



Navigating Digital Payments

Reshaping customer experience
by simplifying complexity

2021 Edition

Digital Payments
for a Trusted World

**“Payment processing is like an iceberg.
Just a small part sits visible above the waterline;
the vast majority sits below the surface.”**



Foreword

I have often felt that payment processing is like an iceberg. Just a small part sits visible above the waterline: the cards, devices and apps that people use to pay with. The vast majority sits below the surface: the array of organisations and systems that ensure money is routed from payer to payee.

We observe every day that the payments space is changing rapidly, in innovative and disruptive ways. And these changes quickly ripple out to retailers and the many other businesses who depend on payment technology daily.

In 2021, I launched the Worldline Discovery Hub and tasked them with identifying disruptive trends in our industry and helping our clients understand what this will mean for them, so that together we can create bold, innovative solutions. This is what they have done in this report. Here you will find their vision of how payments may look in 2030 and what that world could be like, based on the trends they have analysed. To some readers, their vision may seem futuristic but, in the rich and granular chapters that follow, you will see that all of this, and more, could be achieved with innovations that already exist in some form today.

They have also confirmed the iceberg analogy. They have described an ongoing duality of complexity and simplicity. Complexity of the payment landscape. Simplicity for the consumer and the merchant. They talk about the gap between these as the Pay-Xperience gap, and they predict that it will grow.

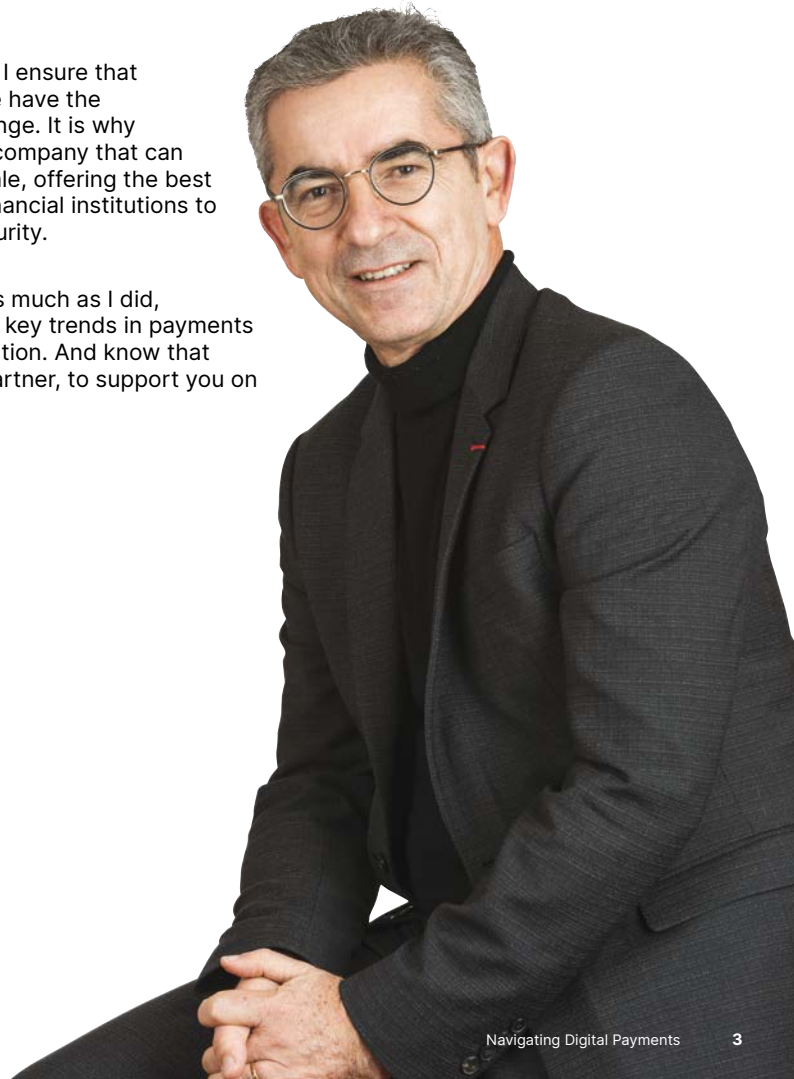
I believe them. This gap will continue to grow. And therefore more skill, ingenuity, innovation and technical know-how will be needed to bridge it.

And this is where the role of payment service providers will become even more critical than it is today. Complexity is increasing: in cross border payments, omni-commerce, the range of payment methods, and a plethora of other areas. But it is ultimately payment service providers who must orchestrate all of these diverse payments systems and technologies to simplify them for consumers and merchants.

This is why, in my role as Worldline's CEO, I ensure that we take action every day to make sure we have the necessary strength to address this challenge. It is why we have built, and continue to expand, a company that can offer payment acceptance on a global scale, offering the best user experience, whilst partnering with financial institutions to ensure the highest levels of trust and security.

I hope you will enjoy reading this report as much as I did, and that it will help you to understand the key trends in payments and what this may mean for your organisation. And know that Worldline stands ready, as your trusted partner, to support you on the road ahead.

Gilles Grapinet
Worldline CEO
Paris, France



A glimpse into the future



The year is 2030. It is a sunny summer morning and you are just finishing a relaxing breakfast together with your family.

The doorbell rings for a delivery of several essential household items on which you are running low, plus your food for the week. But you never placed this order or booked this delivery slot. Instead, a loyal, autonomous, context-aware smart agent placed it on your behalf.

Using data from IoT devices in your home combined with knowledge of your past habits, the agent identified the products you needed.

Using knowledge of your budget, spending habits and loyalty programmes enabled identification of the best supplier on your behalf (taking into account availability and delivery costs).

Using knowledge of your diary and habits the agent chose a convenient delivery slot.

Once all of this was done, you were quickly consulted to check you were happy with the proposals.

Then, after your agreement, the agent autonomously completed payment for the order on your behalf using a digital currency known as the ecoDigiCoin.

The ecoDigiCoin was designed specifically to have low power consumption and enable transactions to be completed without requiring plastic cards or dedicated hardware.

To encourage adoption, governments provide tax incentives for its use, which are implemented as smart contracts.

It is also how you have chosen to receive your salary, as it is now more widely accepted by merchants than cash.

As you unpack your delivery, you think about the amount of effort that your smart agent saves you, giving you more quality time with your family and friends, and to enjoy your hobbies.

Of course, many people are still wary of the data sharing that underpins this service.

This is why regulations insist that such agents must be proven to be loyal to their user (not the company who built them or any other third party) and that privacy-preserving techniques must be used to ensure that data is only shared and used in a trusted and controlled manner.



After unpacking your delivery, you decide to go shopping for some new clothes.

You step outside and an electric vehicle is waiting for you. It is self-driving and arrived at your front door whilst you were eating breakfast.

Rather than owning a car, you pay only for the kilometres you travel in shared autonomous vehicles.

Predictive analytics powered by artificial intelligence make sure that one is available when you need it, and this sharing economy model is also reducing the environmental impact of travel. The payment for your journey is automatic.

After you step out to go shopping, the car drives itself to a charging hub (where it also autonomously pays for the recharge).



Once on the high street, you receive an alert on your phone. Some shirts you were viewing online the night before are available in the shop you are just walking past, with a promotional offer available today. You visit the store to look at them. Before trying them on, you enter their immersive virtual fitting rooms, where you can quickly see how the clothes will look on yourself without having to change into them.

After this, you try on physically the ones that you like the most and ask one of the shop's fashion advisors for some suggestions for trousers that might be a good match. Finally, you choose three shirts and two pairs of trousers, thank them for their helpful advice, and walk out of the shop without passing through a checkout, with payment made automatically based on biometric identification from your palm scan. In this case your eWallet has determined that a cash-back offer associated with your credit card account would make this the preferred method of payment.

The high degree of automation at the checkout is what gives the staff plenty of time to provide you the highly personalised advice and attention that you have enjoyed.



As you continue along the high street, you walk past a musical instrument shop. Suddenly you make an impulsive decision to buy a guitar – you have always wanted to learn to play one!

Inside the store you check that the guitar is genuine by scanning a QR code which validates the full traceability of its production – including which parts were recycled from discarded instruments, giving you full visibility of the environmental impact of your purchase.

After you buy it, the digital ID contained in your eWallet is used to add your ownership onto the traceability blockchain.

Many years ago, this type of high-value, atypical transaction might have been blocked as suspected fraud. However, the permissioned and secure sharing of data means that your earlier journey, your recent purchases, and the location of your phone and exactly how you hold and move it can all be used to validate that this transaction is legitimate.

Of course, this has only been possible because of the advanced fraud detection machine learning algorithms that are now commonly in use.



Next you meet some friends for a coffee. Here again you enjoy the personalised service of the barista who recommends a new coffee blend that they think you might enjoy, as well as talking you through their patisserie menu.

After this you can relax and share stories with your friends as the drinks and cakes are brought to your table, with payment (including an ecoDigiCoin tip paid directly to the barista) quickly taken care of by your eWallet, with no need to split the bill or store a physical receipt.

After this social time with friends, you decide to take the tram home. Just as with your car, you only pay for the kilometres travelled. And you do not buy a ticket or make a payment. Secure facial recognition is used to register your journey, which is then paid for using your preferred method (direct debit in this case, as it entitles you to a 10% discount with this transport operator).

You arrive home eager to show your family your purchases and share the news from your friends, as you enjoy your evening meal together.

We have a passion for finding innovative ways to help our clients deliver the best possible experience to their customers.



Executive Summary

In the coming years, the experience of making and receiving payments will be transformed. Many innovations that are currently gaining traction will mature and converge to create a level of convenience that would once have seemed like science fiction. Orders will be placed and paid for autonomously. New business models, digital currencies and traceability solutions will enable greener ways of living. Much of this will be powered by data sharing, which will utilise privacy-preserving technologies to ensure security and trust. And fraud detection techniques will advance to improve protection whilst reducing friction.

This advance will be driven by the fact that business success is closely tied to the quality of the end-to-end customer experience that companies offer, with studies finding that those who deliver better customer experiences earn greater revenues and achieve higher valuations.

The payment experience forms a crucial part of this overall customer experience. A poor payment experience can lead to customers abandoning their purchases. Conversely, a payment experience that is perfectly matched to the customer's needs can not only help them smoothly complete a transaction, but can also increase loyalty, boost repeat custom and elevate brand perception.

However, providing this type of payment experience is not straightforward. This is due to a fundamental duality that exists. The payment landscape has grown in complexity and will continue to do so. However, consumers increasingly expect the payment experience to be simple. They do not want to consciously think about or choose the channel or payment method to use. And they do not want to keep multiple cards in their physical wallets, use multiple e-wallets on their phones, or even install different apps depending on who and where they are paying.

We call this chasm between the complexity of the payment landscape and the simplicity desired by consumers the *payment experience gap*. We are convinced that this gap will continue to grow. We are equally convinced that those organisations who can successfully understand and bridge this gap will be better placed to compete in their markets and deliver long term prosperity.

As the European leader in payments, understanding the complex payment landscape is our day-to-day business. We combine this deep expertise with a passion for finding innovative ways to help our clients deliver the best possible experience to their customers.

To help you understand this gap, we have analysed it from three perspectives:



Unification Taming Diversification

How can the proliferation of business models and new forms of currency be tamed to create straightforward, sustainable solutions?



Seamless Interactions Amidst Accelerated Digitalisation

How can secure, inclusive digital solutions be built that enable new in-store experiences and autonomous payments?



Implicit Trust from Regulations




How can the regulatory landscape and the protection of privacy be embraced in a way that will enable the data economy and trust at the point of sale?

In a document of this size, it is not possible to give a comprehensive treatment of every aspect of the payment experience. Therefore we have focussed only on those topics where we expect there will be the greatest change over the medium term and where we believe businesses need to start their preparations now. For each of these topics, we provide a summary of the current state-of-the-art, the changes we are anticipating, the challenges on the horizon and the choices that organisations must plan for now. For some of these topics we have already published more in-depth papers which go into greater detail, and we will continue to publish additional, comprehensive papers to further elaborate on many other topics.

We hope that these insights will help you to determine how your business and market will change in the coming years, and how you can successfully deliver a great experience to your customers with a perfectly complementary built-in payment experience.



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Navigating this report

To get the most out of reading this report, we recommend reading the chapter [A Glimpse Into The Future \(p.4\)](#) and the [Introduction \(p.11\)](#), which together provide an overview of the main concepts in this report and how they relate to each other.

After this, you can read the whole report sequentially if you wish, but you may prefer to jump straight to the chapters that you find most interesting.

To help you with this, we have identified the relevance of each chapter to different sectors using the icons shown on the right.

Of course, this is intended as a guide only. For example, if you work for a financial institution you may still be interested in [The Renaissance of Physical Stores \(p.45\)](#) or [Counterfeit Detection at Scale \(p.63\)](#).

To further aid your navigation through the document, major links between chapters are also highlighted in the text.

Retailers and Merchants



Financial Institutions



Manufacturing



Transport



Public Sector



Transforming adoption and usage of products and services requires that the experience of using them is transformed as well.





Introduction

When we look at the history of innovation, we see that one of the key factors that has driven the success of products and services is the overall end-to-end experience.

The first digital camera was invented by Steven Sasson at Kodak in 1975. It was an impressive engineering achievement, but weighed 3.6kg and took 23 seconds to store a single 0.01 megapixel black and white picture to a cassette tape¹. It was certainly innovative, but it did not offer an experience that could compete with the film-based cameras of the day. Now, over 100m standalone digital cameras are sold every year², and almost all phones have multiple digital cameras built into them. Size and cost have been reduced. Speed and quality have improved. Furthermore, the way we share photos has changed, from prints manually arranged in physical photo albums, to being instantly shown to friends and family via social media. Today's experience of photography has been transformed beyond recognition compared with its film-based equivalent of the past.

At around the same time as the birth of the digital camera, Vinton Cerf and Bob Kahn created the foundations of the Internet in 1974³. It required tech-savvy users, who had access to expensive computers, and who were comfortable interacting through a command-prompt. This experience has been transformed. In 1989, Sir Tim Berners-Lee proposed the content management system now known as the World Wide Web which spawned a surge in websites from just 130 in 1992⁴ to 200 million active websites in 2021⁵. The combination of user-friendly web browsers, affordable and fast connectivity, and an abundance of frameworks and tools for creating web content and applications, has transformed our experience of the

Internet into what it is today.

Going further back in time, the first touch screen was invented in the 1960s⁶. For decades, touch-screens failed to become mainstream. They were expensive, but also they did little more than try to reproduce the functionality of a computer mouse or keyboard, but with less accuracy and responsiveness. This changed in 2006 when LG (followed closely by Apple) released the first smartphones where the physical keypad or keyboard was entirely replaced by a touch screen. Today, with over 6 billion smartphone subscriptions worldwide⁷, touch has become a ubiquitous way for people to interact with their devices. Advances such as multi-touch, support for gestures, inertial scrolling, and ecosystems of applications and websites that are designed to work well via a touch interface, have transformed an unenticing experience into one that people desire.

These are just three examples. But from them we can see that transforming adoption and usage of products and services requires that the experience of using them is transformed as well.

Brands that improve customer journeys see revenues increase up to 15%

This lesson from history is also backed up by many studies. For example, Forrester found that, compared to their peers, the ten companies providing the best customer experience outperformed the S&P index, with close to triple the returns⁸. A similar study by KPMG found that the top 10 brands for customer experience saw four times the year-on-year revenue and profit growth of those ranked in the lowest 10⁹.

1 <https://www.divphotography.net/worlds-first-digital-camera-introduced-man-invented/>
2 <https://www.statista.com/statistics/1172711/forecast-of-digital-camera-sales-volume/>
3 <https://www.historyofinformation.com/detail.php?id=915>
4 <https://absolute.digital/magazine/seo/the-growth-of-the-internet-from-1990-to-2019/>
5 <https://techiury.net/blog/how-many-websites-are-there/>
6 <https://www.thoughtco.com/who-invented-touch-screen-technology-1992535>
7 <https://www.statista.com/statistics/330695/number-of-smartphone-users-worldwide/>
8 http://uxdesign.uw.edu/why_do_ux.html
9 <https://assets.kpmg/content/dam/kpmg/br/pdf/2017/11/the-connected-experience-imperative-uk-2017.pdf>



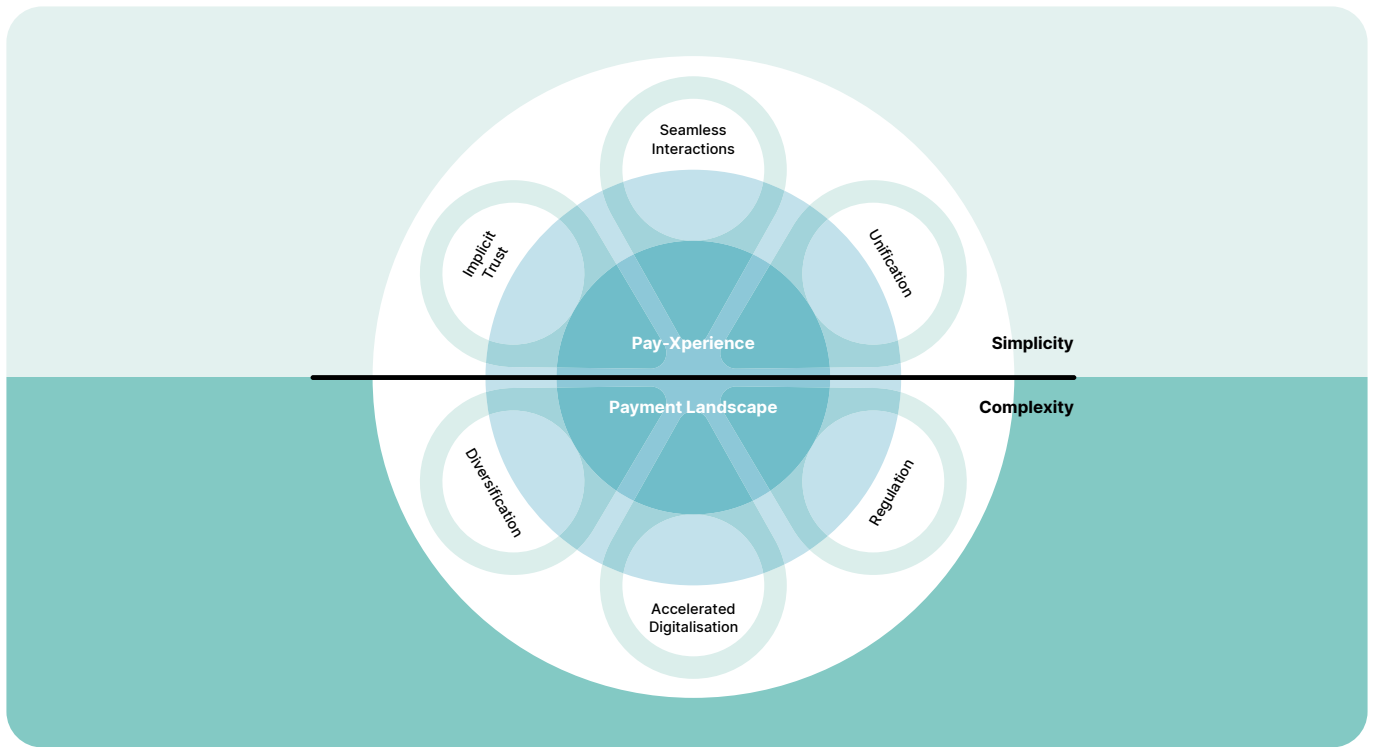


Figure 1: The duality of complexity and simplicity in payments.

Pay-Xperience is critical to customer experience

All businesses need to collect payment for the goods or services that they sell. Therefore, the experience they provide for accepting payments forms a key part of the overall customer experience they offer. We call this the Pay-Xperience (or PX), and it is the critical moment where an exchange of value between supplier and customer is completed. It is when a prospect becomes a purchaser; it is when a browser becomes a buyer.

A slow, difficult or jarring PX will negatively impact the overall customer experience and can lead to a customer abandoning their purchase altogether.

A fast, easy and frictionless PX will positively support the overall customer experience, leading to higher conversion rates, increased repeat business and improved customer perception.

In most cases, the moment of payment is a mere chore for the customer: a hurdle that must be overcome. For these situations, a PX that is as frictionless as possible, or even invisible, is desirable.

In some cases, the moment of payment is a point of joy and celebration: completing the purchase of a luxury car or confirming the booking of a dream holiday. In the customer's mind, the payment represents the conversion of a dream into a concrete reality. In such cases, the PX should accentuate these positive emotions.

However, providing a natural PX, that accentuates and supports the overall customer experience, is not straightforward. The challenges of a complex payment landscape have to be managed to provide simplicity at the point of use.

Simplifying complexity

Figure 1 illustrates this duality. On the one hand, the payment landscape has grown in complexity and will continue to do so. There is huge diversification: in the ways that people can pay, in the number of companies offering payment services, and in the business models that are being offered. Digitalisation has accelerated, creating many new technological options for implementing solutions, but also creating new risks from cyber-crime, as well as potentially alienating some groups of users. And the regulatory landscape is complex and continuing to evolve.

Behind-the-scenes complexity is increasing, whilst consumers and merchants seek greater simplicity

On the other hand, the desire of consumers is for payments to be simple. They do not want to have to manage multiple digital identities or read complex agreements regarding the use of their data. They do not want to consciously think about or choose the channel or payment method to use. And they do not want to keep multiple cards in their physical wallets, use multiple e-wallets on their phones, or even install different apps depending on who and where they are paying. Similarly, merchants also appreciate simplicity. They would prefer not to have to sign multiple agreements with different providers, nor do they wish to have multiple hardware devices in order to accept different payment means. And they want consolidated reporting and reconciliation for all transactions, regardless of the channel or location in which they occur.

This is the dichotomy: behind-the-scenes complexity that is increasing, whilst consumers and merchants seek greater simplicity.

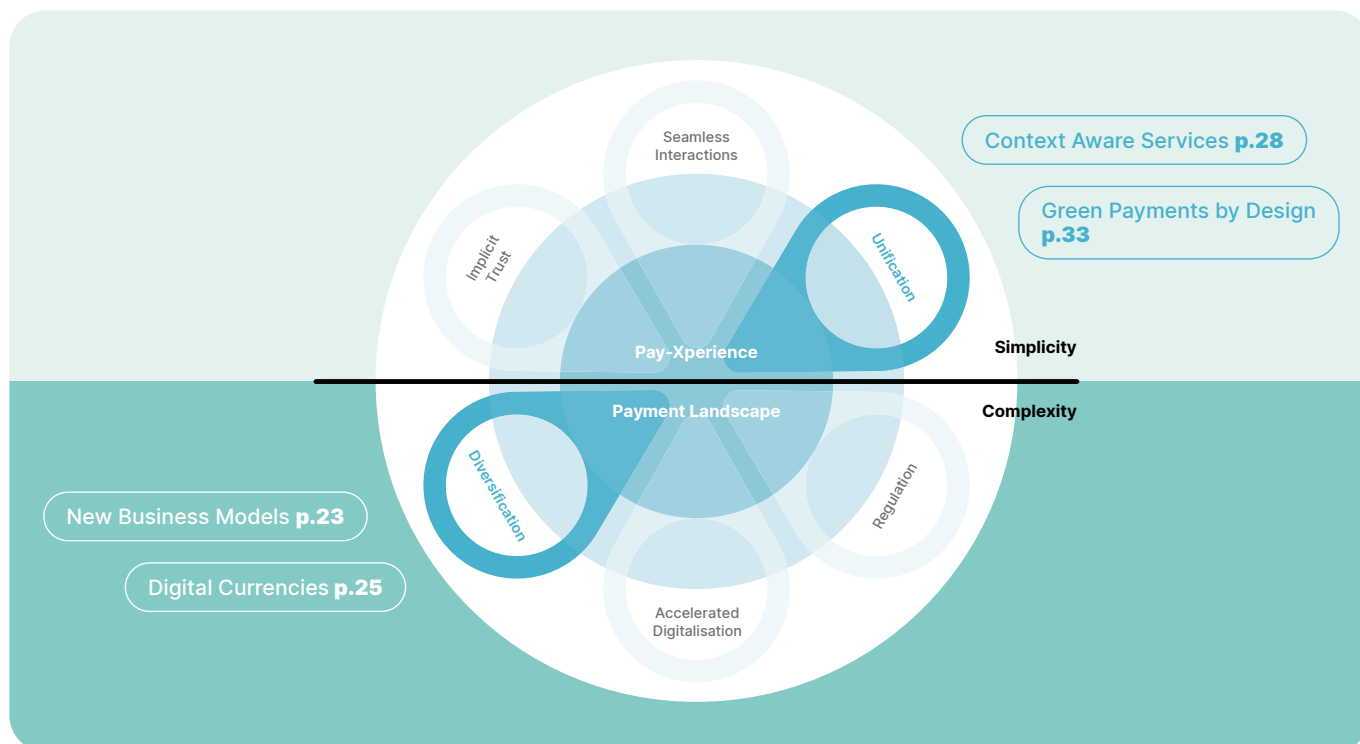


Figure 2: Unification Taming Diversification.

