: Market-Driven vs. Regulatory-Driven," 22 12 2021. [Online]. Available: <https://www.pymnts.com/news/digital-banking/2021/open-banking-series-market-driven-vs-regulatory-driven/>.
- [20] Mastercard Data&Services, "Four European takes on open banking," 26 9 2023. [Online]. Available: <https://www.mastercardservices.com/en/advisors/archived-practices/open-banking/insights/four-european-takes-open-banking>.
- [21] European Commission, "Payment services: revised rules to improve consumer protection and competition in electronic payments," 28 6 2023. [Online]. Available: https://ec.europa.eu/commission/presscorner/detail/en/qanda_23_3544.
- [22] European Commission, "Modernising payment services and opening financial services data: new opportunities for consumers and businesses," 28 6 2023. [Online]. Available: https://ec.europa.eu/commission/presscorner/detail/en/ip_23_3543.
- [23] konsentus, "Q1 2023 Konsentus Third Party Provider Open Banking Tracker," 24 7 2023. [Online]. Available: <https://www.konsentus.com/tpp-trackers/q2-2023/>.
- [24] Open Banking Limited, "THE OPEN BANKING IMPACT REPORT," 10 2023. [Online]. Available: <https://openbanking.foleon.com/live-publications/the-open-banking-impact-report-october-2023/>.
- [25] il Sole 24ore, "L'economia dell'Unione europea vale quasi 17 mila miliardi. Quanto conta l'Italia?," 25 2 2023. [Online]. Available: <https://www.infodata.ilsole24ore.com/2023/02/23/leconomia-dellunione-europea-vale-quasi-17-mila-miliardi-quanto-conta-litalia/>.
- [26] Flagship advisory partners, "https://insights.flagshipadvisorypartners.com/p27-lessons-learned-from-the-latest-failure-in-pan-european-payment-collaborations," 25 04 2023. [Online]. Available: <https://insights.flagshipadvisorypartners.com/p27-lessons-learned-from-the-latest-failure-in-pan-european-payment-collaborations>.
- [27] Pay.com, "5 Top Payment Methods in Poland," 19 02 2023. [Online]. Available: <https://pay.com/blog/top-payment-methods-in-poland>.
- [28] European Commission, "A study on the application and impact of Directive (EU) 2015/2366 on Payment Services (PSD2)," 2021. [Online]. Available: <https://www.ecri.eu/sites/default/files/a-study-on-the-application-and-impact-of-directive-ev0423061enn.pdf>.

- [29 Euronews, "How financially literate are Europeans? Not very it turns out - but who knows the most?," 24 04 2024. [Online]. Available: <https://www.euronews.com/business/2024/04/24/how-financially-literate-are-europeans-not-very-it-turns-out-but-who-knows-the-most#:~:text=The%20overall%20financial%20literacy%3A%20Highest,and%2018%25%20a%20low%20score..>
- [30 Plaid, "What is an open banking API? How apps and accounts connect," [Online]. Available: <https://plaid.com/resources/open-finance/open-banking-api/>. [Accessed 25 10 2023].
- [31 B. N. Alessandro Palmieri, "Open Banking and Competition: An Intricate Relationship," [Online]. Available: https://ec.europa.eu/programmes/erasmus-plus/project-result-content/88f79a68-d8c7-4fa0-b41b-9f60ee3d13d1/1_-_Materials_on_Open_Banking.pdf.
- [32 McKinsey Global Institute, "Financial data unbound: The value of open data for individuals and institutions," [Online]. Available: <https://www.mckinsey.com/industries/financial-services/our-insights/financial-data-unbound-the-value-of-open-data-for-individuals-and-institutions>. [Accessed 24 06 2021].
- [33 Boston consulting group, "Investor Scrutiny Provokes a Moment of Truth," 2023. [Online]. Available: <https://web-assets.bcg.com/9a/d6/e8645fa2482eb2f2aceb7085a7c5/bcg-global-payments-report-2023-sep-2023.pdf>.
- [34 Wordline, "How Open Banking is transforming digital payment," [Online]. Available: <https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwiejMmwm9CDAxVr0AIHHehpChMQFnoECBYQAQ&url=https%3A%2F%2Fworldline.com%2Fcontent%2Fdam%2Fworldline%2Fglobal%2Fdocuments%2Fwhite-papers%2Fwhite-paper-how-open-banking-is-transforming-o>.
- [35 D. Pennetta and L. Gambarelli, "Banks' attitude to partnership as an antecedent of Open Banking platforms: structural determinants and effects on performance in the Italian context," [Online]. Available: <https://iris.unimore.it/retrieve/95d2d57c-7856-4464-bb98-83661fecb159/0223.pdf>.
- [36 GoCardless, "What are open banking providers (AISP & PISP)," 9 2023. [Online]. Available: <https://gocardless.com/guides/posts/what-is-tpp-in-open-banking/>.
- [37 European Commission, "Payment services: revised rules to improve consumer protection and competition in electronic payments," 28 6 2023. [Online]. Available: https://ec.europa.eu/commission/presscorner/detail/en/qanda_23_3544.
- [38 B. N. Alessandro Palmieri, "Open Banking and Competition: An Intricate Relationship," [Online]. Available: https://ec.europa.eu/programmes/erasmus-plus/project-result-content/88f79a68-d8c7-4fa0-b41b-9f60ee3d13d1/1_-_Materials_on_Open_Banking.pdf.