The axes of duality

To help understand this interaction between simplicity and complexity in payments, we have identified three axes of duality (also shown in Figure 1).

We do not see these as a battle between good and bad. Diversification, accelerated digitalisation and regulation may add complexity, but they are all stimulating innovation, providing consumers and merchants with greater choice, and enabling new solutions and business models. The goal should not be to avoid or eliminate them, but rather to leverage them as springboards for driving simplicity in payment experiences.

We will now explain each of these dualities in a little more detail and use them to introduce the topics that we will cover in the rest of this publication.

Unification Taming Diversification

Never before have there been so many possibilities for how people can pay. The long-standing options of cash and cheque have been joined over

the years by debit and credit cards, pre-paid cards, online bank transfers, direct debit and, more recently, digital currencies (with already over 100 digital currencies having a market capitalisation of over \$1 billion¹⁰). The options for how these payment means can be triggered has also expanded. Physical cards, e-wallets, pay-by-link and QR-codes are just some of the different ways that users initiate payments today.

The number of companies offering payment related services has also grown. Once the preserve of a handful of highly regulated institutions, the financial sector now has many disruptive players, with the number of FinTechs worldwide continuing to grow and reaching over 25,000 this year¹¹. Many are applying new technologies to old problems and testing disruptive business models.

The scale of diversification is immense; the challenge is how to unify it.

Collaboration between the different members of the payments ecosystem will be key, and this will depend on interoperability.

The scale of diversification is immense; the challenge is how to unify it

As illustrated in Figure 2, we will explore in more detail [New Business Models \(p.23\)](#) and [Digital Currencies \(p.25\)](#) as two key drivers of further diversification. We will also look at how hyperautomation will enable [Context Aware Services \(p.28\)](#) to simplify these ecosystems for the end user and we will examine how the critical goal of [Green Payments by Design \(p.33\)](#) can only be achieved by working across organisations and taking a fully joined-up approach.

Seamless Interactions Amidst Accelerated Digitalisation

The Covid-19 crisis has accelerated digitalisation¹². In retail, we have seen shops with little or no online presence implement online commerce, including options like click-and-deliver, click-and-collect and live-stream-shopping. Banks have had to move entire call-centres into a home-based mode of operation.

10 <https://coinmarketcap.com/all/views/all/> accessed on 6/9/2021

11 <https://www.statista.com/statistics/893954/number-fintech-startups-by-region/>

12 <https://worldline.com/content/dam/worldline/documents/publications/whitepapers/the-world-after-covid19-white-paper.pdf>

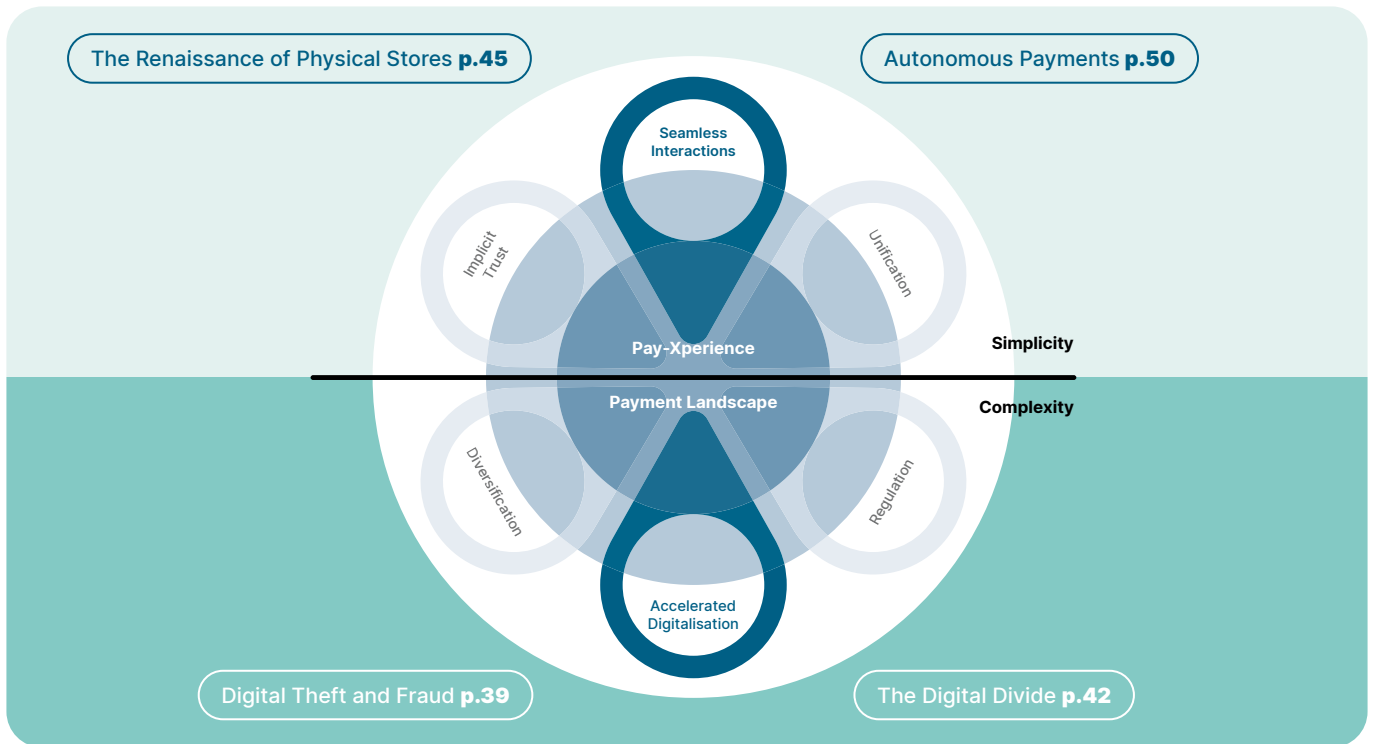


Figure 3: Seamless interactions amidst accelerated digitalisation.

Alongside this, technology has continued to advance. Artificial Intelligence (AI) is being used to automate tasks that previously would have required human intelligence, and it is now being applied at scale and to a wider range of use-cases¹³. The growth of the Internet of Things (IoT) is continuing to surge, enabling a vast array of new solutions¹⁴.

The technological landscape is increasingly convoluted; the challenge is how to make the experience seamless for end-users

The technological landscape is increasingly convoluted; the challenge is how to make the experience seamless for end-users.

With this trend towards seamless interactions, users will be able to switch channels so easily that they will no longer even notice it. An interaction via a chat-bot could switch seamlessly to a call with a live operator. A shopping cart could be started in a browser, added to via a mobile app, and completed in-store. A return and refund could be completed at the same time (and same place) as a new purchase.

As illustrated in Figure 3, we will explore how the rapid advance in the capability and adoption of technology is creating challenges. With more being done in the digital world, the risk of cyber-crime grows. This advancing threat of Digital Theft and Fraud (p.39) must be combatted. There is also a danger that, as many of us move to more digital ways of living our lives, a smaller minority remains left behind

and becomes even more excluded, leading to an increase in The Digital Divide (p.42). In terms of how truly seamless interactions can be implemented, we examine both how this will lead to The Renaissance of Physical Stores (p.45) and how Autonomous Payments (p.50) can create frictionless and invisible payment experiences.

Implicit Trust from Regulations

The changing regulatory landscape provides an insight into what governments are prioritising for the future as they seek to represent their citizens. We see that sustainability, protection, sovereignty and innovation are currently the key drivers for governments around the world.

Payments is a highly regulated industry. Of course, compliance with regulations is mandatory, but businesses that focus only on maintaining this compliance may be missing out on the opportunities that many regulatory changes create.

Understanding the details of the multiplicity of payment regulations is essential; the challenge is how users can implicitly trust every transaction.

Trust underpins all transactions. It is conditional on all parties involved in the transaction having confidence that the outcome will match their expectations (or they will have some recourse to resolve any issues that do occur).

How can users implicitly trust every transaction?

13 https://worldline.com/content/dam/worldline-new/assets/documents/whitepapers/hyperautomation_in_payments.pdf
14 <https://worldline.com/en/home/knowledgehub/publications/download-autonomous-payment.html>

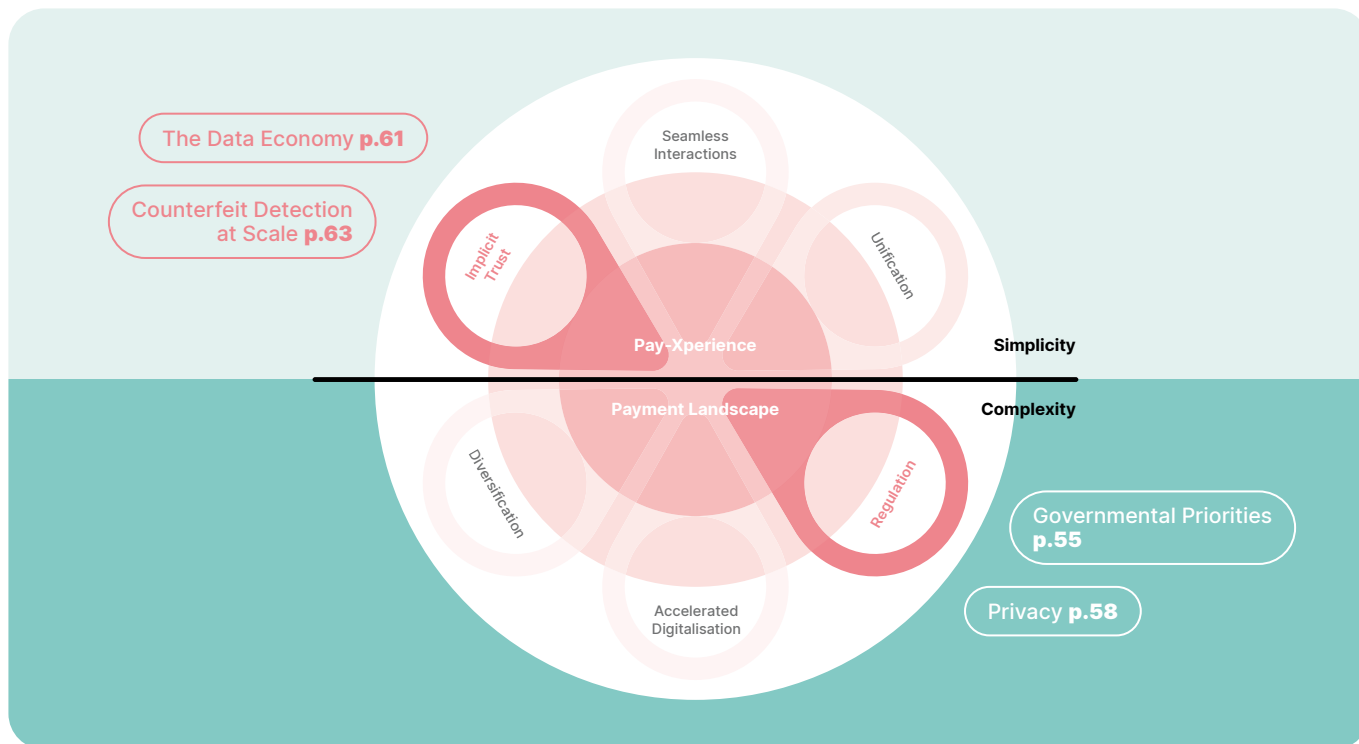


Figure 4: Implicit trust from regulations.

Consumers must be able to trust that when they purchase goods they will receive them; if half of the orders they place are never delivered, they will most likely stop purchasing from that vendor, even if refunds are provided.

Merchants must trust that they will receive the money that consumers pay them; if too many transactions do not arrive or are for the wrong amounts and require manual intervention to resolve, then they will look for alternative ways to collect their income. Merchants also need to be able to trust that, for example, someone is above the legal age limit for buying certain goods (e.g. alcohol).

With accelerated digitalisation, more and more data is being collected about individuals and companies. Every transaction generates a huge number of data points. With this state of affairs, there is a need for trust that the data will be stored securely and not misused.

People also want to know that claims about the provenance or sustainability of products and services they are offered are factually correct.

As illustrated in Figure 4, we will explore in more depth [Governmental Priorities \(p.55\)](#), including how they will evolve and how they will impact businesses. We follow this with a more detailed look specifically at the evolution of [Privacy \(p.58\)](#), from both regulatory and technological perspectives. We also consider several aspects related to the need for and

ways to create implicit trust: the challenges and opportunities offered by [The Data Economy \(p.61\)](#) and how [Counterfeit Detection at Scale \(p.63\)](#) can provide consumers with confidence in the products they are buying.

The interplay between the dualities

There is a complex interplay between each duality.

For example, the rise of unregulated digital currencies such as Bitcoin has led to governments reacting in various ways. India is proposing to ban cryptocurrencies¹⁵ while the EU is suggesting a regulated alternative with the Digital Euro. At the same time, digital currencies could provide an attractive underlying payment mechanism for implementing autonomous payments.

Another example is how certain regulations, such as PSD2, are opening up access to data, leading to an increase in diversification (as FinTechs build new services on top of the data previously only accessible to banks). At the same time, PSD2 is enabling the unification of services by enabling the aggregation of people's banking information. It also provides opportunities to derive new value from data, thus supporting the data economy. Furthermore, PSD2 is impacting the in-store shopping experience with, for example, PIS (Payment Initiation Services) reducing the friction of an account-to-account payment.

15 <https://www.reuters.com/article/uk-india-cryptocurrency-ban-idUSKBN2B60QP>

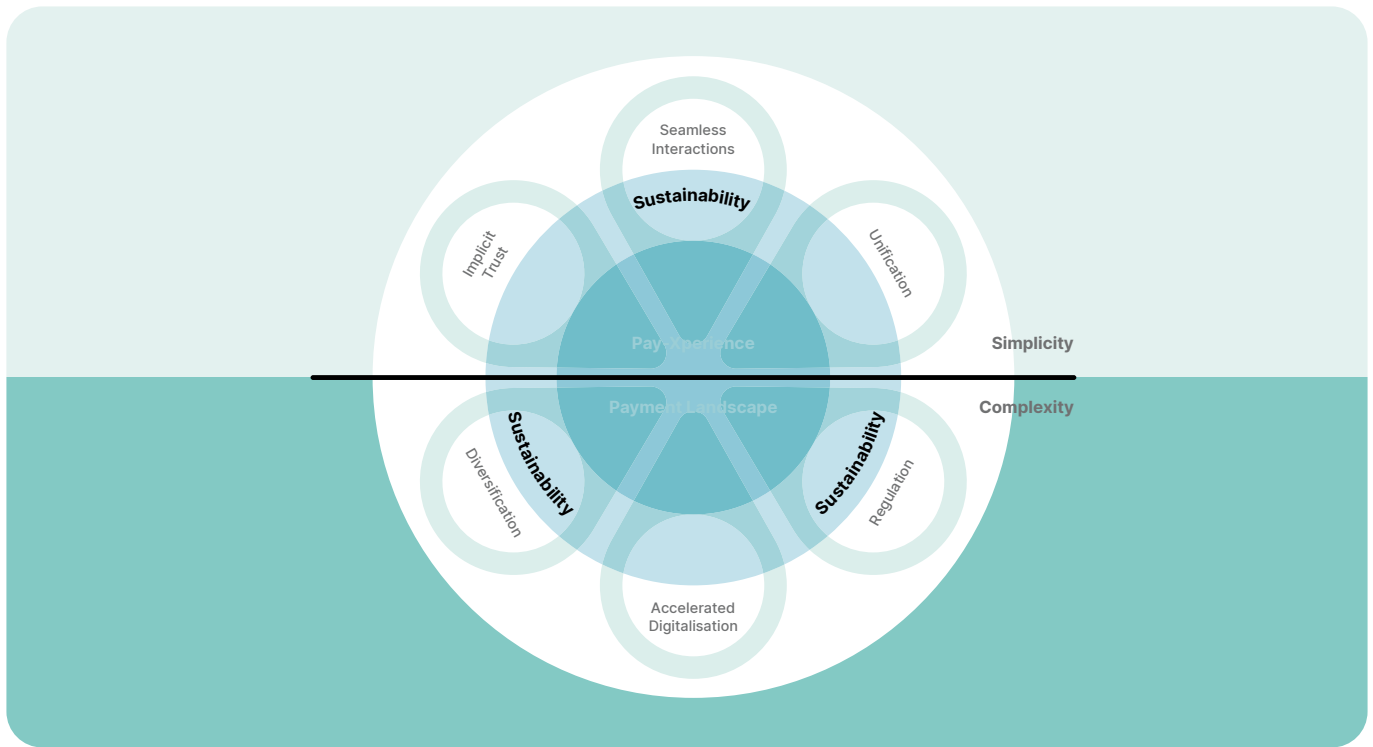


Figure 5: Sustainability impacts everything.

Sustainability

Not only is there a complex interplay between each duality, but we also see that the topic of sustainability has reached such a critical point that its impacts are felt everywhere (as illustrated in Figure 5). We have a chapter dedicated to [Green Payments by Design \(p.33\)](#), and you will also see that sustainability is touched on in many other places. It is a clear focus of governments and will shape how they choose to tax, spend and legislate in years to come. It is shaping the desires of consumers, who will increasingly want to make informed choices about products and services, taking into account the environmental impact they will have. Businesses not only have to anticipate these changing demands from governments and consumers, but also the new opportunities opened up by models such as the circular economy or sharing economy.

As such, you will see that sustainability is a recurring theme which is examined from many different angles in later chapters.

Reshaping customer experience by simplifying complexity

In this introduction, we have underlined the importance of customer experience and explained how the Pay-Xperience is a key component of this. We believe that successfully delivering a great Pay-Xperience will increasingly depend on simplifying complexity: managing divergence, digitalisation and regulation, to provide trusted, seamless and unified payment experiences.

We have identified three axes of duality. Along each one we have identified key topics where there will be changes and challenges, and where organisations

will need to make choices now in order to capitalise on the opportunities they bring.

We remain convinced that, at least in the short to medium-term, the level of complexity will continue to increase. We are equally convinced that the expectations of consumers and merchants will be for experiences that are simpler. As illustrated in Figure 6, this creates a growing Pay-Xperience Gap.

Our belief is that those organisations who can successfully understand and bridge this gap, will be better placed to compete in their markets and deliver long term prosperity.

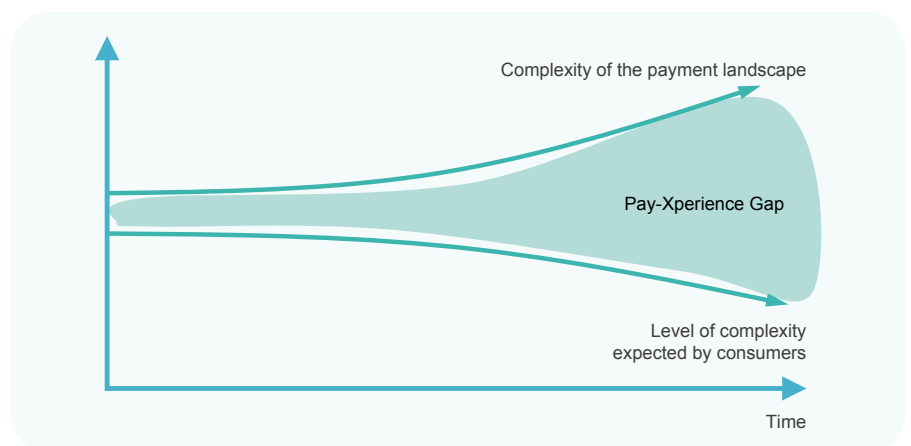


Figure 6: Increasing complexity of the payment landscape versus consumer expectations.

Navigating Digital Payments

To summarise, Figure 7 provides a full overview of the topics we have introduced so far. In the next chapter we will start by unpacking customer experience: addressing what we mean by a great customer experience, what the challenges are in delivering it, and how it will evolve into the future. In the rest of this report, we will explore each duality in more detail.

We hope that these insights will help you to think about how your business and market will change in the coming years, and how you can successfully deliver a great experience to your customers with a perfectly complementary built-in payment experience.

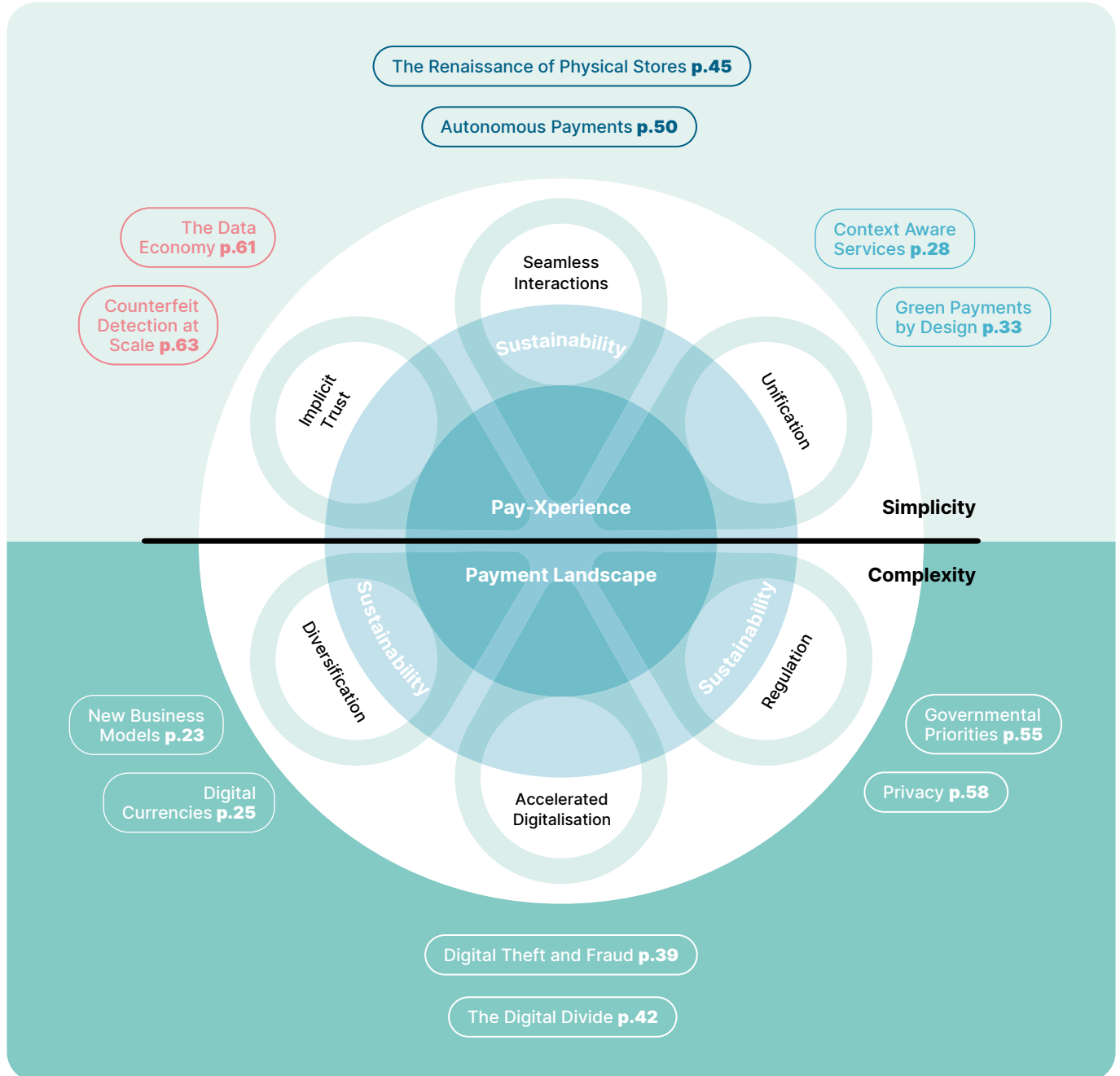


Figure 7: Navigating Digital Payments.

Great customer experience is ultimately the sum of many tangible and intangible characteristics that together create value and a positive connection.





Unpacking Customer Experience

Delivering a great customer experience is not an easy thing to do. Moreover, the payment experience dimension nested within is, as discussed already in the introduction, beset by a series of dualities that can mean that making it seamless is more complicated than perhaps many businesses might expect.

Much of what customers need, want or expect is muted and unspoken but, nonetheless, present and ready to surface if they are not satisfied. We can characterise the essence of these needs, wants and expectations as illustrated in Figure 8. There are aspects that are obvious, such as a product or service being simple to use and of good quality. Then there are essential criteria like being trustworthy,

secure and complete. Then there are new expectations, for example that the experience should be hyper personalised and accessible instantly.

These qualities are the essence of what underpins a great customer experience, which is ultimately the sum of many tangible and intangible characteristics that together create value and a positive connection.

This backdrop provides clues to the challenges faced in delivering a great customer experience and the basis to examine how organisations can take the experience they offer to the next level.

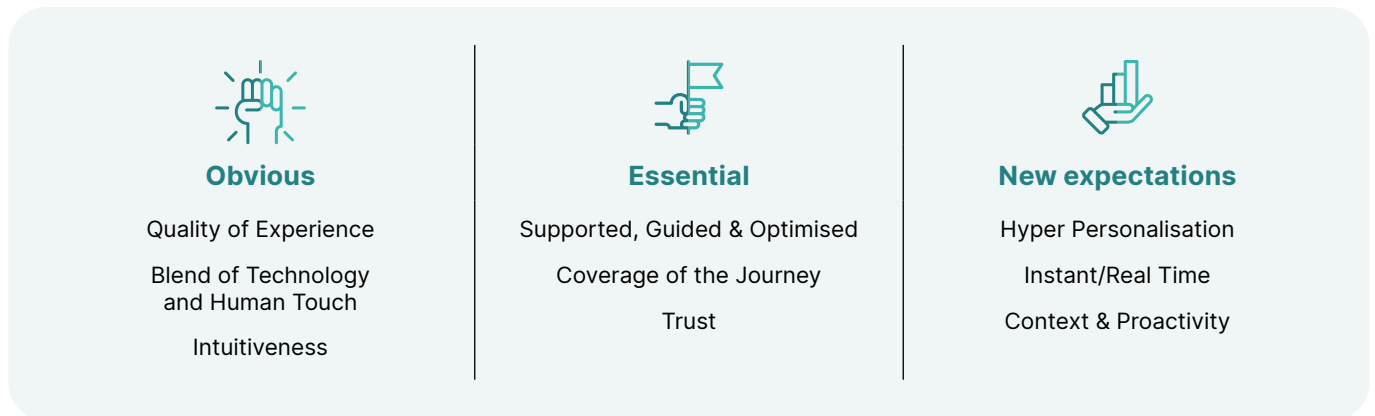


Figure 8: Characterisation of customer experience needs, wants and expectations.

The aspects of customer experience

In the following pages we consider in more detail each of the aspects of customer experience illustrated in Figure 8.

Quality of experience - This must equate to a good or great experience versus the individual customer's expectation. Unless there is good reason, customers will not tolerate poor experiences, they will simply vote with their feet by migrating to an alternative, better solution or service. One customer experience survey found that "only 1 out of 26 unhappy customers complain, the rest churn", with 67% of that churn being caused by a bad experience¹⁶. And a study by Gomez (the web performance division of Compuware) found that a single bad experience on a website makes users 88% less likely to visit the website again¹⁷.

Customers' expectations are constantly evolving. Therefore, businesses must continually examine what they deliver, how they deliver it and what feedback they are getting from their customers, in order to identify what needs to be improved. This applies as much to the payment experience as it does to

the whole customer journey, with attention to detail being key. Knowing when to be attentive versus when to automate, or how to reduce the steps involved or improve the guidance offered, are the kinds of things that have to be perfectly matched to the brand expectation. One topical example today is electric vehicle charging, where Worldline has built the WL Easy EV payment solution, to address the challenge of providing a simple, smooth and secure customer experience based on simplified acquiring coverage over Europe¹⁸.

Blend of technology and a human touch - Great service never goes out of fashion, and new technology can enable great service to be provided in new and innovative ways. The key is in blending the efficiency and power of technology sensitively with appropriate human interactions, something that we will explore more in [The Renaissance of Physical Stores](#) chapter (p.45).

Intuitiveness - The experience and journey must be intuitive. Users should not have to understand how it works behind the scenes, rather they should be able to use it intuitively and and trust in the fact it will work.

16 https://www.huffpost.com/entry/50-important-customer-exp_b_8295772
17 http://www.mcrinc.com/Documents/Newsletters/201110_why_web_performance_matters.pdf
18 https://worldline.com/en/home/pressroom/press-releases/2021/pr-2021_04_12_01.html

Supported, guided and optimised - Just making payment easy is not enough, the experience offered should be supported, guided and ultimately optimised. Every interaction where payment is handled is also an opportunity for further value creation.

Coverage of the journey - Payment is only one aspect of the wider customer journey. The experience should link from stage to stage seamlessly, letting the customer navigate a simple, intuitive course to their destination. For example, combining a scan and go solution (such as Worldline Scan & Pay¹⁹) with store loyalty services all leads the customer towards making a payment, but provides value through the information and discounts offered en route. Payment may be the destination, but the journey looks to reward the customer with choice and loyalty recognition along the way.

Trust - Key to every successful payment journey is confidence that it will work and that it will work safely and securely. Customers need reasons to allow their trust to be won and sustained: no trust, no business.

Hyper personalisation - Traditionally, consumers have always enjoyed and valued personalised experiences. Visiting a restaurant and being asked by the waiter if you would like your “usual” table, or having a suit made-to-measure by a skilled tailor are just two examples of this. Hyper personalisation uses technology to tailor the customer journey to meet the needs and expectations of the individual, blending the right level of intimacy with the context of the demand and the customer’s attitude to privacy.

Hyper personalisation uses technology to tailor the customer journey to meet the needs and expectations of the individual

Instant/real time - People have become accustomed to having “everything now”. Films can be accessed in a few seconds via Netflix; goods can be ordered and delivered at home within an-hour in some locations. And we now have ways of transferring money digitally that are near instant. This expectation also extends to how exceptions are handled: re-arranging a failed delivery or returning goods should be just as quick and easy as placing the initial order.

Context and proactivity - The experience should fit the context; tap and go for charging your electric vehicle or grabbing a coffee, engaging and interactive when individuals need to be informed or require the human touch.

Barriers to great customer experience

Of course, creating a customer experience that addresses all of these aspects comes with a number of challenges:

Regulation, transparency and control - Regulation is key to the operation of safe, fair and efficient markets. Even if ensuring compliance with regulation can extend timescales, it ultimately improves the quality and security of life for consumers. Regulation remains a key feature of the payments landscape: not only ensuring quality and security for consumers but also promoting innovation, for example through PSD2. In the [Governmental Priorities chapter \(p.55\)](#) we will explore how the priorities of governments are shaping the regulations of the future.

Security - Any enhancement of the customer experience and, in particular, the payment part of the journey needs to

be secure. This requires commitment, attention to detail, and sustained investment in the latest technology that combines security and simplicity (such as biometry).

Fragmentation - Competition stimulates innovation and increases customer choice. However, increased competition can also result in fragmentation. Having many options available can lead to confusion.

Organisational capability and readiness - Organisational readiness for change is a multi-level, multi-faceted construct. When organisational readiness for change is high, businesses are more likely to initiate change, exert greater effort, exhibit greater persistence and display more cooperative behaviour. Of key importance is the organisational culture which needs to embrace open-minded and experimental approaches to transformation. These values must be exemplified by a company’s leadership, who must also articulate an inspiring vision which will encourage people to persevere, even when faced with challenges along the way.

Technical debt - As we will see later, today’s great customer experiences rely on technology, yet many organisations have an application landscape that contains much legacy software (often with large amounts of accumulated technical debt). These can be difficult and costly to adapt which reduces agility. However, the investment needed to modernise or rewrite them can also be substantial.

Market readiness - With the current pace of change, tensions can open up between those ready and able to move and those resistant and fearful. As one side pushes for a digital future, the other resists the pace. This is a topic we explore in more detail in [The Digital Divide chapter \(p.42\)](#).

Enabling future customer experiences

As we look to the future of customer experience, we see several underlying technologies and approaches that will have a key influence:

The Role of Artificial Intelligence/Machine Learning, Data and Intelligent Automation - Artificial Intelligence (AI) is transforming the way businesses interact with customers. With AI, brands can be available 24/7 at every stage of the journey. We expect to see more businesses use this technology to synthesise and contextualise customer data to deliver personalised experiences at scale, using a learning process to adapt the route map through both simple and complex choices. We will explore this topic in more depth in the [Context Aware Services chapter \(p.28\)](#).

Connected services - Connected services have changed our wider work and life domains so much that people can now carry out work, leisure, family and travel activities at the same time. A long standing example of a connected service is how booking an airline ticket may shift to suggestions for booking a hire car, taxi, hotel room or parking. What might have been four or five separate tasks can now all be done in one place, under one umbrella, with one payment.

Now Super Apps are taking this a step further, combining together services that may seem increasingly disparate in order to provide convenience for the consumer. For example, in Latin America, the start-up Rappi provides an app that combines food delivery with e-scooters, payments, P2P transfers and movie tickets – it is even possible to ask a Rappi delivery person to bring you something you have forgotten to take with you, to walk your dog, or to buy clothes and pay for services²⁰.

¹⁹ <https://worldline.com/en/home/solutions/pos-and-terminals/scan-and-pay.html>
²⁰ <https://agiletech.vn/super-apps-examples-review-2021/>

This connected services principle can be applied anywhere in the customer journey where one transaction or service could naturally lead to another. For example, Worldline and Evoke Creative recently demonstrated this principle by creating a new railway ticket vending machine²¹. With 64 inches of screen space it not only provides an improved ticket purchasing experience, but it also offers useful travel information and other targeted, relevant content.

Let the consumer choose where they start, stop, pick up again and complete their purchase

Optichannel and channel uniformity

– Regardless of where and how a customer starts on their journey, the means to switch channel, media, or process should be possible whilst

always maintaining a seamless, common experience on the most optimal channel. It makes sense to let customers pivot their journey in line with their needs. For example, a consumer browsing the internet in the evening may see a shirt that catches their attention and add it to their basket but go no further. Then, whilst they are out shopping the next day, they might pass the store that sells the shirt and think a small detour to check it out would be worthwhile. It looks good and fits well, but the tills all look really busy, so the consumer can go back to the saved basket and complete the purchase on their phone. Experiences like this let consumers choose where they start, stop, pick up again and complete their purchase.

Customer journey analytics -

Customer journey analytics allow customer experience, customer care and marketing professionals to measure

cross-channel journeys over time which in turn supports and enables the better design of and improvements to the customer experience.

Partnerships and ecosystems -

No single organisation can conquer all the dimensions required to deliver the best future experiences. Instead, the landscape will be populated by a combination of ecosystems and partnerships. Here, the power of big data coupled with the very best AI algorithms, payment solutions, telecoms, fulfilment and logistics services and the merchant or service provider is going to require better design, more emphasis on the points of connection, greater respect for security, regulation and transparency. For this very reason, we have seen the rise of the API (Application Programming Interface) and its quiet role in helping join pretty much everything to everything.



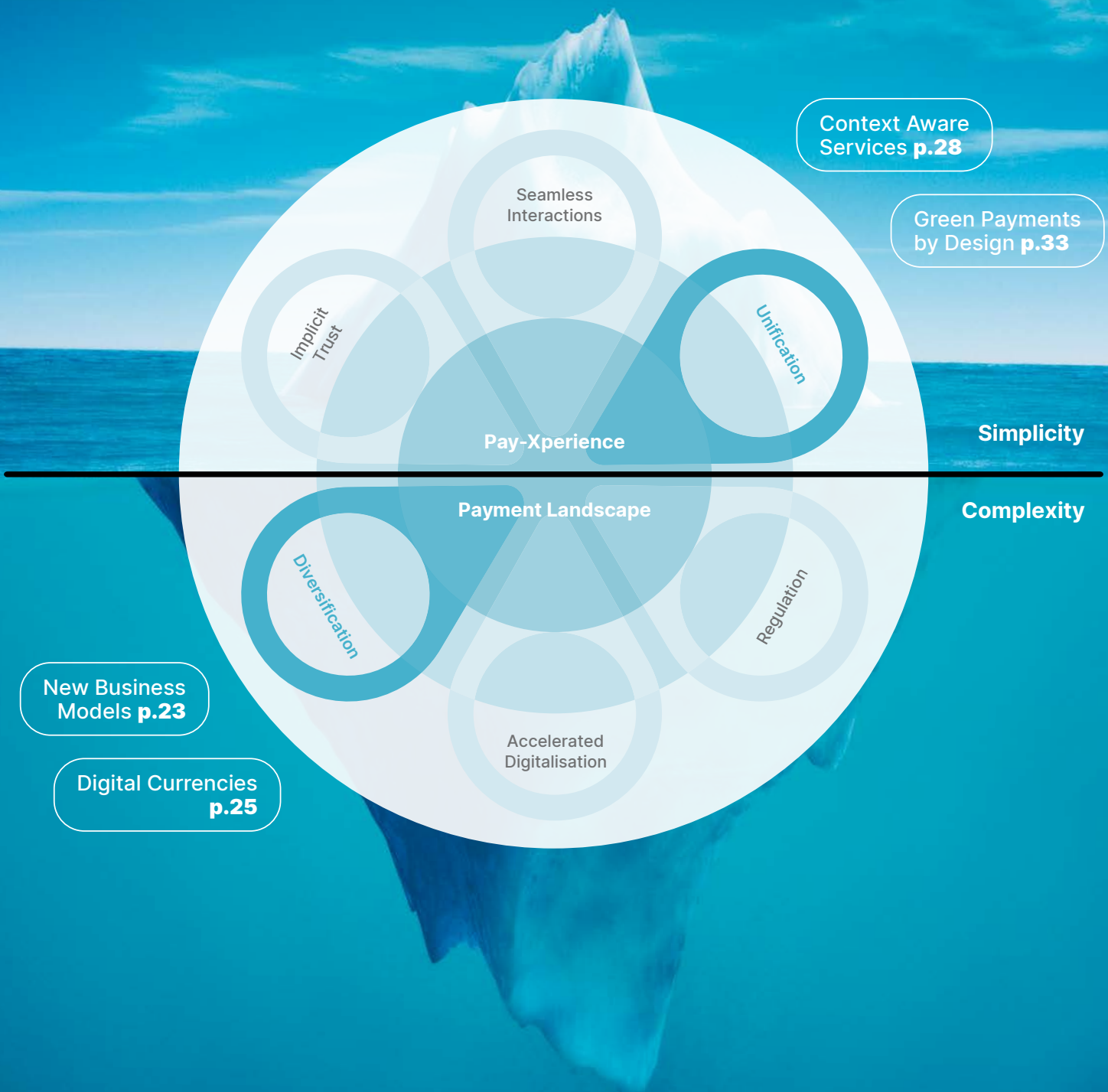
Unpacking Customer Experience		
Changes	Challenges	Choices
<ul style="list-style-type: none"> • People will expect hyper-personalised customer experiences, where technology is used to tailor the customer journey to meet their individual needs and expectations • “Everything now” will become the norm, with instant real-time responses expected for all interactions • Increasingly contextualised experiences will be expected, where the nature of the experience is adapted to fit the context 	<ul style="list-style-type: none"> • Enhancing customer experiences must only be done in ways that are secure and remain compliant with regulations • Increased fragmentation can lead to a proliferation of options, degrading customer experience • The readiness and capability of organisations and consumers to adapt can limit the pace of change for customer experience 	<ul style="list-style-type: none"> • How could you use data, AI and other new technology (as well as humans) to boost the experience you deliver to your customers? • Where could you connect together different experiences and journeys, and apply an optichannel strategy? • Which partners and ecosystems could you work with to deliver a more complete and compelling customer experience?

21 https://worldline.com/en/home/pressroom/press-releases/2021/pr-2021_07_08_01.html



Unification Taming Diversification

Never before have there been so many possibilities for how people can pay. The scale of diversification is immense; the challenge is how to unify it.



New Business Models

The Covid-19 crisis has led many businesses (often those that are smaller and local) to digitise their services. This has opened their minds to new ways of selling and delivering their products and services. Previously stable sectors have been driven to reinvent themselves with more digitised solutions and new business models that blend the online and physical worlds, bringing converged experiences and the need for converged platforms to support them.

We saw not only an increase in traditional retail and resto e-evolutions (such as click and collect, increased takeaway and home delivery), but also emerging new service and business models in multiple sectors: from a theatre company producing WhatsApp reality shows²², through to brand new platforms like one that brings hairdressers and beauty professionals into contact with their customers in pop-up locations or at home²³.

Business models had already been moving towards recurring, usage or value driven models:

- **Servitisation** – Rather than paying to “own” a product, paying a recurring fee to access/use it (e.g. renting a car instead of buying it)
- **Pay-as-you-use** – Rather than a fixed recurring fee, paying only for how much you use the service (e.g. paying for the time spent driving or the distance travelled)
- **Pay-for-outcomes** – Rather than paying to access or use the service, paying only for the value it generates (e.g. paying for successful trips completed)

Similarly, operating models have also shifted, with an increasing preference for more resilient cost structures that scale up or down in alignment with the revenue generated, for example through:

- **Cloudification** – Enabling businesses to pay only for the infrastructure they require at a particular time, scaling up or down according to demand
- **The gig-economy** – Providing a more flexible work force that can scale as needed (both in terms of capacity and skillset)

- **Distributed sourcing models** – Avoiding dependence on single suppliers or distribution chains

A more digitised world could bring more intelligent and scalable financing models to a much broader spectrum of sectors

We expect many of these transformations will continue and accelerate, even in unexpected, previously stable sectors. A more digitised world could bring more intelligent and scalable financing models to a much broader spectrum of sectors without introducing uncontrolled risks. From Philips “Light as a Service”²⁴, Bosh “home connect”²⁵, to financing proposals for merchants where the payback automatically follows the rhythm of business turnover²⁶. These are just some examples of how a more integrated and digitised world helps to deliver new ways to conduct business.

The age of FinTech 2.0

In 2015, it was recognised that, despite a large amount of investment in FinTechs, the impact of these new, innovative entrants to the market had been limited:

“FinTech 1.0 has brought only minor disruptions to the banking market, mainly in the areas of payments, credit and personal financial advice. But changes in customer preferences, advances in technology and growing investment in FinTech set the scene for more radical change. FinTech 2.0 could mean a ‘seamless specialisation’ across core elements of the value chain whereby a variety of providers combine to deliver cheaper and easier-to-use propositions to end customers.”²⁷

Since then, as mentioned in the introduction, the number of FinTechs worldwide is continuing to grow, reaching over 25,000 this year. Investment in FinTech has also reached record highs: \$98 billion in the first half of 2021²⁸. We now appear to be at the cusp of realising this vision for FinTech 2.0, with an expectation that, in the coming years, we “will see the widespread integration of financial

technology within virtually every other product and service — embedded in everything from transportation to entertainment to healthcare and beyond”²⁹.

The big successes in the coming years will be where both new-entrants and incumbents manage to combine forces

With the continued rise in FinTechs, the financial services business ecosystem is now more complex than ever. The small, nimble new-entrants are often leading the way in applying the new business and operating models we previously mentioned. These innovations have the potential to bring improved customer experiences. However, we also believe that businesses and consumers value the reliability and trust that can only be provided by larger, more stable businesses. We predict that the big changes (and successes) in the coming years will be where both new-entrants and incumbents manage to combine forces and leverage their unique strengths to deliver innovative and trusted services to their customers. Indeed, this is one of the reasons we host the annual e-Payments Challenge, where we bring corporations and FinTechs together with our e-payments expertise to co-innovate solutions to real-world business challenges.

The shift to glocal

Some major platform providers have reached a scale in their operations that allows them to innovate and deliver an unrivalled digital experience, as this is their main (and often only) touch point with their client base. Many consumers have benefitted from such global services, which are able to provide:

- Affordable products from anywhere
- Broad and rich services
- Digital experience excellence

But people equally value the virtues of products and services that are provided locally. One of the lessons that lockdowns have taught us is the value and fun of physical/local experiences with friends and family, [something we also explore further in [The Renaissance of Physical Stores chapter \(p.45\)](#)].

22 <https://skagen.be/en/home>
 23 <https://www.lipsnrazors.com/>
 24 <https://www.lighting.philips.be/systemen/aanbod-van-pakketten/winkels-en-horeca/light-as-a-service-retail>
 25 <https://www.bosch-home.be/nl/innovaties/homeconnect>
 26 https://be.worldline.com/en/home/newsroom/general-press-releases/2020/pr-2020_01_13_01.html
 27 https://www.oliverwyman.com/content/dam/oliver-wyman/global/en/2015/jun/The_Fintech_2_0_Paper_Final_PV.pdf
 28 https://www.altfi.com/article/8210_global-fintech-investment-hits-98bn-in-first-six-months-of-2021
 29 <https://oakhctf.medium.com/fintech-2-0-the-future-of-money-82b2cf301382>



Combine this with growing demand for increased sustainability and the benefits of local services and products become more stark:

- **Shorter supply-consumption chain** - Reducing the environmental impact
- **Personal touch** – Leading the consumer to feel more cared for and increasing loyalty
- **Physical/live experiences** – Creating a deeper, more positive connection between business and consumer

So we now see momentum building towards global digital platforms that focus on local services as a key differentiator. For example, Google launched its “Dear Local” campaign³⁰ and has implemented specific features to help local businesses be found online and to optimise for store visits³¹.

What we clearly see is that nothing prevents the addition of a local dimension to digital platform and app ecosystems, with nationwide or global reach. Offering the services and products of local players via the best digital experiences, can keep consumers loyal to local entrepreneurs and shorten supply chains. As illustrated in Figure 9, these *glocal* services could clearly combine the best of both worlds, with local producers becoming more digital, and global platforms favouring and supporting local products and services.

We see momentum building towards global digital platforms that focus on local services as a key differentiator



Figure 9: Advantages of local service providers and global platforms.

New Business Models		
Changes	Challenges	Choices
<ul style="list-style-type: none"> • Trends in new business models continue to accelerate, particularly the shift to servitisation, pay-as-you-use and pay-for-outcomes • Fintech 2.0 will bring significant changes, with the big successes coming when incumbents and new-entrants combine forces • There will be growth in the use of global platforms to enable and support local services 	<ul style="list-style-type: none"> • Many businesses will have to adapt their business and operating models to match consumers’ expectations • With the continued growth of FinTech, all financial services players need to understand their unique value within this ecosystem • Local businesses and existing and new dominant global platforms will need to interact to deliver glocal solutions 	<ul style="list-style-type: none"> • How could you adapt your business and operating models towards servitisation, pay-as-you-use and pay-for-outcomes? • Who are the main actors in your business ecosystem (including major global platforms) and how could you deliver or benefit from a glocal approach?

30 <https://www.mybusinessonmaps.co.uk/why-google-are-supporting-local-businesses/>
 31 <https://www.google.com/retail/localcampaigns/>

Digital Currencies

The world is experiencing accelerated digitalisation, with many aspects of day-to-day life that were once physical being replaced by virtual equivalents. In this chapter, we explore how fiat money could undergo such a digital transformation and what needs to be considered for its digital equivalent to become widely used.

The origins of currency

Trade is the lifeblood of the economy. It represents an exchange of value and dates back around 40,000 years³². Currency, however, is a relatively new concept. Barter had become too cumbersome and inefficient and currency has thus endured into the modern world with several changes along the way. In its latest incarnation (that dates back to the early 1970s) fiat money has become the de-facto currency standard. Fiat money has no underlying assets to back up its value and is merely a guarantee by governments that the banknote or coin is legal tender for the repayment of debt, interest and to exchange value for goods and services.

Fiat money offers several advantages. It is stable, avoids the volatile cycles of commodities (such as gold) and central banks have full control over the money supply and liquidity. However, in recent years, a new type of money has emerged: digital currency. To understand its evolution, let us first look at two cryptocurrencies that have gained popularity: Bitcoin and Ethereum.

Bitcoin made digital currencies mainstream

Bitcoin is a completely decentralised public ledger system to record transactions on a per-block basis while interlinking the blocks (a blockchain). The issuance and distribution mechanism of bitcoins is achieved through “mining” – a system where miners are rewarded for solving computationally intensive mathematical problems.

While Bitcoin is not the first digital currency (this title goes to DigiCash³³), it is the first digital currency to have entered the mainstream, enabled by the ubiquity of computers as well as the Internet. The value of this currency has continued to increase over time. While Bitcoin has enjoyed some popularity, it is not without criticism.

It uses a lot of energy because the proof-of-work method³⁴ uses a lot of computational power. So much so that there are estimates that it accounts for 0.55% of total global energy use³⁵. It is also suspected that a quarter of all Bitcoin transactions are in some form facilitating illegal activities³⁶. Some of these shortcomings are being addressed by moving away from “proof-of-work” to “proof-of-stake” (for example, Ethereum 2.0).

Ethereum catalysing decentralised finance

After the invention and creation of Bitcoin, came another disruptive invention called Ethereum. Vitalik Buterin, co-founder and inventor of this new currency, was already well engaged in the Bitcoin community. However he pursued the idea of “programmable money” in the form of smart contracts. Given that he was unable to agree with the proposal for Bitcoin, he decided to launch his own cryptocurrency platform in 2014, called Ethereum with its own currency called ether or “ETH”. Ethereum is different from Bitcoin in one important respect: it is meant to be a platform for decentralised applications and smart contracts and comes with its own programming language. In other words, the digital currency ETH is part of an ecosystem and is intended to be used by the applications that reside on the Ethereum platform. Because of this form of openness, Ethereum gave rise to new concepts, such as Decentralised Finance and Non-Fungible Tokens [which we discuss further in the [Counterfeit Detection at Scale chapter \(p.63\)](#)]. Ethereum also provided the foundation for ICOs (Initial Coin Offerings). With the advent of Ethereum and ICOs, the space for cryptocurrencies has exploded and there are now thousands of cryptocurrencies (or “crypto tokens” as they are sometimes referred to) in circulation.

Ethereum is a platform for decentralised applications and smart contracts and comes with its own programming language

Stable coins

Cryptocurrencies such as Bitcoin and Ethereum have seen wild fluctuations in value, which has led some to characterise them as highly speculative investments rather than meaningful currencies.

To provide a solution to such volatility, stable coins are digital assets that have a value which is pegged to stable assets like fiat money. Facebook’s Libra (since renamed Diem) is a prime example of a stable coin (albeit one that was rapidly sanctioned by governments). Facebook’s idea was aimed primarily towards the underbanked and non-banked global population, with a focus on emerging markets (remittance applications, for example). Other blockchains such as Multichain, Hyperledgers, Cardano, R3 do exist and offer broad technical variations.

Central bank digital currencies

Central bankers have reacted to stable coin initiatives such as Diem by starting work on central bank digital currencies (or CBDCs). These CBDCs have the potential to provide the benefits of digital currencies whilst also providing the stability and control mechanisms associated with fiat money. Currently 75 countries are implementing, piloting or investigating the use of CBDCs³⁷. One example is the Digital Euro which is already being worked on by the European Central Bank. CBDCs are government controlled therefore trust issues are eliminated. This means that they do not have to be implemented as a cryptocurrency but, even if they are, they do not have to utilise the “proof-of-work” method, and hence energy consumption is greatly reduced. In fact, the majority of new blockchain initiatives are moving towards a “proof-of-stake” model whereby the instance with the most “at stake” or which holds most of the tokens, determines validity of a transaction in relation to its holdings. The more one holds, the more “blocks” in the blockchain one can validate.

CBDCs have the potential to provide the benefits of digital currencies whilst also providing the stability and control mechanisms associated with fiat money

32 <https://theconversation.com/when-and-why-did-people-first-start-using-money-78887>

33 <https://en.wikipedia.org/wiki/DigiCash>

34 <https://www.coindesk.com/tech/2020/12/16/what-is-proof-of-work/>

35 <https://hbr.org/2021/05/how-much-energy-does-bitcoin-actually-consume>

36 <https://academic.oup.com/rfs/article/32/5/1798/5427781>

37 <https://www.atlanticcouncil.org/cbdctracker/> accessed on 29th July 2021

From electronic money to digital currencies

Electronic money (as distinct from digital currency) has been around for many years. In the 1960s, the financial services industry began digitising the processing of its money. Since then, many technological implementations have been attempted. Some were successful and many were abandoned, either due to technological issues, UX issues or other factors that prevented wide adoption (such as a problem with the business model or regulatory challenges). Some examples of successful manifestations are:

- Credit card schemes
- Debit card schemes
- Stored value cards
- Digital wallets and super apps (with funding mix, account based or stored money)
- Account-to-account payments (ACH, SWIFT, SEPA)
- Person to Person payments (UPI, PayPal, Venmo, Cash app)

Until 2008 (the commonly accepted birth date of blockchain), all successful solutions were based on traditional ledger systems, involving several intermediaries. This system requires a form of clearing and settlement of the transacted funds and most often requires a form of post-transaction reconciliation. Blockchain, on the other hand, has been designed to allow for a shared “single point of truth” (the blockchain) and transaction processing that usually takes no longer than an hour. We will now discuss further some of the alternative options for implementing digital currencies.

Account versus token based

In the case of digital currencies, two transaction structures are possible. Either transactions simply bear amounts (i.e. a check provides the authorisation to take, for example, 10 Euros from a specified account without specifying which 10 Euros out of all the Euros available) or the transaction authorisation specifies actual assets/tokens (just as a 10 Euro bank note may represent a unique item with a value of 10 euros, identified by its unique serial number).

Fungible versus non-fungible

With the invention of blockchain, a new way to track currency and transactions has come into play. When a person has 3 coins of 1 Euro in their pocket, it is not possible to tell where each one came from, therefore the coins are fungible. In the case of crypto tokens, they can be made non-fungible, so that every coin has a unique reference that it maintains when passing from wallet to wallet.

Public versus private

Before blockchain, all implementations of electronic money would have been considered “private” due to the fact that governance is exclusive to the central or private banks and “public issuance”. A digital currency can be publicly operated (such as Bitcoin, Ethereum) or privately operated (such as CBDCs, Diem or DaVinci). Privately operated digital currencies require authentication. Another way this is commonly described is as a difference between permissionless (public) or permissioned (private) approaches. For DaVinci, which was offered through Worldline’s strategic partnership with Gold Global, the Worldline Digital Asset Management platform takes advantage of a private Blockchain with full control, guaranteeing security³⁸.

Anonymous versus authenticated

Public digital currencies are considered by many to be anonymous, because they are permissionless and thus, while it is possible to trace transactions, it is difficult to associate them with a particular identity. This is different for private digital currencies, where the identity is known and thus traceability is much easier. There are efforts underway to respect privacy for individuals with CBDCs but, in theory, the central bank could always trace any transaction. This will help to reduce fraud and money-laundering, but only if the privacy concerns of currency users can be addressed.

CBDCs will help to reduce fraud and money-laundering, but only if the privacy concerns of currency users can be addressed

Applicability and use cases

At the centre of the current disruption are financial system participants and stakeholders such as acquiring and correspondent banks, retailers and public offices that currently interact via existing payment instruments (credit card schemes, SWIFT, SEPA, ACH, etc.). All financial service customers could benefit from lower cost, greater privacy, zero fraud, and increased resilience. This can be applied to practically all their business operations ranging from customer support, invoicing, contract management, procurement and tax reporting to corporate tax and IT audits.

Other verticals that would benefit from privacy and identity management provided by digital currencies include insurance and travel. For example, travel and insurance companies could elevate their existing loyalty programmes by making relevant data (e.g. information, analysis, assessment, profile) available at the start of an experience. In the case of insurance, relevant data could be made available when an event is triggered (e.g. car accident in a hailstorm, house on fire).

Opportunities will arise in which agile payment service companies can help customers move into the digital currency space either by helping them implement a particular use case (e.g. migrating loyalty programmes to digital currencies), creating a representation of value through crypto tokens or by redesigning a process to remove friction by using digital currencies. Digital currencies can also help forge new partnerships in emerging markets, where the opportunity is clear and the desire to be in business is shared but trust is not yet available against the background of poor governance and weak control measures.

We observe three main aspects of digital currencies, where numerous potential services arise:

Cryptocurrencies leveraged by banks, FinTechs and service providers as a means of payment instrument or to hold digitised assets.

Stable coins where public (e.g. states and cities) and private bodies create a new type of payment rail: a closed loop write-once system that facilitates online and physical real-time payments as well as easy issuing (for example, as a replacement for local vouchers).

38 https://worldline.com/en/home/pressroom/press-releases/2021/pr-2021_01_19_01.html

Decentralised finance where FinTechs and tech companies are enabling end users to create decentralised alternatives to many privately provided existing services, like lending or insurance. As an example, when we interviewed Tallyx CEO, Aditya Menon, who works on diversifying and democratising trade finance, he told us:

“We wanted to take banks out of the game of charging a premium for being a trusted provider but give banks the full opportunity to use their balance sheet and their ability to raise capital cheaply”.

Opportunities and threats for financial market players

For each of these aspects, we also see both opportunities and threats for current financial service businesses:

Cryptocurrencies create an opportunity to provide services to banks, other financial institutions, retailers and others. Despite the controversy around cryptocurrencies such as Bitcoin and Ethereum, their usage has massively increased beyond a specific niche market. To support merchants who wish to accept these currencies, payments companies should look to provide support for them, in ways that minimise the risks for merchants and consumers (such as the crypto payment solution launched earlier this year by Worldline and Bitcoin Suisse which enables more than 85,000 Swiss merchants to easily accept payments in either Bitcoin or Ether³⁹).

Stable coins provide the opportunity to offer clients access to a digital currency of stable value, with instant transaction speeds, increased security and the ability to transact across national borders seamlessly.

Decentralised finance brings the possibility, through technology, to provide services beyond the established perimeter of the financial services industry. These new products and services would allow a larger part of society to participate in the financial system. However, there is a risk that these services could grow to the point of jeopardising sections of the current banking ecosystem.

Strategic outlook

Undoubtedly, the companies that have been able to detect and adapt to change, regardless of the technology used (cash, cheques, debit cards, credit cards, wire transfers, instant payments, wallets, etc.), have emerged as clear market leaders by demonstrating the know-how and support that clients need to fully leverage the benefit of each new technology. Agile partners in the payment space are structured in such a way that they can rapidly and sustainably continue to operate and provide all the associated services to successfully process billions of transactions per year, no matter what the payment infrastructure.

Digital currencies can be seen as new payment rails that will compete with and potentially replace some of the existing rails. Therefore, for those who

wish to maintain a competitive edge, it is paramount to understand the pace of adoption and quickly develop and deploy the best new competitive and disruptive services.

It is paramount to understand the pace of adoption and quickly develop and deploy the best new competitive and disruptive services

Payment rails that obtain prominence enable businesses to offer more alternatives and services to their end users while also creating value, often by reducing costs through efficiency gains, providing greater transparency, and reducing the potential for fraud. A rail that allows businesses to have increased and better-quality information about customers enables a better customer experience, thereby driving increased revenues.

Examples of such rails include digital wallets, which often deploy and leverage APIs (Application Programming Interfaces). This in turn improves the experience of end users of businesses such as banks, merchants and public services while establishing the basis for businesses to launch new business models. New entrants, such as public Bitcoin and other unstable coins, branded or private stable coins and CBDCs help create the ecosystem for commercial innovation.



Digital Currencies		
Changes	Challenges	Choices
<ul style="list-style-type: none"> Public cryptocurrencies (notably Bitcoin and Ethereum) have demonstrated, despite their pitfalls, that digital currencies can provide an attractive alternative to fiat money for certain use-cases In the coming years we will see CBDCs launched 	<ul style="list-style-type: none"> Private digital currencies avoid many pitfalls of public digital currencies (energy usage, criminal activity) but raise new challenges around privacy, as all digital transactions will leave traces Given the huge array of use-cases that can be supported through digital currencies, it can be difficult for a given business to identify which ones are worth pursuing 	<ul style="list-style-type: none"> How could cryptocurrencies, stable coins and decentralised finance impact your business strategy? How ready are you for these changes and how ready are your suppliers and partners to support you?

39 https://worldline.com/en/home/pressroom/press-releases/2021/pr-2021_09_01_01.html

Context Aware Services

For traditional software automation, human users still need to frequently interact with programmed code, because data or decision input is required, which only they can provide.

As ever more interactions between consumers and vendors (or just from one human to another) become digital, a wealth of additional data sources becomes available, both from the devices being used and from the myriad of applications accessed via the Internet. These data sources mean that increasingly larger proportions of the data and decision inputs can be inferred via machine learning.

AI can harvest this vast range of contextual data and turn it into recommendations or even use it to make decisions. This application of AI to automation is known as hyperautomation⁴⁰, as it goes beyond programmed automation through the application of incremental machine learning.

The payments sector, and more generally the financial services industry, is seeing growth along three dimensions:

1. Diversity of payment means and currencies
2. Complexity, number and pace of change of compliance frameworks
3. Transaction counts and types

But even with this growth, it simultaneously needs to increase convenience, reduce costs and maintain trust, security and agility.

This makes financial services an ideal candidate for the autonomous service industry, which aims at improving convenience, seamless customer experiences and efficiency without incurring unmanageable costs. This industry is expected to grow from \$345 million in 2019 to \$2,992 million in 2024⁴¹.

What is hyperautomation?

Humans have used water, wind and muscle powered machines for centuries to help with mechanical tasks like milling grain or creating and weaving threads. The seemingly limitless power of fuelled engines drove the industrial revolution, which later, combined with electronics and software, achieved today's sophisticated automation, where most consumer goods are produced with a minimum of direct human involvement. Instead,

mankind has used its intelligence to delegate and automate any task that a machine could do better or more cheaply.

Hyperautomation is shifting this delegation to the next level, moving decision making to computers, for tasks which no longer require true human intelligence, as they achieve satisfactory results using the latest machine learning techniques. With the growth of AI and the rapidly expanding sources for contextual data relating to each task, we can now see the possibility of having tools that rely on AI-based context-awareness to progressively automate more and more decisions (as illustrated in Figure 10).

Download our whitepaper
"Hyperautomation in Payments:
Harnessing AI to automate complexity
at scale".

Not only does it explain the different types of AI that can be used for automation, but it also explains the needs for data-awareness and the right organizational culture. It ends with six key takeaways to help you progress on your hyperautomation journey.

Why is traditional automation not enough?

As mentioned earlier, until recently software-based automation relied on human programmed solutions. In essence, domain expert and engineering knowledge coded into programming languages using a fixed set of inputs, sensors and rules that hopefully covered all cases. Everything from a simple accounting system to the most sophisticated ERP solution strictly followed the encoded logic, which was carefully documented, tested and whose behaviour could thus be explained and trusted.

Adding new data sources or types that might influence a decision process, required fully understanding how this data and specific inputs could play out and then rewriting the code. Adding lots of data sources and types resulted in diminishing returns: quickly the effort of rewriting the code would not justify the improvements in the quality of decisions made.

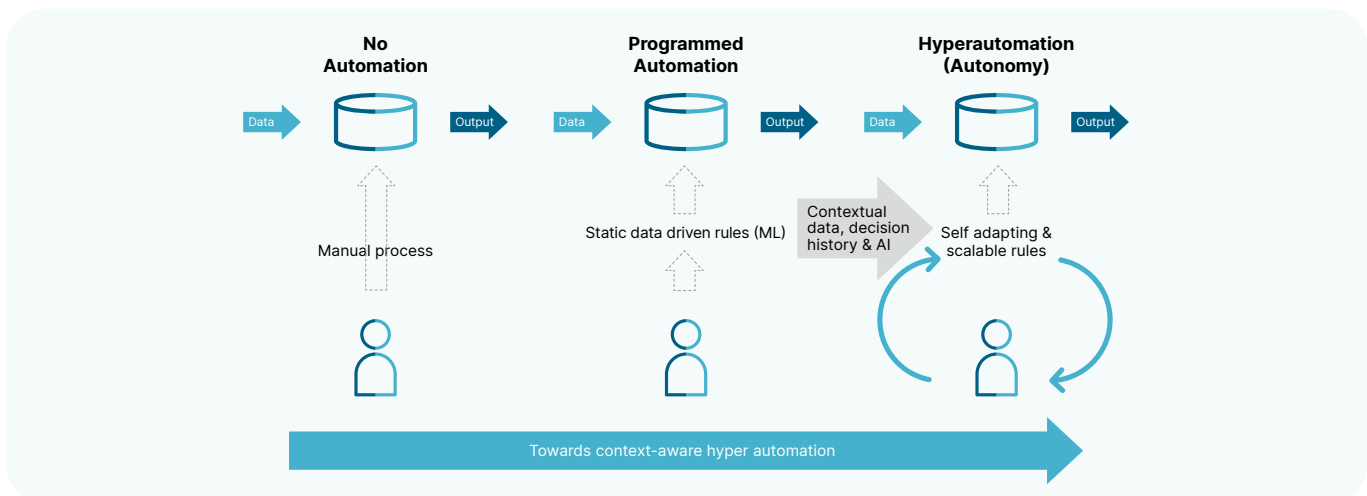


Figure 10: The road towards hyperautomation.

40 https://worldline.com/content/dam/worldline-new/assets/documents/whitepapers/hyperautomation_in_payments.pdf
 41 <https://www.marketsandmarkets.com/Market-Reports/autonomous-agents-market-201425821.html>

Machine learning replicates to some degree how we learn ourselves, which varies for different skills. With infants it is mostly trial and error; lots of trials as we start, and fewer and fewer errors as we learn to make use of the feedback that our senses provide.

As we get older, we start to use observation and imitation; huge amounts of observations, first faltering attempts at imitation, ideally accompanied by careful feedback.

In the end, we gain the ability to generalise, abstract, reason and explain our choices thanks to experience. Experience is context that has been made useful, and this provides a template for the creation of context-aware hyperautomation.

If the volume and quality of data are sufficient, machine learning can acquire a staggering level of skill. For example, the BERT natural language processing model⁴², after being fed with much of Wikipedia, can not only distinguish a correctly formulated English sentence from a random jumble of letters, but can also construct similarly well-formed sentences. Better still, when asked a question, its answer can appear a quite reasonable response using the information gleaned from Wikipedia.

In payment processing, machine learning based anomaly detection models can find fraud in never-before-seen transactions based on feedback from fraudulent ones. But that does not mean that a language processing model trained on Reuters and Wikipedia would be qualified to make financial arbitrations for a multi-billion-dollar company, because the decision bias depends too much on the learning context and material. Adapting machine learning approaches, models, data and training methods to a sensitive area such as payments will require real human intelligence for the foreseeable future.

This is an example of where we hit the limits of simple machine learning tools in their inability to automate decision-making. Stepping up to hyperautomation requires much more than having skills in machine learning and an abundance of data.

Hyperautomation to provide context-aware Services

Even big data evangelists admit that not every bit of context may be useful⁴³. But they point out that very often insights hidden in collateral data are overlooked or that modern tools are much more capable at extracting information from unstructured data than many expect.

Being context-aware is not just about data integration; human intelligence today is still used when it comes to identifying potential sources of context and assessing their relevance to a given issue. Context-awareness helps by using evolving AI algorithms to orchestrate service requirements and propose or make tailored choices on managing the interactions with other services, selecting the appropriate parameters and combining the right dosing of requirements per service. All of this while managing the security and trustability of all information coming in and ensuring privacy and discretion for all data going out.

Another way of looking at context awareness is to look at how our brain processes data from our five senses, which gather raw, heterogeneous, multi-modal and multi-channel data. Thanks to medical science, we know today that the

brain is separated into different parts dedicated to different activities. When we think of the brain, we tend to focus on its ability to reason, but that is only one of several more complex and compartmentalised processes which ultimately enable it. Indeed, before being able to reason, other parts of the brain must gather information, merge it, classify it, and link it to other knowledge to converge on what we call an idea. It is only because we have ideas that the process of reasoning can take place.

Contextual knowledge is the necessary step to harnessing the power of AI

The same is true for AI. Raw data and AI will not be enough to generate autonomous decisions. Contextual knowledge (what we refer to as "experience" in humans) is the necessary step to harnessing the power of AI to make more effective decisions. We call the compartment in which this context processing is performed the *smart proxy*.

From a practical point of view, the smart proxy decision-making acts as an agent managing the interface between the service user and the digital world. This includes all back-office interactions with digital services while ensuring a trusted interface between the real world and cyberspace.

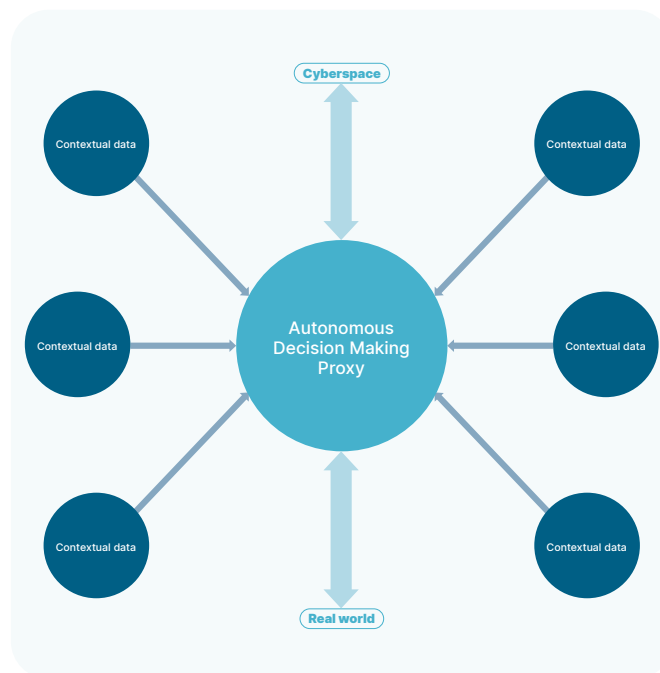


Figure 11: Smart proxy's role in managing context-aware service interactions.

Figure 11 illustrates how the smart proxy acts as an intermediary, simplifying the processing of contextual data so that the service can evolve according to the user's aims and wishes. As figure 12 shows, the proxy is made up of different modules that first retrieve and merge the data, calculate the changes necessary to the service and then update the service. These modules are respectively named in the figure: data fusion, model enhancement and service update.

42 <https://ai.googleblog.com/2018/11/open-sourcing-bert-state-of-art-pre.html>
 43 <https://www.dataversity.net/big-data-smart-data-big-drivers-smart-decision-making/>

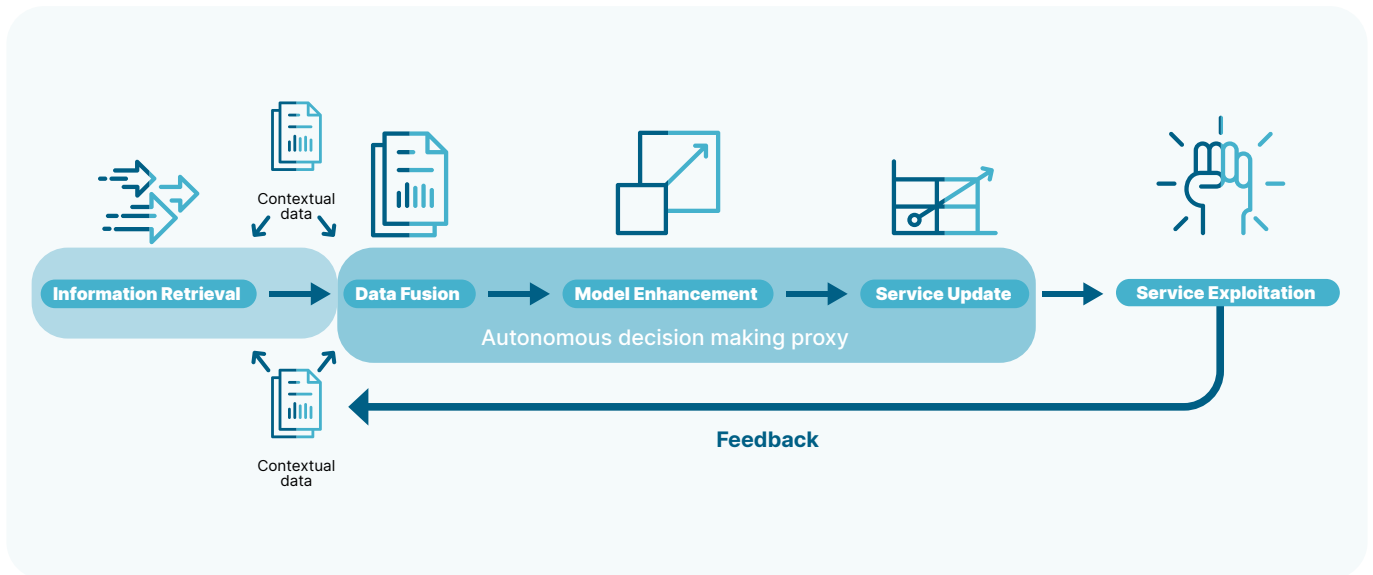


Figure 12: Sequence diagram representing the interactions of information in the operation of the smart proxy.

Showing such simplicity for the user while achieving such a context-aware service will require addressing several different domains:

Quality/Accuracy: Building a customised and automatically adjusted quality model based on feedback while watching the quality bias by retrieving relevant newsfeeds or channel updates with an autonomous source cross checking process for trustworthiness and authenticity verification.

Privacy: Vetting outgoing information against information publishing policies based on dynamic privacy parameter tuning according to the context and the user profile; automatic tokenization/ encryption of the appropriate private information in case of mandatory exchange of sensitive information; and ensuring solely the strictly required information sharing towards external services providers.

Diversification: Provide relevant information according to user preferences but including new and diversified elements in accordance with past proposals so as to increase value and avoid relying on a small pool of the same sources. This will require finding the best trade-off between user satisfaction and curiosity stimulation.

Interactivity, explainability and evolution: The autonomous proxy needs to look for feedback through interaction initiatives to keep the user profile up to date while being able to provide an explanation regarding the options taken or suggestions provided.

Multi-platform, resiliency and interoperability: The autonomous proxy needs to be multi-platform compliant and

able to be migrated and scaled according to needs (such as security, proximity, latency, etc.), either autonomously or at the request of the user.

Interoperable: The autonomous proxy needs to seamlessly interoperate with other proxies over the provided services through an automatic ecosystem and past context discovery.

Trust/Verification: Guarantee the ability to assess the autonomous proxy behaviour despite its non-deterministic running due to the constant acquired knowledge of the system.

Legal: The autonomous proxy needs to offer a human fall-back whenever there is no formalised autonomous decision regulation.

Loyalty/Ethics: The autonomous proxy needs to be loyal to the service user, not to its manufacturer. Its purpose should be to fulfil its user's interest while ensuring ethical operations and managing any conflict of interest.

The path towards hyperautomation

The objectives of hyperautomation are not fundamentally different than those that arose from machines and automation. A human weaver would quickly notice a broken warp thread on the loom and repair it as unobtrusively as possible, while a power loom might have gone through twenty sheep's worth of wool before its operator discovered that a whole batch of the most elegant cloth is now destined for the pauper's market: small errors, mistakes and failures add up much more quickly with machines running at inhuman speed.

It took engineers decades to perfect the processes, mechanics and software to the point where, at every step, the input materials had precise qualities so that a well-designed machine could perform the next step with relentless efficiency. Confidence was built through scientific approaches, splitting steps, testing or proving their function and by providing observation points and sanity checks to human operators.

Sticking to a manual loom for textile production or an abacus for Enterprise Resource Planning (ERP) was not an option once the competition had advanced. And it will be similar with the use of AI to attain hyperautomation. Not every business will become more successful by deploying hyperautomation. But sooner or later those businesses that do manage to make it work for them, will use the advantages in efficiency, market responsiveness, security and resilience to their competitive advantage.

To achieve this success with hyperautomation, four major topics need to be considered:

Firstly, choosing where best to apply hyperautomation. In a competitive environment, the survival and evolution of a business lies in its ability to renew itself by using, amongst other things, new technologies to gain a competitive advantage. The key question is where and how to go towards hyperautomation, whilst containing the risks, attaining the quickest wins and retaining control. Taking quick baby steps may both reduce the risks and increase the benefits.

Secondly, guaranteeing the privacy of big data. People and businesses are naturally concerned about disclosing their most valuable data. At Worldline we believe that there is significant value in the ability to offer the processing and maintenance of very personal data, if guarantees can be provided that no one processing it can read it in clear format. One application of hyperautomation could be the ability to negotiate for just the minimum amount of data disclosure required for a given service with the maximum of convenience, while maintaining a large amount of contextual data that might one day be useful. And to keep that contextual data completely out of reach of anyone, until the consumer decides it is worth disclosing within a tightly controlled context.

Thirdly, controlling the delegation of decision-making. Hyperautomation is no different from machines and automation in that it is a long journey that starts with small steps. This will only happen past waypoints of controls, feedback loops, and human monitoring. The ultimate objective is to take advantage of the huge progresses in AI and computing power to take into consideration amounts of data that would not have been manageable by humans, and in this way identify complex or nascent patterns and enable better decision-making. When possible, some levels of autonomy will be progressively given to the AI algorithms after careful consideration. But we expect that human input and feedback will always remain the norm for critical decisions, not least because ownership of the decision implies responsibility.

We expect that human input and feedback will always remain the norm for critical decisions

Finally, managing progressive adoption. The outcome of context integration will be different levels of autonomy. According to the way the output of the service is provided, it varies from an augmented contextual service to a fully autonomous service. This evolution is depicted in Figure 13 through a timeline with 4 main milestones:

1. **Augmented Contextual Services:** the service is enhanced and augmented periodically thanks to gathered contextual information.
2. **Advisory Contextual Services:** the service is regularly improved with contextual information and offers advice to optimise results.
3. **Trusted Contextual Services:** the service is regularly enhanced with contextual information and has a proven track record on elements of trustworthy advice.
4. **Trusted Autonomous Contextual Services:** the service is dynamically improved according to contextual information with a track record giving it the ability to make autonomous decisions within its certified domains.

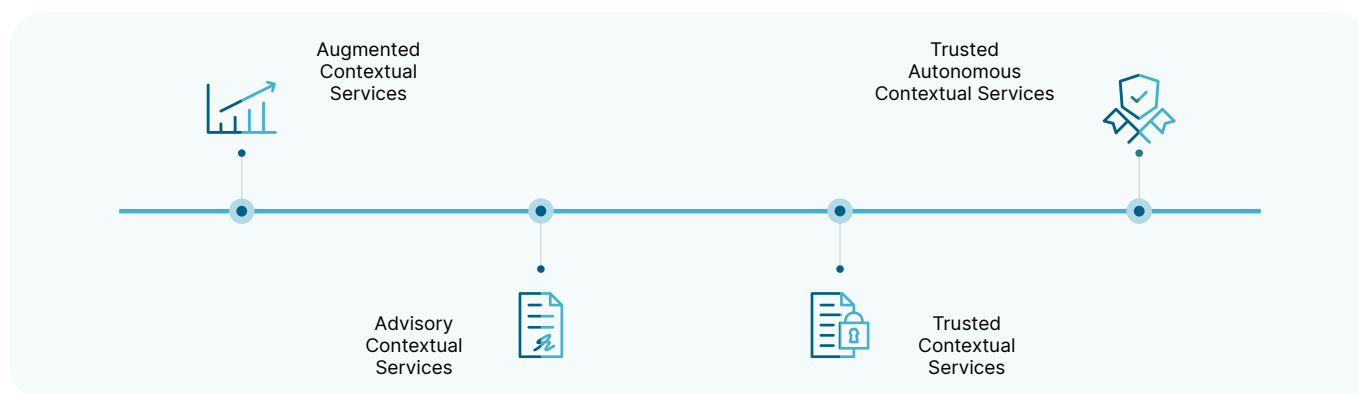


Figure 13: Timeline for the evolution of contextual services according to the degree of autonomy.

Possible applications of context awareness

There is an ever-expanding scope of diversity in payment methods, schemes, currencies and compliance regulations. It is therefore an ideal candidate for hyperautomation so that the cost of payment processing does not rise as this diversity increases.

One application of hyperautomation and context-awareness in payment processing could be the use of greater contextual knowledge to offer the most appropriate payment method to a customer, based on their historical preferences and the type of purchase being made. This could boost conversion rates and improve the customer experience by making it contextual and proactive, as described in the [Unpacking Customer Experience](#) chapter (p.19).

Another payment related application is for fraud monitoring and risk assessment solutions. For example, hyperautomation can consider a large range of context-related data to take the decisions to reduce the ratio of transactions for which a Strong Customer Authentication will be required. Not only could this improve the user experience, but simultaneously it could reduce overall fraud levels. Hyperautomation can also be instrumental in the early identification of new fraud

patterns, as well as supporting the collection and analysis of a large range of data when it comes to dynamic risk scoring for credit-based payments such as instalments or Buy Now Pay Later (BNPL) transactions.

These examples show the direct application of hyperautomation to improve existing processes. However, when looking more broadly at the financial industry, one can imagine brand new services based on hyperautomation.

For example, based on an autonomous proxy, a smart financial service would be able to automatically move funds between a party's different financial accounts to reduce overdraft fees or optimise returns on their savings. It could browse automatically various investment vehicles and asset classes and propose new investment opportunities, taking into consideration their current asset portfolio, mid to long term outlook, risk appetite and preference for liquidity level. Being autonomous, it could alert when it is the right time to renegotiate credit or insurance contracts, ensuring guarantees will not be adversely affected. It could even pre-register the person's profile to open an account with new providers, sharing only the Know Your Customer (KYC) elements which are absolutely required. Once advice provided by the hyperautomated service is browsed, only a few clicks would be required to finalise onboarding.

Perhaps surprisingly, most of the technical building blocks for such a solution already exist, and the combination of the trends towards Open Data, Open Banking, Open Finance, APIs and e-ID will progressively put state-of-the-art money management within reach for most people.

Remaining in the financial services domain, one could easily imagine a “Home Bot”, able to rove around a person’s home, automatically recognising objects and identifying new, displaced or missing ones, and able to take actions such as sending notifications, updating their belongings inventory (with associated invoices gathered from emails or e-commerce accounts) for their home insurance, or helping them to find something they have lost.

More generally, context-aware hyperautomation could help any IT intensive business optimise the carbon footprint of its business operations. Based on real time data, such a system could automatically source its electricity from different providers to choose the least CO₂ emission electricity source available. It could also launch non-urgent IT processes and batches at times when spare electricity is available on the grid, which might be lost otherwise, or at times when electricity from renewable sources is available.

These are just a few examples of how hyperautomation can be instrumental in managing complexity and an ever-growing amount of available data in a self-adapting mode. But the potential applications are virtually limitless and will keep on increasing and becoming more feasible, as more and more data becomes available and interoperability between heterogeneous systems progresses.



Context Aware Services		
Changes	Challenges	Choices
<ul style="list-style-type: none"> • The need for interoperability and transparency with regards to compliance will require extra effort from service providers • Fast growth of available data sources and volumes will require additional knowledge in order to leverage it • Increased and accelerated decision-making will demand continuous service adaptation to user needs 	<ul style="list-style-type: none"> • Ensuring responsibility, relevance and quality of AI based automated decisions, maintaining ownership and confidentiality of data and ensuring fair and loyal decision-making by autonomous processes • Controlling the evolution of autonomous services via careful assignment of responsibilities, restrictions within the application and the explainability of autonomous decisions • Managing scalability and interoperability of platforms hosting the autonomous decision proxies to enable smooth interactions between autonomous proxies and humans 	<ul style="list-style-type: none"> • What do you see as the most pressing areas for transitioning towards hyperautomation inside your organisation? • What would be the adequate pace of adoption and proper degree of autonomous decision-making for your business? • What would be the right balance between the scope and depth of contextual data, against the needs, relevance and realisable value?

Green Payments by Design

It is not a hyperbole to state that we are facing an environmental crisis.

This year is the 51st anniversary of Earth Day and what is generally acknowledged as the start of the modern environmental movement. It was not until 2016 that the Paris Agreement was signed, with 191 members agreeing to the objective of keeping the rise in global average temperature to below 2 degrees Celsius above pre-industrial levels⁴⁴. Despite this, the World Meteorological Organisation says that there is a 20% chance that annual global temperatures will exceed 1.5 degrees Celsius above pre-industrial levels in the next five years⁴⁵. As a sobering reminder, a 1.5 degrees Celsius rise is the expected maximum for the whole century agreed during COP21 just 6 years ago.

Due to human activity, we face the depletion of natural resources, irreversible loss of biodiversity, and extreme weather events leading to a possible economic collapse.

As mentioned in the introduction, the world is experiencing accelerated digitalisation, which many assume has a positive effect on environmental sustainability. Yet, digital technology is – as philosophers like Bernard Stiegler call it – a *Pharmakon* – it is both a cure and a poison. What is clear is that digital technology's environmental footprint is far from immaterial, as illustrated in Figure 14⁴⁶. In fact, quite the opposite is true: according to a recent study, the digital world represents a 7th continent in terms of energy and water consumption – between 3 and 5 times the size of France.

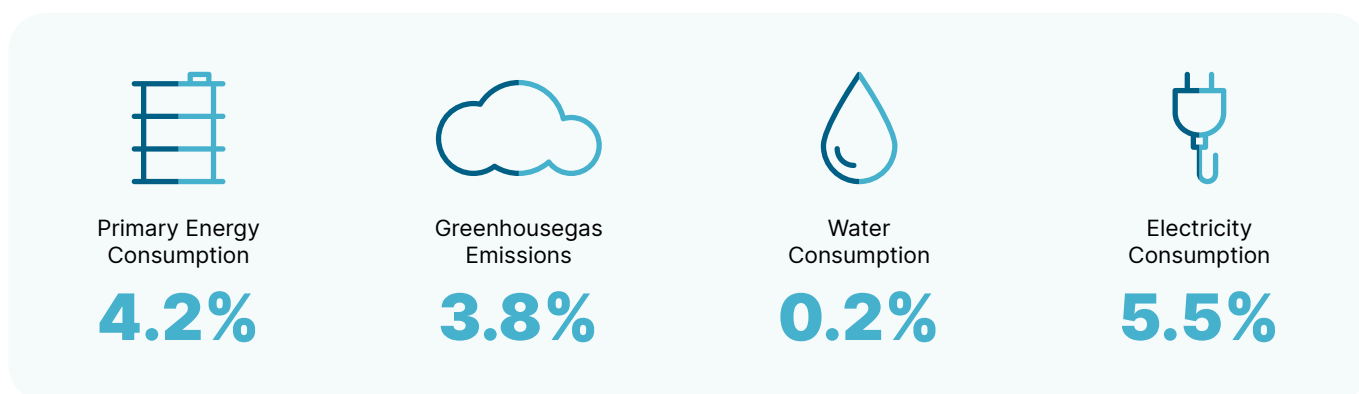


Figure 14: Environmental footprint of the digital world as a percentage of total human impact.

Digital payments are part of this digital world. And, even though they are touted as environmentally friendlier than other forms of payment such as cash, they still have an environmental footprint. Just because digital payments are the least environmentally damaging form of payment, this does not mean that no action needs to be taken. Digital payments do have a footprint that needs to be reliably measured and understood so that actions can be taken to minimise it.

In this chapter we present existing studies which aim to measure the impact of a digital payment, revealing the varying consequences of different parts of the value chain.

This knowledge is a starting point to enable us to examine the level of maturity of different entities within this value chain regarding footprint reduction.

However, achieving truly “green payments” requires more than simply individual stakeholders focusing on their own individual part. As illustrated in Figure 15, a digital payment is a complex interaction between multiple stakeholders, some of which may directly have a small environmental impact but, indirectly, may cause another stakeholder in another part of the value chain to have a greater impact. Only by understanding this and acting collaboratively in an end-to-end approach as an industry can we truly achieve a meaningful reduction in our environmental footprint.

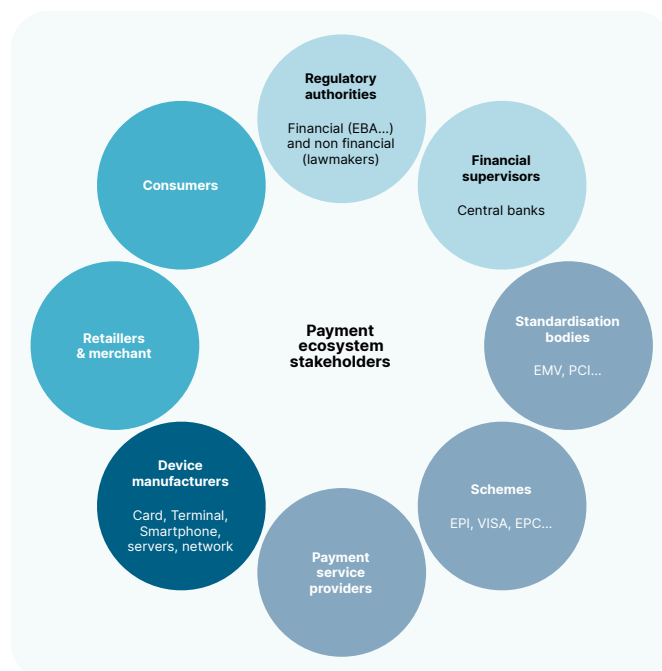


Figure 15: Main stakeholders of the payment industry.

44 <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>
 45 <https://public.wmo.int/en/media/press-release/new-climate-predictions-assess-global-temperatures-coming-five-years>
 46 Figure based on data from https://www.greenit.fr/wp-content/uploads/2019/11/GREENIT_EENM_etude_EN_accessible.pdf

The footprint of card payments may not be where you think it is

The environmental Life Cycle Assessment (LCA) is an industry standard technique for assessing the environmental aspects associated with a product over its life cycle. An LCA gathers environmental data (e.g. natural resource consumption, emissions, waste generation,

etc.) which are associated with a product or a service. As illustrated in Figure 16, it goes from the extraction of raw materials, through manufacturing, transport, usage and to end of life. These studies are key as a decision support tool since they provide the basis to assess, analyse and compare the actual environmental footprint of the products and services that surround us⁴⁷.

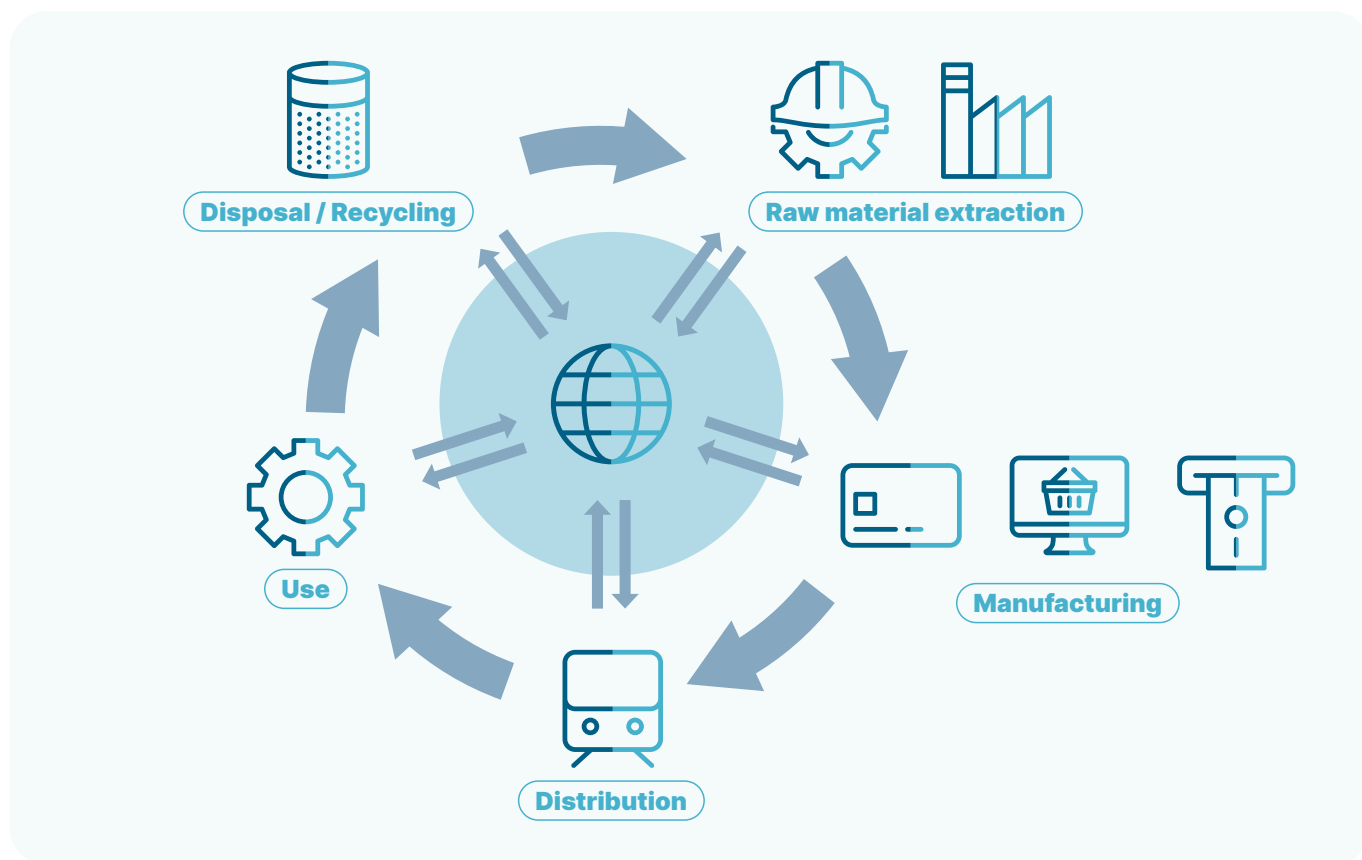


Figure 16: Stages of an environmental Life Cycle Assessment.

While there are several such studies available on cash payments, much less has been published so far on digital payments. One study that has been published was conducted by The Dutch National Bank (DNB) into debit card payments in the Netherlands in 2017⁴⁸.

As shown in Figure 17, the results of this study can be broken down to show the relative impact of cards, data centres (merging all stakeholders) and payment terminals:

- Data centres only represent a very small share (10%) of the overall impact of card payments
- The manufacturing of cards also has a rather small impact (around 15%) mainly due to the PVC used to produce them
- Much of the impact (75%) is due to the POS terminal devices, mainly from their materials (37%) and energy consumption (27%)

The study also tells us that more than a third of the overall environmental impact of the debit card payment system

(36%) consists of greenhouse gas emissions, mostly through energy usage and transport.

From this study we can learn three main lessons:

First lesson: More robust studies are needed - The DNB underlines that the result of their study is fragile and should be strengthened. This is mostly due to data scarcity and the extrapolations used. More studies are needed to cover:

- Online card payments
- Other payment instruments (e.g. direct debit and account-based payments)
- Other countries

Second lesson: The major environmental impact lies in the end-user equipment - Data centres are often seen as the guilty stakeholders of the digital world. However, they are not the main source of environmental impact. A recent study published by the Green-IT association on the global environmental footprint of the digital world stated that⁴⁹:

47 Note that an LCA does not, however, consider social and economic impacts.
 48 <https://www.dnb.nl/media/a3sk2oob/574-evaluating-the-environmental-impact-of-debit-card-payments.pdf>
 49 https://www.greenit.fr/wp-content/uploads/2019/11/GREENIT_EENM_etude_EN_accessible.pdf

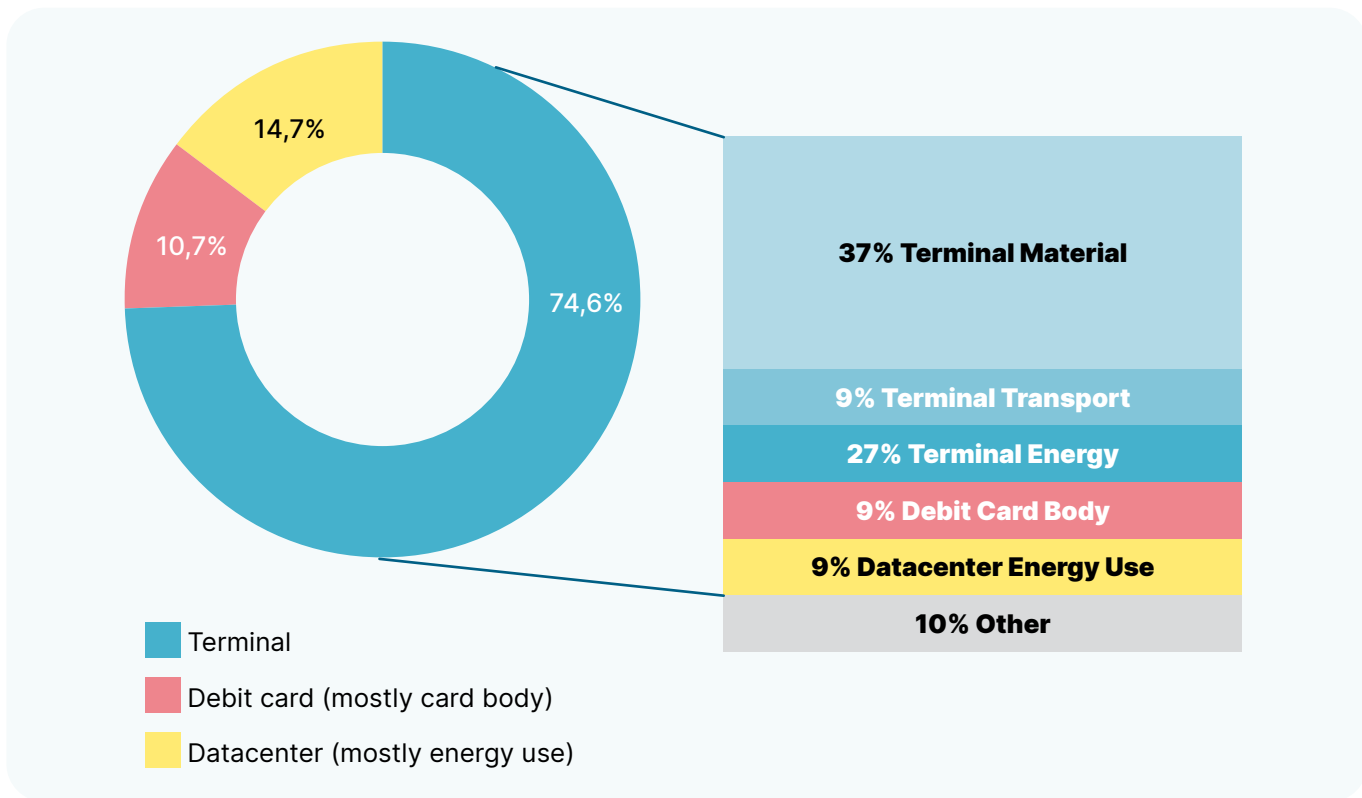


Figure 17: Environmental impact breakdown of debit card payments in the Netherlands in 2017.

“Regardless of the indicator observed, the user equipment manufacturing stage is still the main unitary source of impact, followed by their electricity consumption. Next come, in descending order of importance, the electrical consumption of the network, then that of data centres.”

In the DNB study, this user equipment was the POS terminal and the card, and they represented 90% of the environmental impact. However, citing this as a core driver to digitise both the card and the POS terminal through smartphones is too simplistic, as the manufacture, usage and lifecycle of such devices also has a significant impact⁵⁰.

Third lesson: Optimisation cannot be achieved without looking at the bigger picture - Once we understand the impact of the respective elements in the lifecycle, we can maximise the reduction of an environmental footprint by focusing on the most impactful parts.

To illustrate this fact, let us consider a 50% optimisation of the data centre footprint versus a 50% reduction of the terminal raw material usage. The first one would only contribute to a reduction of 5% of the overall footprint of payments, while the latter would contribute to an overall reduction of nearly 15%.

By implementing the set of measures identified in the DNB study, huge savings could be made to reduce the environmental impact of debit card payment in the Netherlands. However, some measures require changes at the national level and beyond, in domains that payment stakeholders do not directly control, such as using renewable energy. Other measures, such as improving low-power standby modes of terminals and the lifetime of cards, are under the control of payment industry stakeholders.

The Limitations of today’s approaches

We recognise that service providers across the payment value chain are not complacent and are all working to reduce their environmental impact. However, as in most industries, this action is generally being taken at the individual corporate level using a “measure, reduce, offset” approach.

Recently, some are highlighting the limitations of these approaches. For example, the recent “Net Zero Initiative: A framework for collective carbon neutrality”⁵¹ launched by Carbone 4 (a leading consulting firm in low carbon strategy) states that the scope of the greenhouse gas emissions taken into account often overlooks the induced sources of emissions (upstream and downstream in the so called “scope 3”). The initiative calls for a reconnection of “corporate neutrality” with the objective of global neutrality.

As we have seen, environmental topics are systemic and complex and the environmental impacts of payments cannot be precisely identified and reduced unless we consider the problem as a whole. There are, at the level of an individual company, many approaches possible to reduce the impact of payments. But the challenge remains that their results can be compartmentalised and will not consider the wider value chain or ecosystem. Indeed, individual stakeholders do not have a way of measuring the impact of an end-to-end use case. Therefore, their efforts may only represent a small part of the total footprint. Apart from using an environmental LCA, there is currently no concrete way of knowing and, most importantly, measuring, this footprint and then acting accordingly.

50 <https://www.ericsson.com/en/reports-and-papers/research-papers/life-cycle-assessment-of-a-smartphone>
 51 <http://www.carbone4.com/wp-content/uploads/2020/04/Carbone-4-NZI-Guidelines-april-2020-1.pdf>

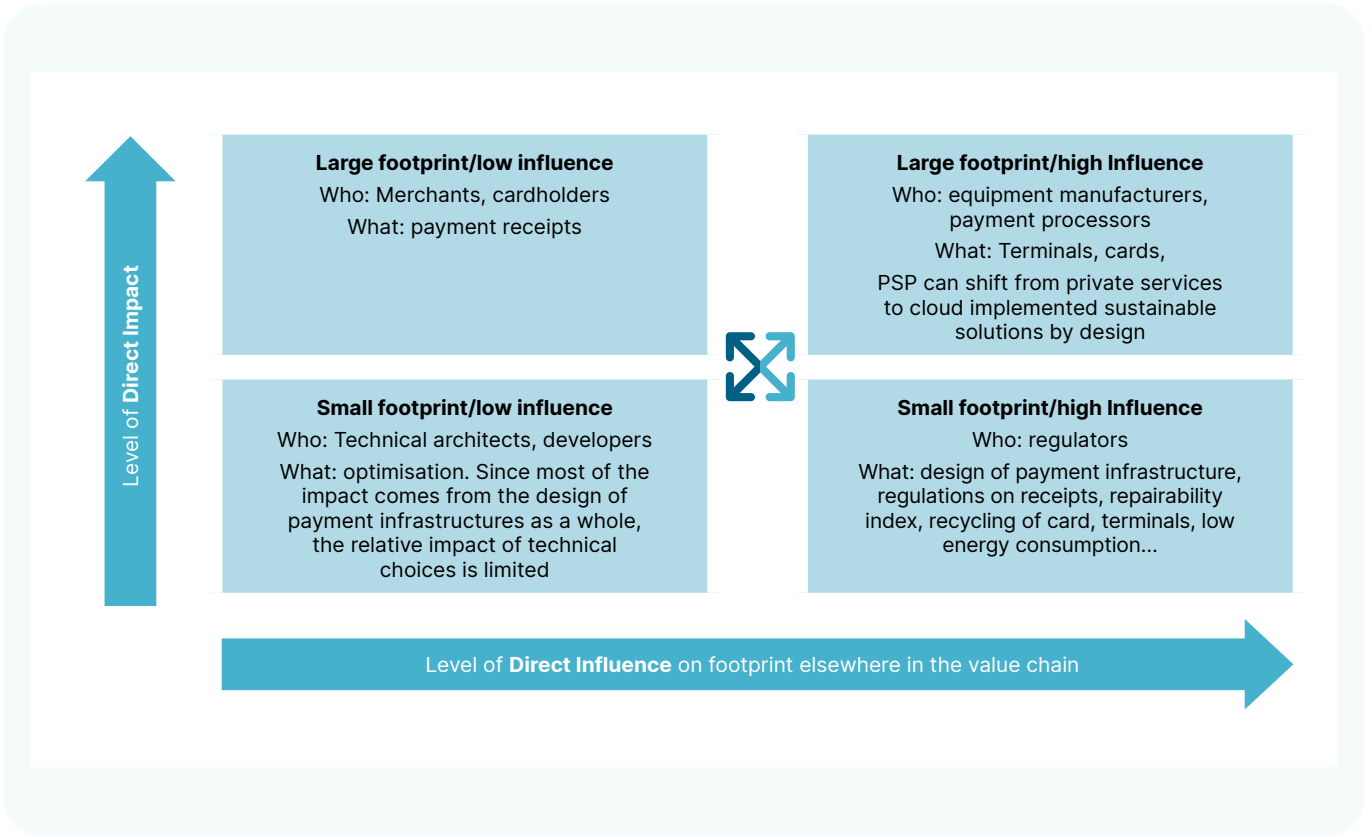


Figure 18: Impact/influence Matrix - Environmental footprint of digital payment stakeholders.





Once stakeholders recognise and understand their direct impact in the wider value chain, it is important that they examine any causal impact or influence that their activities may have in another part of the value chain. An added complexity is that, within this complete digital payment footprint, there are certain stakeholders that can exercise a level of influence on the ability of others in the value chain to actually address their own respective direct footprint. It is quite plausible that actions undertaken by a stakeholder can unintentionally either shift part of the problem to another party or even create more of a problem. The diagram shown in Figure 18 illustrates this.

In the payment industry, it seems clear that the merchants who operate the terminal and the cardholders themselves can do relatively little to directly reduce their payments-related footprint - although they remain by far the largest share of the overall footprint.

As illustrated in Figure 18, we suggest that regulations - produced by schemes and international bodies in the form of functional and security standards - in combination with the design of the payment system may well be the most influential yet indirect contributors to the environmental impact of payments.

Collaboration to reduce the footprint of payments

Some companies are taking steps to contribute in a more collaborative way. For example, Worldline already delivers eco-designed payment terminals. Mastercard has analysed the material make up of a plastic card to help issuers offer more eco-friendly cards to consumers⁵². In 2018, it formed the Greener Payments Partnership, with card manufacturers Gemalto, Giesecke & Devrient and Idemia to establish

environmental best practices and address first-use PVC plastic in card manufacturing.

Nevertheless, today, most companies in the payment industry focus on their own environmental impact, with little or no view on the complete ecosystem. To limit the impacts on the environmental crisis, the payment industry must focus on a systemic approach: the lifecycle impact assessment and the design of the "end to end payment" need to take into account the full environmental life cycle. No single company can tackle the problem by itself; collaboration is therefore required between all stakeholders, including those who operate the systems and public bodies that regulate and supervise them:

Operational payment stakeholders:

- Consumers, merchants, manufacturers of devices, payment service providers, schemes and standardisation bodies (technology, security)

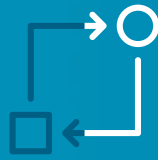
Public body stakeholders:

- Responsible for the creation of laws and regulations with laws on environment which may have implications for payments but also regulations more specific to the retail payments (Payment directives)
- Responsible for the supervision of payment activities, at national (AMF) or regional level (EBA)

They all need to collaborate. Firstly, to assess the environmental footprint of current services provided for retail payments. Secondly, to identify mitigation actions in terms of standards, regulations and deployment or adaptation of technology.

Green Payments by Design		
Changes	Challenges	Choices
<ul style="list-style-type: none"> • Accelerated digitalisation is both a cure and a poison, with the digital world now representing a 7th continent in terms of water and energy consumption • Action is needed to reduce the footprint of the digital world, including in digital payments 	<ul style="list-style-type: none"> • To effectively reduce the digital footprint of payments, an end-to-end life cycle assessment is needed • Due to the complexity of the payment ecosystem, optimising single parts of the value chain in isolation is ineffective (and can make things worse) 	<ul style="list-style-type: none"> • How do you understand your own payment related footprint and what level of direct vs. indirect impact/influence do you have with other stakeholders? • How you can best collaborate with other stakeholders in the payment ecosystem to drive progress towards greater sustainability?

52 <https://www.mastercard.com/news/research-reports/2020/sustainable-cards/>

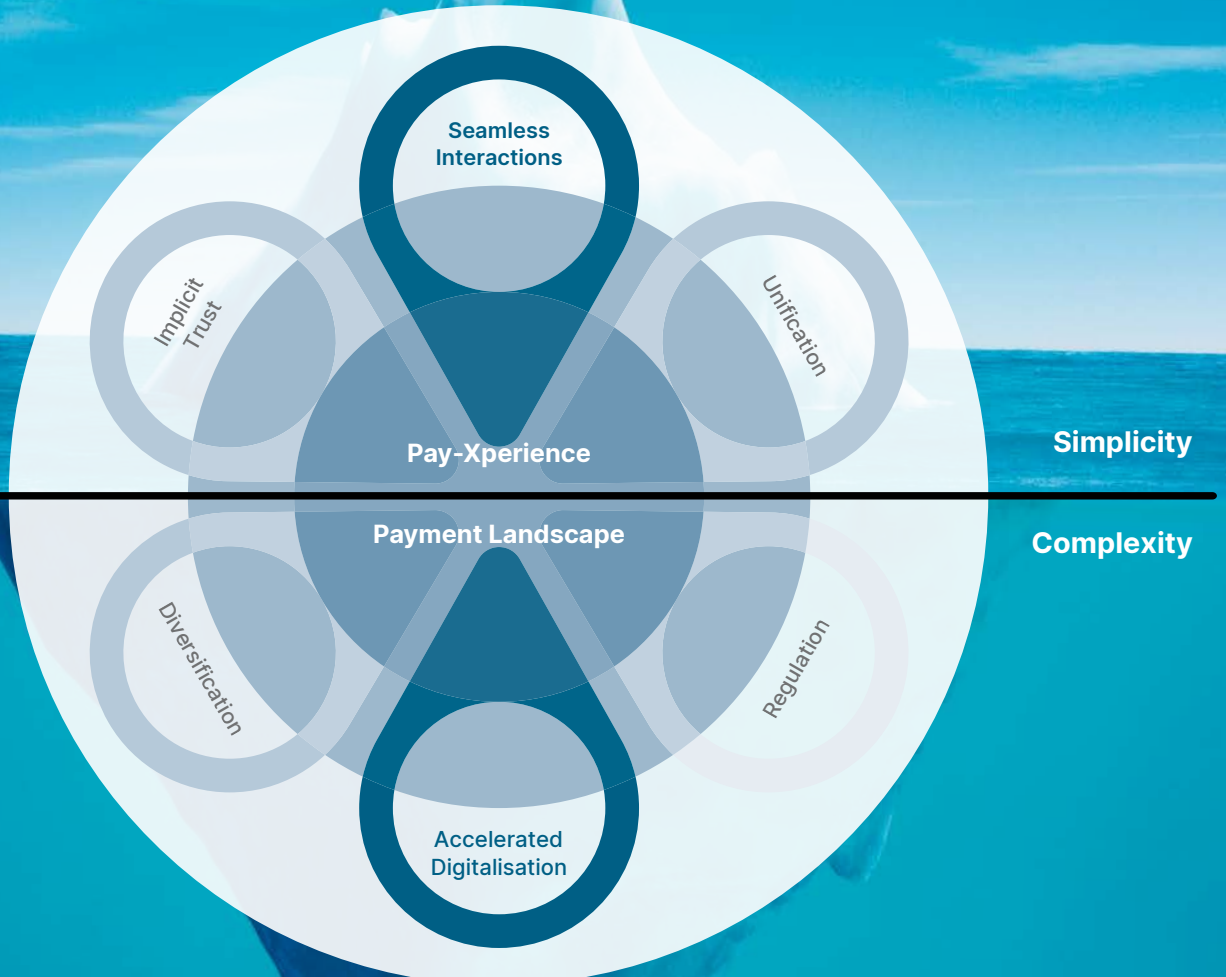


Seamless Interactions Amidst Accelerated Digitalisation

Digitalisation has accelerated and the technological landscape is becoming increasingly convoluted; the challenge is how to make the experience seamless for end-users.

The Renaissance of Physical Stores **p.45**

Autonomous Payments **p.50**



Digital Theft and Fraud **p.39**

The Digital Divide **p.42**

Digital Theft and Fraud

With accelerated digitalisation, new risks of cybercrime are emerging as fraudsters continue to find new ways to make financial gains. Historically, they have found weaknesses in systems to obtain funds, whether it is by obtaining access to people's financial assets or by trading non-existing goods or services in exchange for a payment⁵³.

Financial institutions aim to develop systems that are fraud proof. However, not all fraud modus operandi can be prevented by the financial institutions alone. For example, see the Ponzi schemes (started by Charles Ponzi in the 1920's)⁵⁴, corporate fraud (such as Enron in the 1990's)⁵⁵ or Wirecard (in 2020)⁵⁶. Therefore, governments also play a key role by creating appropriate regulations and governing bodies to protect citizens and businesses [a topic we discuss further in the [Governmental Priorities chapter \(p.55\)](#)].

Fraud in a non-digital world

Before widespread digitalisation, fraud took longer to detect. For example, it took several days to detect the major cheque fraud conducted by Frank William Abagnale Jr., where he used false identities to open bank accounts and then forged and duplicated cheques for cash⁵⁷. This delay in detection was due to the fact that, in the 1970's, the cheque system was paper based. Only after paper cheques had been processed could the verification and validation of the available funds be performed. Similar fraud occurred with paper vouchers for credit and store cards.

Cross-border fraud took even longer to detect, and the liability for the fraud was even more complex to determine. Barriers created by language, time zones and governance meant that communication and achieving a common understanding was highly problematic.

Whilst introduced to the fight fraud, cheque guarantee cards led fraudsters to stay below the guarantee limit, so cheque fraud continued. The main change being that the risk for the fraud was transferred from the merchant to the bank.

The impact of digitalisation on fraud

In the 1990's, the digital age started to influence banking, finance and retail. Shopping with a choice of multiple payment methods became a reality. As a result, fraudsters adapted their approaches to exploit new weaknesses in these automated, digital systems. Developments in checking consumer balances before purchase, the introduction of 3D Secure for ecommerce, and Data Encryption Standards (DES) led to greater security. This set the scene for an ongoing digital race, pitting fraudsters against merchants and financial institutions.

Here are some examples of digital fraud, which illustrate the advance in methods used and the scale of attacks:

The Rosselli brothers employed hackers to steal identities. They then used that information to target casinos to obtain loans and credit. In 2000, they disappeared with \$40 million⁵⁸. Although technical hackers were used in this case, not all fraud requires such techniques to obtain identities. Sometimes a careless worker may ignore the security rules

of their company and keep on paper (or a memory stick) data that, in the wrong hands, can enable fraud.

Fraudsters also use ATM machines to obtain card details, placing card skimming devices inside the ATMs which read the magnetic stripe as the card is inserted and using a camera to capture the PIN number as it is entered. In 2016 in Japan, 1,400 ATMs were hit with 1,600 forged credit cards which, in three hours, cost \$13 million⁵⁹.

One of the latest stages in the race against fraud is the use of biometrics, which has the potential to both reduce fraud and make the customer experience more frictionless. However, with these developments, there will doubtless come more, as yet unimagined, avenues for fraudsters to exploit.

The impact of fraud

Fraud impacts the consumer experience in two ways. Firstly, more complex and stringent payment processes, which can lead consumers to abandon their transactions. Secondly, they may face a complex process to report fraud and recover stolen funds.

For financial institutions, there is also an impact. Increased complexity to fight fraud as well as managing compliance with stringent security regulations can increase their operating costs. Financial institutions are exploring the use of Machine Learning (ML)⁶⁰ as a tool to fight fraud. Whilst ML will not prevent fraud from occurring, it will detect it quickly, raise alerts and enable checks to be proactively made by the financial institution (instead of merely waiting for a consumer to notify them). In this way, the application of ML helps to limit their losses.

The future of early detection

With the rapid technological pace of change, it is extremely difficult to predict how, in the future, fraudsters will obtain data and steal identities, and how they might use them to trick merchants out of goods and financial institutions out of funds. Today, the cost of fraud per consumer is set to increase.

Global losses from payment fraud have tripled from \$9.84 billion in 2011 to \$32.39 in 2020, and this is expected to continue increasing to a projected cost of \$40.62 billion in 2027 (25% higher than in 2020)⁶¹.

Global losses from payment fraud have tripled from \$9.84 billion in 2011 to \$32.39 in 2020

No matter what prevention measures are put in place, history shows us that fraudsters will always find new ways to commit their crimes. What history also tells us, however, is that early detection can prevent fraud or limit the losses. We predict that the future developments in the early detection of fraud using Machine Learning will be based on applying modular algorithms inspired by the latest scientific understanding of how the human brain operates.

53 <https://technologymagazine.com/digital-transformation/evolution-fraud-300bc-digital-age>

54 <https://www.sjsu.edu/faculty/watkins/ponzi.htm>

55 <https://www.moneycrashers.com/enron-scandal-explained/>

56 <https://www.ft.com/content/3b9afceb-eaeb-4dc6-8a5e-b9bc0b16959d>

57 <https://www.wirecard.co.uk/article/frank-abagnale>

58 <https://www.roulette-bet.com/2015/05/the-greatest-casino-scam-rosselli.html>

59 <https://thehackernews.com/2016/05/japan-atm-hack.html>

60 Machine Learning (ML) describes subset of Artificial Intelligence (AI) algorithms which work by being trained using (usually large) sets of labelled data

61 <https://www.merchantsavvy.co.uk/payment-fraud-statistics/>



Modular algorithms can be more easily tuned for accuracy, throughput, and latency, and are easier to develop. Simultaneously, Artificial Intelligence (AI) will become more generalised so that the need to design new algorithms for each new threat will diminish. Quantum computing will enable these algorithms to be optimised with many more parameters than is possible today.

Using technologies like homomorphic encryption, which allows for computation directly on encrypted data, data privacy will be guaranteed even while analysing sensitive data.

The benefits of ML fraud detection

Fraud detection ML algorithms may be data-intensive and computationally-intensive. However, they do not require continuous manual tuning like traditional rulesets. At Worldline, we have already improved our fraud detection capability by up to 30% by feeding new training data to an ML algorithm instead of having a team of domain experts manually write an entire ruleset.

To make this possible, labelled data (verified fraud cases) is required and “ML features” must be generated

that incorporate human intuition into the models (as illustrated in Figure 19). On demand, these features are automatically updated for every entity (card, merchant, location, etc.) in advance of every single transaction. To have a safety net, there can be hardcoded rules to counter known threats. Algorithms, however, respond to unknown threats. And we will continue to expand our use of advanced algorithms to achieve even higher accuracy.

At Worldline, our ML models are hosted on servers where new transactions are evaluated in real-time, generally within 10-100ms.

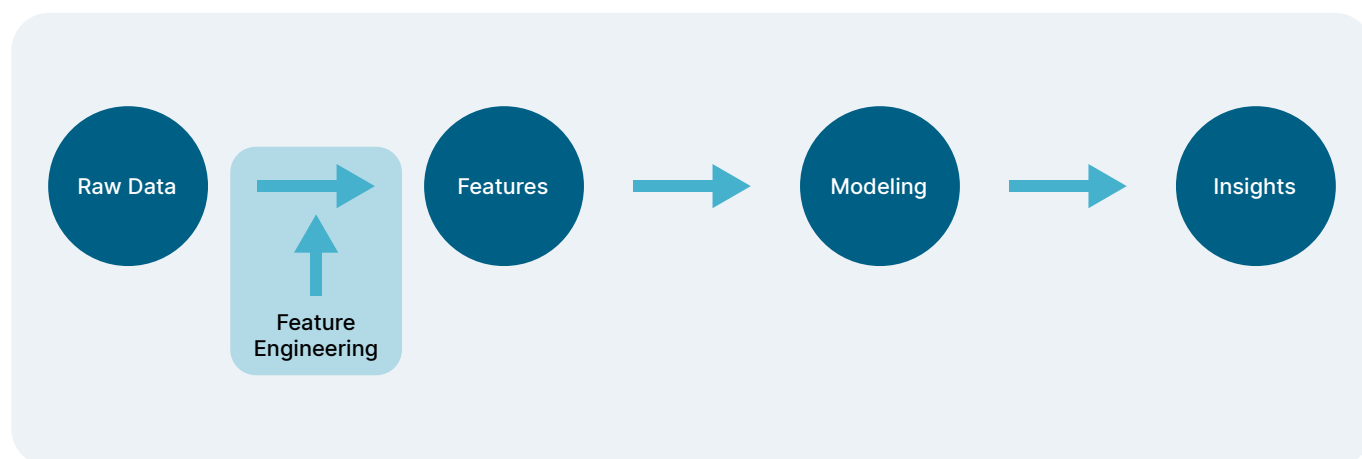


Figure 19: ML feature engineering.

The key benefits of modular algorithms

Since good accuracy can be achieved by algorithms that do all processing in a single step, one may wonder what advantages modular algorithms bring. The primary benefit is that it will be easier to plan for very difficult use cases, due to three main reasons:

1. When the performance of each module can be measured separately, it is easier to calculate how improving each module will increase its accuracy.
2. The cost of improving each module can be estimated with more certainty.
3. The computational resources needed to run each module can be determined according to throughput and latency requirements.

Considering all three of these aspects, development teams can then perform a cost/benefit analysis to decide where to focus their efforts. Business analysts can prioritise additional

development work on modules that will bring the most accuracy gains, if the development costs are reasonable, and if the computational latency and throughput will fulfil their customer's requirements. Furthermore, these aspects also allow service providers to be transparent with their customers.

Many other state-of-the-art ML algorithms are already implemented in a modular way. With facial recognition, for example, different modules work on detecting a face, separating it from the background, and on processing parts like the eyes, nose, and mouth. This is another reason that we believe this trend will be extended to fraud detection.

Mimicking a human approach to fraud detection

How can we make fraud detection algorithms more modular and component-based? Current ML fraud detection is performed by computing features at the card and merchant level. These features are then given to a predictor, and it generates the probability

of a transaction being fraudulent.

But what if each feature was instead used as a predictor itself? For example, instead of the amount of the current transaction as a feature, a predictor could be trained to predict the amount of the current transaction. Then a new feature would be the difference between this prediction and the actual amount of the current transaction. In fraud detection literature, there are extensive descriptions of potential features⁶².

This approach aligns with how human fraud investigators think. They typically develop an intuition for normal behaviour and become suspicious when they see deviations from what they expect.

Bringing generalised AI to fraud detection

Currently it is necessary to narrowly train a separate algorithm for every type of fraud.

Google's DeepMind recently published its theory of artificial general

62 Fraud Analytics Using Descriptive, Predictive, and Social Network Techniques: A Guide to Data Science for Fraud Detection by Bart Baesens, Véronique Van Vlasselaer and Wouter Verbeke (2015)

intelligence. The research supports the theory that all intelligence serves to maximise rewards. Regardless of whether that reward is to maximise joy or to minimise pain, the reward is sufficient to build up intelligence across a broad variety of tasks.

DeepMind argues that agents that learn via reinforcement learning (in other words, trial and error) will maximise their reward and, in doing so, will evolve towards a system that can perform diverse tasks rather than today's models which are highly specialised.⁶³

Research is already underway for creating algorithms that are generalised for multiple use cases. For example, future ML algorithms for fraud will be able to learn automatically how to prevent both counterfeit card and stolen card scenarios.

Quantum computing for ML optimisation

Machine learning algorithms optimise across many parameters. In fact, ML is often called part science and part art. Skilled ML practitioners gain an intuition about how to optimise the parameters, but they cannot predict in advance which will perform best. There is even

a mathematical theorem that proves this — the so called “no free lunch theorem”⁶⁴.

More training data yields better performance. But this is only true for models that can fully capture the nuances in the data. Capturing these nuances requires models with more tuneable parameters. But just imagine trying to make an important life decision based on a spreadsheet with billions of rows and hundreds or thousands of columns. Optimising over so much data is clearly not something that humans can do. We believe that quantum computing will, however, fundamentally expand the possibilities for tackling large optimisation problems.

Homomorphic encryption will speed ML optimisation

It will not be feasible for every company to spend tens of millions of dollars to buy a high-end quantum computer with enough qubits. Nor will they be able to own and manage an even more expensive laboratory environment where it can operate at a constant temperature, free from all noise, vibration, and electromagnetic interference. But they will not need to either. A small amount of rented

time on a remotely accessed quantum computer will suffice.

However, this will also bring its own challenges. Today's standard encryption techniques require communication between a classical computer and a quantum computer after each step in the algorithm. And many algorithms require thousands of loops over the entire dataset (which may contain billions of rows). Encrypting and decrypting data at this rate would make generating meaningful results impossible.

This is another case where technologies like homomorphic encryption are expected to play a critical role. Such encryption eliminates the need for messages to be transferred between computers at each step of the computation, because the data can be used for computation as if it were not encrypted. It sounds like science fiction, but these calculations will return correct results, while making it impossible (even for people with physical access to the remote quantum computer) to gain any intelligence from the sensitive data. Additionally, removing the need for excessive back and forth communication, will speed up these algorithms by many orders of magnitude.



Digital Theft and Fraud		
Changes	Challenges	Choices
<ul style="list-style-type: none"> • Further digitalisation and innovation in payments will lead to fraudsters finding new attack vectors • Fraud detection algorithms will become more modular and mimic more closely how human fraud investigators think • Quantum computing and homomorphic encryption will play a critical role in optimising future fraud detection algorithms 	<ul style="list-style-type: none"> • Understanding the range of ML techniques required in order to stay ahead in the fight against fraud • Understanding how technologies such as quantum computing and homomorphic encryption can be applied to optimise ML fraud detection algorithms 	<ul style="list-style-type: none"> • How much of your fraud detection capability should you maintain and conduct in-house and to what extent do you need to rely on partners and suppliers? • To what extent are your partners and suppliers prepared for the evolution in fraud and in the techniques that will be required to face it?

63 <https://www.sciencedirect.com/science/article/pii/S0004370221000862>
 64 https://en.wikipedia.org/wiki/No_free_lunch_theorem

The Digital Divide

The digital divide refers to the gap between those benefiting from the digital age and those who are not. During the pandemic, digitisation was a key to survival for many businesses, pushing many to board this digital train.

Mind the gap

Let us use an analogy to illustrate this digital divide. Every underground station is built around the same elements. A fast-moving train takes you on your journey, the platform gives you access to this train and in between the train and this platform there is the famous gap. The train represents the digitalised world. It is a fast-moving vehicle. Stops are reduced to a bare minimum in time. The train wants to keep moving. On the platform, we have different types of people. Some of them can get on the train, others are unable to access the train. The train might be too fast (skill), the doors might not open (economic), or the gap between the train and the platform may be too big to overcome (knowledge).

To board the train, a ticket is required. Without the right ticket, it is not possible to get onto the train. This ticket is a unique collection of skills, knowledge, economic capabilities, and willingness to adopt. Every ticket is unique, and not all tickets will give access to all parts of the train. The better the ticket, the more expensive it is, and the more investment is needed in it.

Beyond digitals and non-digitals

This divide is not simply a binary distinction between the *digitals* and the *non-digitals*. Each group can be sub-divided into many subgroups with many different levels of digitisation.

For individuals, this digital divide is strongly linked with *adoption*. How much does someone accept a digital technology into their lives? When they experience something as natural, the technology behind becomes invisible and becomes normal. For example, being *able* to complete a bitcoin transaction (in terms of knowledge, technological capabilities and skills), does not mean the individual will *wish* to make the transaction in this way.

Whilst the digital divide is often discussed at the level of individuals, it can also be considered as a distinction between companies, and even nations.

The digital divide between companies

For many companies, the Covid-19 crisis showed that boarding the digital train was a critical factor for remaining solvent during the pandemic.

Those who were primarily offering non-digital experiences (e.g. pure brick-and-mortar shops) had to quickly implement digital alternatives. For example, shops switching to online ordering for home delivery or click and collect.

Companies who were already offering digital options often had to adapt their development roadmaps to take into account the new habits of consumers. With many more people and companies boarding the digital train, creating differentiating experiences in a crowded space became an important priority.

Of course, companies also had to adapt their internal operations (digital and non-digital) in response to the pandemic. The way employees interacted changed from mostly face-to-face to mostly face-to-screen, creating new demands on IT infrastructure and security. In some cases, whole call centres had to be moved into a home-based mode of operation, something Worldline helped many organisations to achieve, with our cloud-based Contact solution now supporting the customer communications of over 100 banks⁶⁵.

Many perceive that Covid-19 led to several years' worth of digital transformation in just 12 months. And many of these changes are permanent or semi-permanent. For example, many employers (even those who are quite traditional) are now considering working arrangements that would have been unheard of 18 months ago (such as a major bank offering its staff the opportunity to "work from anywhere"⁶⁶).

The digital divide between nations

The digital divide is influenced at the country level partly by local regulations, cultural differences and the availability of enabling infrastructure.

For example, regulatory changes such as the one being proposed in Belgium to oblige shops to accept at least one electronic means of payment⁶⁷, can act as accelerators of adoption (whilst also increasing the choices available to consumers).

The digital divide is influenced at the country level partly by local regulations, cultural differences and the availability of enabling infrastructure

Cultural differences are also a significant factor. For example, the study conducted by the European Central Bank (ECB) into consumer behaviours and preferences within the euro area⁶⁸ found that the percentage of people saying it is important to have the option to pay in cash is much higher in some regions than others. In some cases we can imagine very practical explanations: in countries where more people *only* have access to cash, the option to pay in cash is generally valued more highly. But there are also countries where this explanation does not hold. In Germany, almost the entire population has access to non-cash payment means, yet still 74% of the population considers the option to pay with cash as either important or very important (compared with only 41% in Belgium).

In terms of infrastructure, fast and high-bandwidth communications is one example of something that can increase the responsiveness and usability of applications, therefore encouraging adoption. 5G illustrates this well. Many countries have already rolled out or started rolling out their 5G network, with 30% of the world's countries having access to 5G as of February 2021⁶⁹. However, others have not yet started their roll-out. For example, in Africa only a few countries have so far begun, with less than 1% of mobile connections in the region being 5G (and only expected to reach 7% by 2026)⁷⁰.

65 https://worldline.com/en/home/pressroom/press-releases/2021/pr-2021_06_17_01.html

66 <https://www.bbc.co.uk/news/amp/business-56510574>

67 <https://www.brusselstimes.com/news/belgium-all-news/159344/shops-belgium-law-electronic-payment-options-finance-minister-vincent-van-peteghem-cash-fraud-contactless-oecd-european-commission/>

68 https://www.ecb.europa.eu/pub/pdf/other/ecb_spacereport202012--bb2038bbb6_en.pdf

69 <https://www.lifewire.com/5g-availability-world-4156244>

70 <https://qz.com/africa/2032165/is-africa-ready-for-5g/>

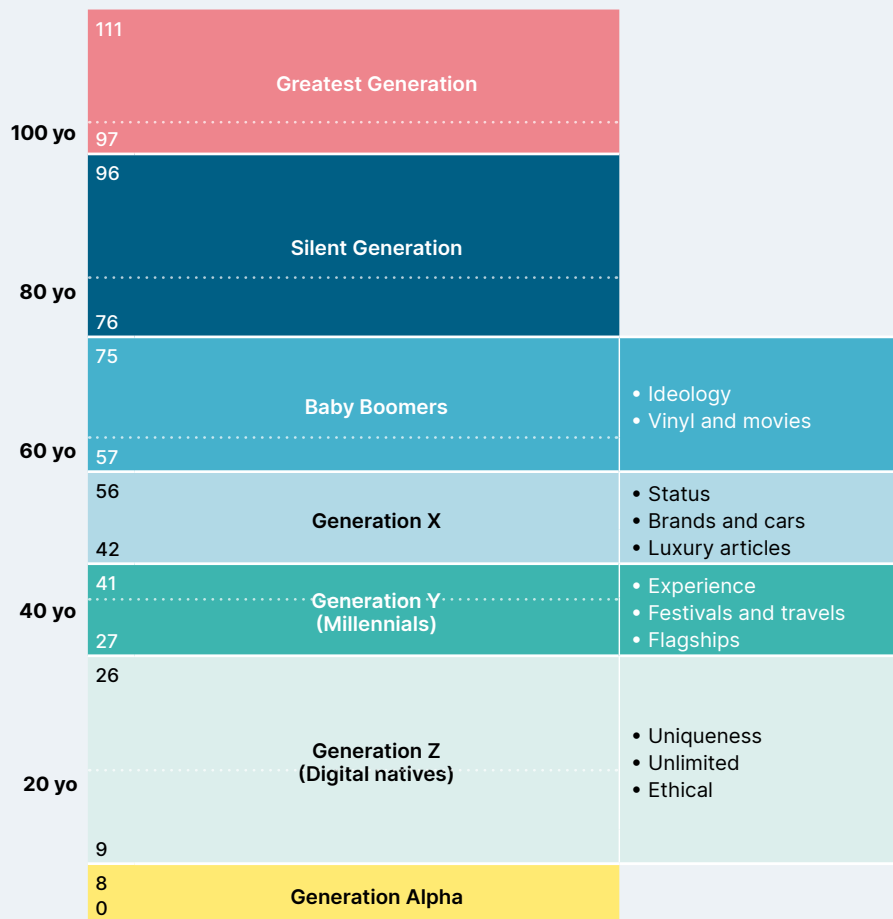


Figure 20: Consumption habits of each generation and their age in 2021.

Generational shifts

We can get a glimpse into the future by understanding how the expectations of younger generations are different to the generations that preceded them (see Figure 20⁷¹). After all, today's younger generations will, quite literally, be the older generations of tomorrow.

Generation Z have different expectations and habits to previous generations. They are meeting their friends less face-to-face and communicating more digitally⁷². They consider flexible-working to be the default⁷³ and, despite being the first digitally native generation, most of their favourite pastimes are actually offline (with learning a musical instrument top of the list)⁷⁴.

Just like Generation Y, they enjoy experiences and travel, but place a greater emphasis on these experiences being unique and ethical. In fact, Generation Z is extremely concerned about climate change, with one study in 2019 finding that they see this as the most important issue facing the world⁷⁵. We expect this will drive them to prioritise sustainable ways

of living, and hence products and services that support this. There are also already some studies into what we might expect from the generation after Generation Z: Generation alpha⁷⁶. They will care even more about a wider range of issues than previous generations. They may also be more impatient, having grown up with the immediacy of digital from a young age. They could also be rapid adopters of innovative solutions that address their priorities: for example, "bleisure" where business trips are mixed with leisure experiences⁷⁷, saving them time and money, and reducing environmental impact.

How do people want to pay?

When we look at people's attitudes towards payment, the ECB study⁷⁸ reminds us that we should be wary of stereotyping digital-natives as being more keen to abandon cash. Although they complete three times as many online transactions as those over 65, 28% of them still prefer to pay using cash (possibly explained by the fact that this age group is also more likely to receive cash as part of their regular income).

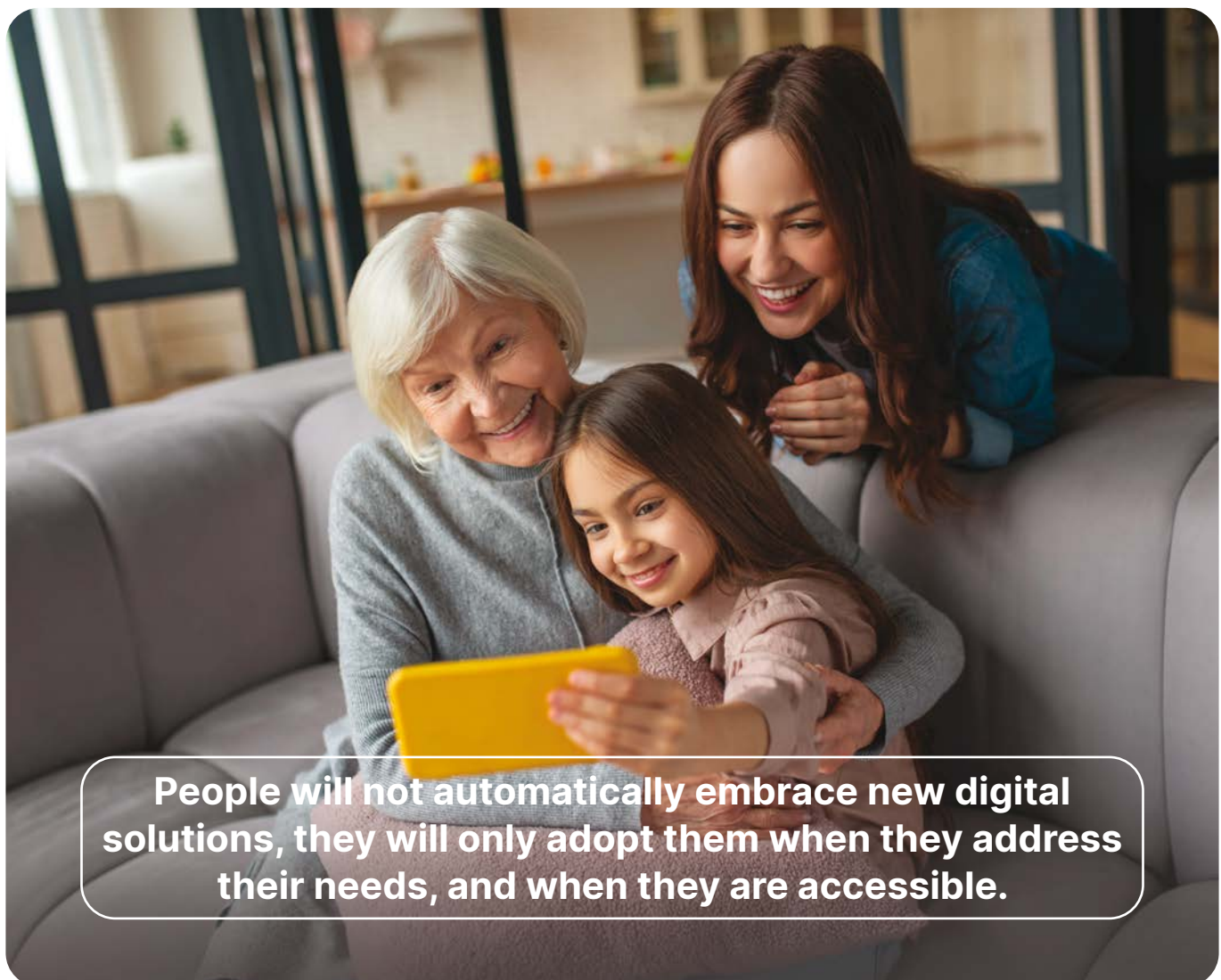
71 Consumption habits as characterized by McKinsey & Company in [Generation Z characteristics and its implications for companies](https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/generation-z-characteristics-and-its-implications-for-companies) | McKinsey
 72 <https://nitralnews.com/blog/gen-z-worst-at-keeping-in-touch-with-friends-new-survey-finds/>
 73 <https://www.forbes.com/sites/nathanpearl/2020/01/14/gen-z-attitudes-should-be-influencing-company-decisions-right-now/?sh=7610ee501f7d>
 74 <https://www.ypulse.com/article/2019/04/23/most-of-gen-z-millennials-top-20-hobbies-are-offline/>
 75 <https://www.forbes.com/sites/emanuelabarbiroglia/2019/12/09/generation-z-fears-climate-change-more-than-anything-else>
 76 <https://www.theatlantic.com/family/archive/2020/02/generation-after-gen-z-named-alpha/606862/>
 77 <https://www.forbes.com/sites/geoffwhitmore/2019/09/13/how-generation-z-is-changing-travel-for-older-generations/?sh=7983e6a278f7>
 78 <https://www.ecb.europa.eu/pub/pdf/other/ecb.spacereport202012-bb2038bbb6.en.pdf>

As it happens, when it comes to payment habits, factors other than age can play a much bigger role. The same study showed the greatest variation existing between countries. For example, 75% of people in Finland preferring to pay by card versus just 16% in Cyprus. The variation by age group is much smaller: with 55% of 25-39 years old preferring cards, versus 44% of people over 67.

What we can conclude from this is that, although digital natives may find it easier to adopt digital solutions, this does not necessarily mean they will choose to do so. Unless those solutions give them what they want (unique experiences and products that are both ethical and sustainable), they will not use them.

When it comes to payment habits, factors other than age can play a much bigger role

The Digital Divide		
Changes	Challenges	Choices
<ul style="list-style-type: none"> The digital divide will continue to exist at the individual, company and nation state levels, but will also be more nuanced and less binary Generational trends show that consumers will communicate more digitally, work flexibly, seek unique experiences, and place a high priority on sustainability 	<ul style="list-style-type: none"> Skills, knowledge, economic status and willingness to adopt can all impact the digital divide People will not automatically embrace new digital solutions, they will only adopt them when they address their needs, and when they are accessible 	<ul style="list-style-type: none"> How does the digital divide impact your customers and how could you update your products and services to make them more digitally inclusive? What will the changing expectations of younger generations mean in your sector? How digital/non-digital is your organisation, how may you need to adapt, and what are the main blocking points?



People will not automatically embrace new digital solutions, they will only adopt them when they address their needs, and when they are accessible.

The Renaissance of Physical Stores

The evolution of the in-store retail experience, particularly as it relates to payments and associated services, has been somewhat overlooked in recent years in favour of ecommerce. Whether it has been the emergence of online marketplaces, Super Apps or other innovative online propositions, ecommerce has led the way in adapting to changing customer demands and preferences. By comparison, in-store retail innovation has lagged behind.

As large portions of the world's population have been forced into lockdowns and faced limited mobility due to Covid-19, there has been further acceleration and acceptance of ecommerce as a preferred way for many customers to shop.

However, the real-world social contact and engagement during a shopping experience that is important for so many is not easily replicated in a digital environment. And we believe that consumer demand for in-person, physical, brick-and-mortar shopping is going to reappear in large parts of the market.

A pent-up shopping demand is bringing customers back into stores for an engaging, real-world shopping experience

A pent-up shopping demand is potentially bringing larger populations of customers back into stores for an engaging, real-world shopping experience enhanced by digital solutions. But as the whole world has seen accelerated digitalisation driven by Covid-19, yesterday's models and tactics in retail will not be sufficient in the future. Retailers need to be ready to meet this new challenge.

There is no doubt that customer expectations of the in-store experience will continue to evolve. But the basic human need for socialisation presents an opportunity for in-store retail to be re-energised and re-valued by a society that has largely been deprived of it during the pandemic, as detailed in our recent whitepaper "In-Store Payments Re-Imagined: Delivering seamless multi-channel retail experiences"⁷⁹.

We recently published a whitepaper "In-Store Payments Re-Imagined: Delivering seamless multi-channel retail experiences" which gives a more in-depth look at the range of technologies that can be used to transform the experience offered by physical shops. It covers retail experiences, payment experiences, technology enablers and which factors influence their successful adoption.

For many years, market analysts feared a "retail apocalypse" due to the financial crisis and rapid changes in customer behaviour. It is now apparent that a global health crisis lasting more than a year has created an environment where the retail industry has demonstrated its resilience, adaptability and willingness to innovate to meet the needs of its customers.

We are seeing examples of this adaptability and willingness to innovate in the payments space (such as those shown in Figure 21) in different regions across the world. Retailers are leveraging their investments in digital propositions that were necessary to survive the crisis by now applying this to their in-store experience.

Global	Asia	Europe
Japanese multi-national conglomerate Toshiba recently launched its new Pro-X Hybrid Kiosk which is a global solution that enables both a customer self-service and cashier assisted transaction experience ⁸⁰ .	In the world-famous hawker centres of Singapore, the government launched the "Hawkers Go Digital" programme with the aim of having all 18,000 stallholders adopt e-payment solutions by mid-2021 ⁸¹ .	Fruitschur, a small fresh produce retailer in the Netherlands, has just implemented a frictionless, non-attended checkout experience named Pick & Go. Customers will be able to enter the shop to buy products at any time, without a cashier inside the shop, all in a secure environment ⁸² .

Figure 21: Examples of innovations in the payment space

79 <https://worldline.com/content/dam/worldline-new/assets/documents/whitepapers/in-store-payment.pdf>
 80 <https://commerce.toshiba.com/wps/portal/marketing/?uril=wcm:path:/en-us/home/hardware/self-checkout/pro-x-hybrid-kioskce>
 81 <https://www.sdo.gov.sg/programmes/hawkers-go-digital/>
 82 <https://www.youtube.com/watch?v=5SyxHJ45z0>

In this chapter we provide guidance about the challenges and opportunities that retailers face, and how they may position themselves in such a way to be at the forefront of this retail renaissance.

Challenges & trends faced by the retail industry

As illustrated in Figure 22, we can view the challenges and trends faced by the retail industry from three different angles.

Firstly, there are the external trends linked to the ecosystem and the market itself. Secondly, there are the expectations from customers and their role as buyers and shoppers. Thirdly, are the challenges faced directly by the merchants as sellers of goods or services.

In the following sections we explore each of these in more detail.

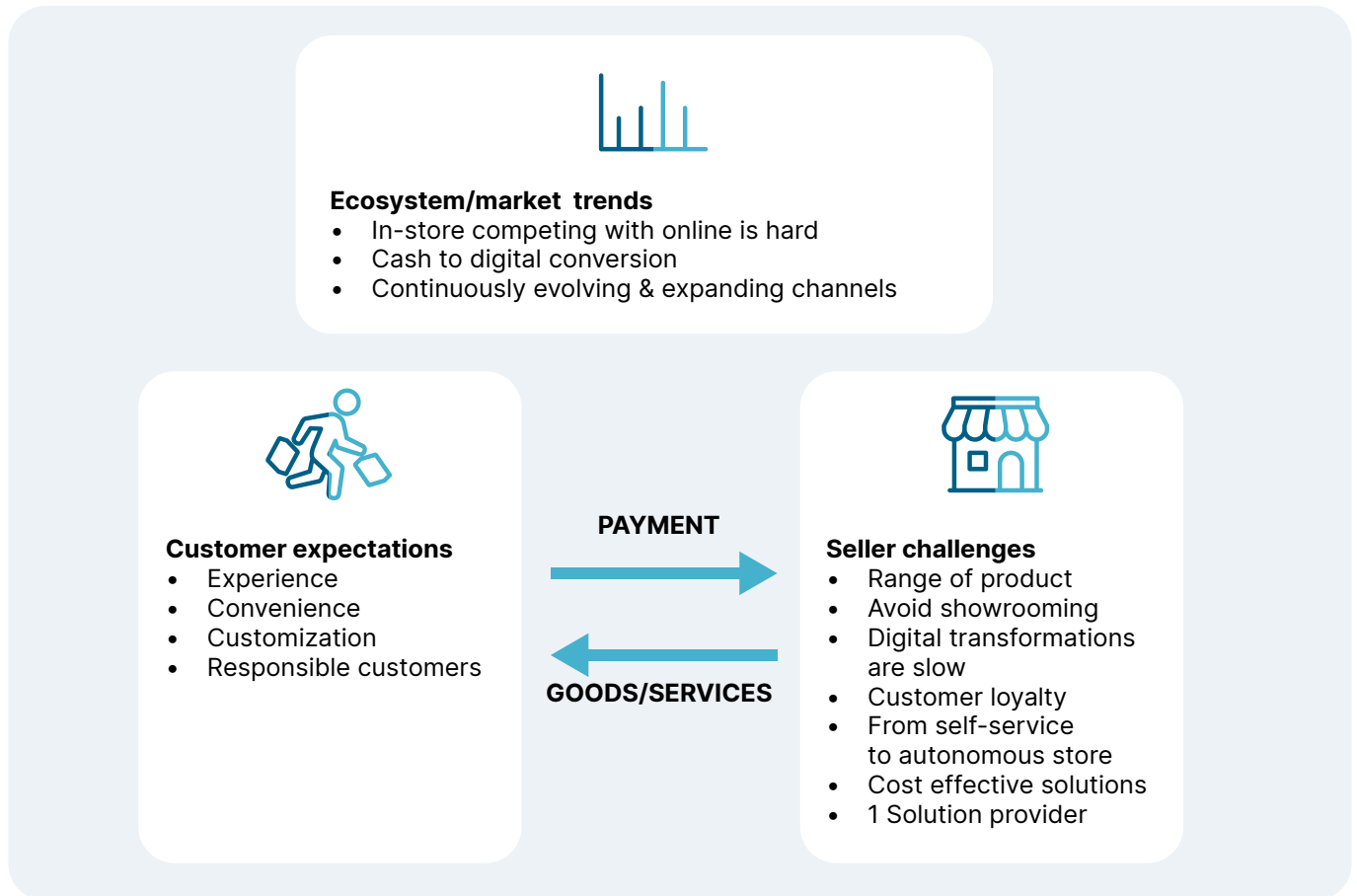


Figure 22: Challenges and trends faced by the retail industry.

Ecosystem / market evolution trends

In-store competing with online is hard. Virtual stores can adapt much faster to situations than physical stores. Customers are gravitating towards the virtual world for multiple reasons, chief among them are convenience and lower prices.

Cash to digital conversion. While digital payments are accelerating, cash is still a dominant mode of payment in some countries for both in-store and virtual shopping (through cash on delivery).

Continuously evolving and expanding channels. In the payments space, what is emerging today may become mainstream in a short period of time. The challenge is to understand which technologies will mature and what return on investment can be expected from their implementation.

Customer expectations

Experience. Connected customers expect a unique experience regardless of the channel or device they use. They expect a great, immersive in-store experience, and want the same immersive experience when they are at home (but these are not widely offered today).

Convenience. Prior to the pandemic, the shift away from in-store to ecommerce was driven by online shopping being more convenient.

Customisation. Physical stores have lagged behind virtual stores in the adoption of customised experiences for customers. Loyal customers expect to be rewarded for their loyalty. They may share their data with retailers on the understanding that this will result in curated, personalised experiences.

Responsible customers. Merchants need to cater to the growing percentage of customers who are very concerned with the impact of their actions on the environment and society. As we saw in [The Digital Divide chapter \(p.42\)](#), younger generations are extremely concerned by climate change, which we believe will make them more willing to prioritise ethical and sustainable products/brands, even if they are more expensive.

Seller challenges

Range of products. Virtual stores have become far quicker than physical stores to offer in-vogue products. They can also offer a much wider product range as they do not have the same space constraints faced by physical shops.

Avoid showrooming. It is important for retailers to challenge a rising trend in showrooming⁸³ which, if not addressed, may significantly reduce sales (and hence revenue and profit).

Digital transformations are slow. While retailers, large and small, may want to transform to adapt to the new world, the digital transformation itself may be a costly, cumbersome and time-consuming process involving multiple stakeholders.

Customer loyalty. Physical shops have to retain their customers and find ways to attract new ones who might never otherwise step into the store because of geographic restrictions.

From self-service to autonomous store. Customers are getting used to self-service, self-checkout and finding information and support for themselves. The new model of autonomous stores with solutions like Amazon Go or the more recent unmanned Nanostores by AiFi might drive this transformation further, leading to stores that are open 24 hours a day without any staff.

Nanostores might drive this transformation further, leading to stores that are open 24 hours per day without any staff

Cost-effective options. Solutions launched by a merchant in one country should also be available in another country with minimum customisations required.

1 solution provider. Retailers face a challenge of finding one provider who will be able to take care of their payment needs as well as their automation/technology needs.

Embracing the renaissance of physical stores

Merchants will need to think about the ways in which technology can help them improve both the “buying experience” (making transactions seamless for their customers in order to save time) and the “shopping experience” (giving the customer an experience that they want to spend time engaging with). This may require them to acknowledge and adapt to the rapidly changing landscape of both increased online competition and rapidly evolving customer tastes.

Using available data they can get to know more about their current and prospective customers and offer customised, personalised, contextualised and seamless experiences. And they should consider how they utilise technology to automate their back-end processes related to logistics and predictive analytics.

In Figure 23 we show four categories of actions that merchants may need to take, which we describe in more detail in the following sections.

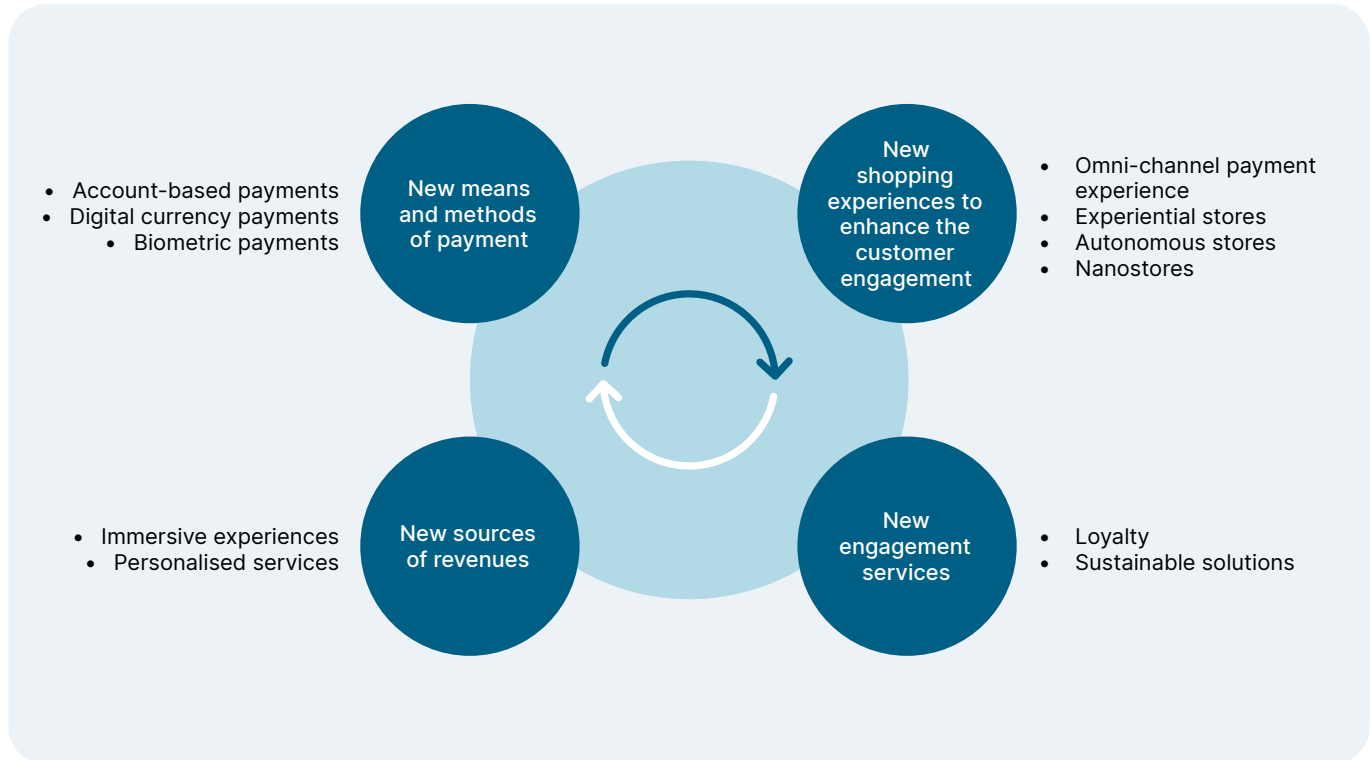


Figure 23: How merchants can embrace the renaissance of physical stores.

83 The act of visiting brick-and-mortar retail stores to research merchandise before purchasing it online for a lower price.

New means & methods of payment

Merchants and customers need to have efficient, secure, trustworthy and easy digital payment channels to move from cash to digital payment with the level of privacy expected by the user. Merchants need to have a clear knowledge of the maturity of the payment technologies available in the market in different regions and decide their strategy for adopting them. For example, there are a number of markets where local payment schemes make up the majority of all payments.

With customers becoming more and more omnichannel-oriented, they have increasing expectations of a consistent payment experience across all the channels. The best examples of this are mobile wallets (Google Pay, Apple Pay, Samsung Pay, WeChat Pay, Alipay etc.) which are reshaping in-store payments across the globe.

New payment methods are emerging due to their potential to provide greater convenience and ease of use:

Account-based payments. We are starting to see account-to-account payment methods deployed in physical stores making possible new, secure and fast methods of payment.

Digital currency payments. As described in the [Digital Currencies chapter \(p.25\)](#), the coming years may see the issuing of Central Bank Digital Currencies (CBDCs) as an enhanced electronic version of cash. These digital currencies could provide a fast and secure payment for merchants to attract new customers in the future.

Biometric payments. Face, fingerprint, hand, voice and behavioural recognition are some of the enabling technologies that can facilitate customer identification at the store and be used to provide a seamless, convenient, secure, private and trusted payment experience.

New shopping experiences to enhance customer engagement

Omni-channel payment experience. Merchants can offer different payment options to customers combining the physical store with the online channel (such as buy online pick up in store, web in store, buy in store return online, etc.). Merchants should look into providing the digital experience in-store in the same way they provide an in-store experience through digital channels. They could offer new options like Click & Go so customers can purchase products in-store for delivery to their home, even when they are not in stock at the shop itself.

Experiential stores. Merchants need to show their customers the added value of their physical stores (versus online stores) by providing new experiences that can only be achieved in the physical shop where the customer can touch, try, taste or feel the products before buying them.

Autonomous stores. These stores provide a new and improved shopping experience, enabling cashier-less checkout and invisible payments for customers.

Nanostores. Moving stores to people instead of moving people to the store, Nanostores operate autonomously and allow one customer at a time to enter the container-sized store. These can be enabled by solutions such as Worldline's Pick-Go-Pay which we piloted in The Netherlands earlier this year⁸⁴.

New sources of revenue

Immersive experiences. Merchants can offer online interactions in-store. For example, live-stream shopping which provides an attended one-to-one shopping experience where customers can view the products they buy, select their preparation and interact with the seller to receive recommendations such as recipes. This more closely mirrors the real physical experience and humanises and personalises the online experience for the customer.

A unified commerce strategy will enable retailers to drive these customer experiences across every channel

Personalised services. Retailers can offer customised, personalised and contextualised experiences to their customers. A unified commerce strategy will enable retailers to drive these customer experiences across every channel.

New engagement services

Loyalty. Actions need to be embraced by merchants, small businesses and large corporations, to engage their customers with their brand and increase stickiness and loyalty. For example, they could apply analytics to better understand customer behaviour throughout their journey at the store, enabling the creation of personalised and contextualised experiences.

Sustainable solutions. Merchants need to adapt to sustainability trends impacting stores, such as second-hand stores, the circular economy, green payments, carbon calculators, digital receipts, digital warranties, social currencies and charitable donations. One example of this is Worldline terminals that enable people to make a micro-donation when buying goods or services and which, in 2020, collected over 25 million donations totalling more than €339 million⁸⁵.

No one-size-fits-all payment solution

The retail ecosystem is very heterogeneous; from the smorgasbord of products and services they sell, they can be as small as a 1-person store with 1 square metre of space to one that is staffed by hundreds of employees and extends over thousands of square metres of real estate. Given this, any proposed solution cannot be a one-size-fits-all but a nuanced one based on the characteristics of the merchant.

The smallest merchants will be looking for something that is cost effective and practical. This could range from a printed QR code, to an "asset-lite" software-based Point-of-Sale solution (known as a SoftPOS), to a countertop payment terminal. The SoftPOS solution and the countertop terminal should accept card payments, QR payments as well as Pay-by-Link. In addition, they should enable merchants to sell other value-added services at the point of sale, so they can boost their revenues and increase customer loyalty.

Small and medium merchants will need all of the above, along with the additional option of selling their goods/services online and providing an omnichannel experience. Beyond a website and a payment gateway that accepts all major forms of payments, they will need an Enterprise Resource Planning (ERP) solution that manages inventory across store and online sales.

84 https://worldline.com/en/home/pressroom/press-releases/2021/pr-2021_06_08_01.html
85 https://worldline.com/en/home/pressroom/press-releases/2021/pr-2021_06_21_01.html

Large merchants with multiple stores, in addition to all of the above, will want to boost the in-store experience as well as the experience for online customers. For online customers, this can be achieved by investing in immersive experiences where customers can get the in-store experience while being at a convenient location. For physical customers, queue busting solutions can boost the experience. One such solution is Worldline's Scan and Pay that allows customers to scan products in-store, pay with their mobile and eliminate waiting lines at the checkout. Other innovative solutions that are coming into play are cashier-less shopping where customers walk out of the store with goods and their wallets are charged. From a back-office perspective, it is in the

interest of these merchants to invest in solutions that include reporting, predictive analytics, automation, loyalty, and logistics, among others. For example, stores should be able to predict products that customers are likely to buy and keep them in stock or at least source them quickly.

Merchants with a presence in multiple countries will require solutions that can be deployed in different geographies with minimal in-country customisation. They will also need consolidated reporting from the various geographies. Merchants will also need to keep in mind that the habits of users are different in different countries/cultures leading to different levels of acceptance for the same solution.



The Renaissance of Physical Stores		
Changes	Challenges	Choices
<ul style="list-style-type: none"> We foresee a renaissance of physical shopping experiences as merchants combine the best aspects of online shopping with the unique benefits of in-store retail The technological progress enabling zero-checkout or immersive online experiences will continue, making these increasingly prevalent 	<ul style="list-style-type: none"> For physical stores to out-compete pure-online, they must address challenges such as showrooming, having a reduced product range, and finding ways to ensure customer loyalty Digital transformation of physical stores can be a complex undertaking. It can be a challenge to find suppliers and partners who can support the entire end-to-end solution 	<ul style="list-style-type: none"> How could personalised services and immersive experiences boost your revenue? How can you engage with your customers at a deeper level, for example by helping them lead more sustainable lives? Which payment experiences will best support the overall customer experience that you want to provide, not just in-store but across all channels?

Autonomous Payments

Today's consumers and merchants expect payment experiences to be increasingly frictionless, or even invisible, to the point where customers do not need to even trigger or complete a payment themselves. Autonomous payments are payment transactions triggered by an authorised virtual payment agent acting on behalf of the consumer. This payment agent can be part of an IoT device such as a smart refrigerator. It could also be a piece of software, such as a printing application. Or it could take the form of a smart contract which automatically triggers payments when certain conditions are met (which some commentators refer to as "programmable money"). In either case, the rules and boundaries for the payment are initially set by the user/owner within a specific context, giving the payment agent the authority to activate and complete the payment on their behalf. Autonomous payments help decrease friction and improve consumer experience, because the transaction can be completed easily and quickly with little to no effort by the user.

Autonomous payments are payment transactions triggered by an authorised virtual payment agent acting on behalf of the consumer

Many industries across various sectors are demanding innovative payment solutions to support the ever-changing needs of their consumers, the evolution of their market and societal developments. This demand is being driven by both traditional economies (e.g. manufacturing, retail, public transportation, etc.) and increasingly from the service industry (e.g. banking, insurance, healthcare, etc.). The increase in passive connected devices (such as smart light bulbs) as well as devices with sensors and trackers (like smart watches) are making autonomous payments more plausible and possible. For merchants, the focus is no longer just on the products or services they provide, but also the quality of the customer experience they offer. In many cases a frictionless payment experience has a significant role to play here. Therefore, we believe that in many situations, autonomous payments will become the norm, delivering:

- **For consumers**, a truly frictionless experience for repetitive or low-value purchases, saving them time and effort, and reducing stress, energy and complexity (for example, walk-in/walk-out solutions for public transport)
- **For merchants**, a seamless experience for their customers leading to higher conversion rates, increased revenues and more repeat custom (as seen with subscriptions for household items such as environmentally conscious cleaning products)
- **For all businesses creating new offerings based on IoT, Artificial intelligence and APIs**, the ability to embed automated payments into their value propositions to create truly innovative, automated, end-to-end experiences for their clients

One of the most exciting aspects of autonomous payments is the enablement of innovative business models for merchants in both the sharing and circular economies through pay-per-use models. We believe that autonomous payments will impact merchants businesses in the following ways:

- Further improving the customer experience by reducing friction, improving speed of transactions and appealing to those that look to self-serve such as fully autonomous

shopping experiences [as already highlighted in [The Renaissance of Physical Stores chapter \(p.45\)](#)] and vending machines.

- Enabling instant transaction processing in more scenarios, reducing the need for infrastructure and resources (such as with automated road toll charges).
- Growing business by opening up the integration of new ecosystems and business platforms as we see with some of the sharing platforms such as the Car Next Door⁸⁶ app or Hiyacar⁸⁷.
- Increasing consumer engagement with autonomous reward schemes through the use of artificial intelligence.
- Supporting new business models. For example, extending the sophistication of subscription models and X-as-a-service models such as Mobility-as-a-Service or Printing-as-a-Service.
- Controlling costs for merchants by improving the monitoring of costs and providing better insights for treasury and financial management. In addition, it could reduce the administrative processes connected to payments and auditing.

User adoption for autonomous payment remains the key challenge

In our whitepaper "The IoT Payment Revolution: The future of autonomous and invisible transactions"⁸⁸ we described how the rapid growth in IoT devices is accelerating the development of autonomous payments. By 2023, the IoT payments market is expected to reach \$27.6 billion and the market segments that are going to benefit from this development include retail, automotive, transport, smart city and smart housing, to name just a few⁸⁹. Despite high expectations for this emerging opportunity, how popular autonomous payments will become is still not certain. On the one hand, the majority of connected devices are not really relevant for autonomous payments use cases (e.g. temperature sensors, smart door locks, home security cameras, etc.). On the other hand, relevant IoT devices such as connected cars, intelligent fridges or health care devices are still finding their way in the autonomous payments landscape.

In our whitepaper "The IoT Payment Revolution: The future of autonomous and invisible transactions" we defined IoT payments and described a model for their level of autonomy.

This paper also provides more in-depth information about the payment models, trust and accountability needs, technology enablers and the potential business impact.

From the technological point of view, the advancements of IoT, AI, Blockchain, 5G, LPWAN networks, and technical standards have reached a level of maturity where they can be deployed at large scale, whereas other technologies to enable platform interoperability, voice authentication and face recognition still require further development. Other challenges are not technological, and relate more to consumer willingness to adopt. We see that the main challenges for autonomous payments that merchants face are as follows:

86 <https://www.carnextdoor.com.au/>

87 <https://www.hiyacar.co.uk/>

88 <https://worldline.com/content/dam/worldline-new/assets/documents/whitepapers/autonomous-payment.pdf>

89 <https://www.intellias.com/iot-payments-what-s-ahead-for-contextual-commerce/>

Consumer adoption – Every innovation needs to go through the consumer adoption cycle in which the duration to mass adoption depends hugely on solution awareness. A user friendly and intuitive solution would certainly help accelerate consumer adoption, but it is even more important to understand what prevents a consumer from using autonomous payments. Is it because they are losing control of their payments? Or is it because they do not see any value in autonomous payments? Or is it because there is insufficient awareness about the benefits?

By 2023, the IoT payments market is expected to reach \$27 billion

Openness and interoperability between platforms – The economy of platforms has proven its dominance in the online commerce space. We believe that autonomous payments will follow the same philosophy. However, the industry needs to leverage existing API standards to facilitate payment transactions that are triggered by connected objects across platforms and across stakeholders in the ecosystems.

Autonomous payments will impact ecommerce platforms – Ecommerce platforms such as Amazon, Walmart, Alibaba and Cdiscount are deploying automatic processes on a large scale to stay competitive. For example, the shopping cart in Walmart's online shop is re-calculated constantly based on dynamic factors such as customer location, supplier location, delivery prediction, stock availability, to come up with the cheapest suggestion. In order to increase purchase conversion, we believe that merchants should use the techniques envisaged in the *Context Aware Services* chapter (p.28) to provide consumers with an option to delegate to shopping assistants the autonomous handling of purchases based on a variety of factors, such as the best price/delivery time ratio.

Lack of an endorsed ecosystem for autonomous payments – The philosophy behind the building of an ecosystem is not

new. However, building an autonomous payment ecosystem requires a new mind-set. Today, there is a rebalancing of power going on between banks, scheme owners and FinTechs. In the case of autonomous payments, there is a specific challenge regarding building business models and adequate technology enablers around micro payments. The challenge here is to think ambitiously but to act step-by-step. Actions need to be taken on two fronts:

1. Constructing a sustainable business model
2. Building proof-of-concepts/pilots with key customers and partners

Keeping up with new regulations – Building on the 2014 regulation on electronic Identity and Security (eIDAS⁹⁰) that ensures any cross-border transactions can be performed safely and securely, the EU is now proposing a framework for a European Digital Identity⁹¹ aiming to offer 80% of all EU citizens electronic identity (eID) for all online public services. Although new regulations may require additional resources and investments for compliance, merchants and payment providers can benefit from eID solutions to develop and offer new services that would authenticate the consumer securely and conveniently whilst removing friction and delays. In turn, this will help gain the trust of customers which is necessary to make them comfortable with the idea of autonomous payments.

In fact, we expect that the adoption of autonomous payments will be driven significantly by factors relating to trust and accountability, together with the underlying security, scalability and integrated payment means. As these areas become more mature, this will result in outward momentum to upswing adoption by consumers and merchants. Similar to other business ecosystems, autonomous payments need to be endorsed and pushed by key stakeholders. Ultimately, the speed of adoption, powered by the endorsed ecosystem, will generate the network effects of billions of connected devices and millions of users and merchants. Figure 24 illustrates these adoption drivers for autonomous payments.

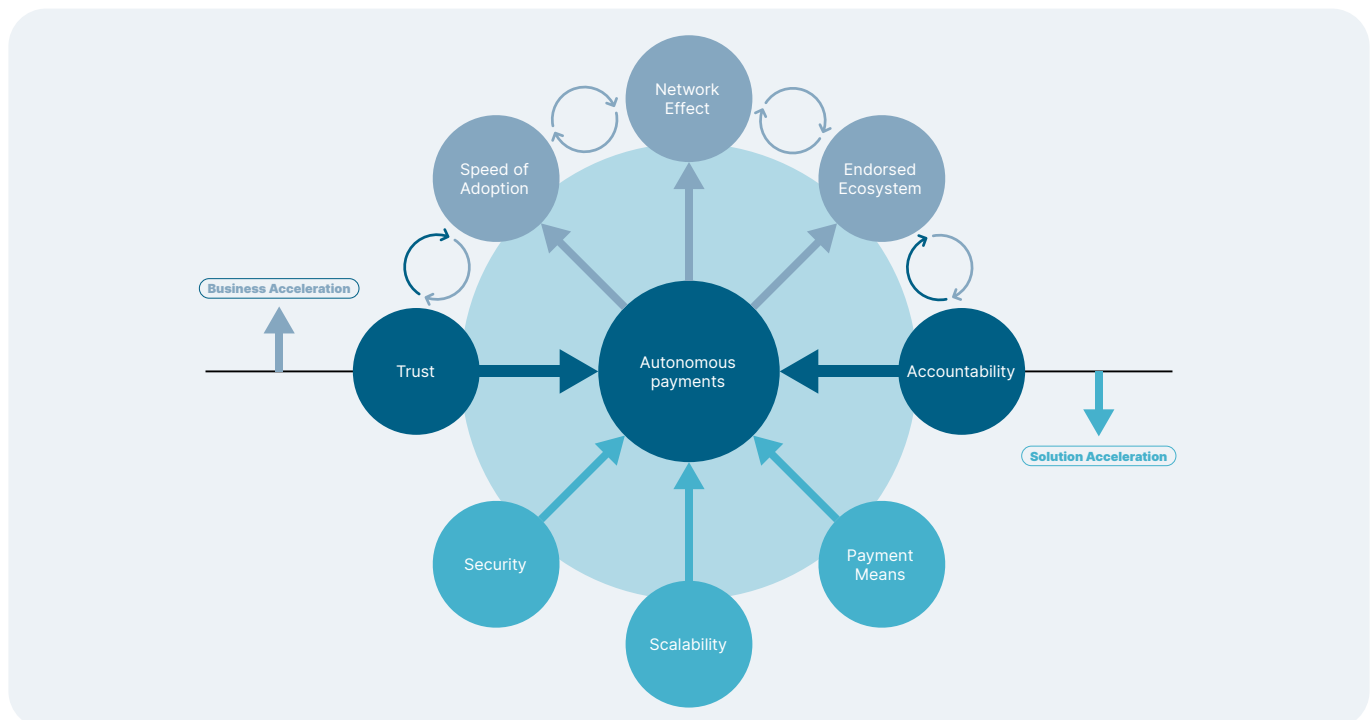


Figure 24: Adoption drivers for autonomous payment.

90 <https://eur-lex.europa.eu/legal-content/NL/ALL/?uri=celex%3A32014R0910>
91 https://ec.europa.eu/commission/presscorner/detail/en/IP_21_2663

Moving towards autonomous payment solutions

As described earlier, an essential enabler for autonomous payments is assuring consumers that autonomous payments can be trusted. To do this, the consumer must be fully in control, either by defining up-front the acceptable payment

conditions or by being assured that controls afterwards will revert any payment not in line with the set expectations. To reach this objective, we consider that there are four cornerstones (as illustrated in Figure 25) which are centred around consumer control and which constitute the foundation of autonomous payments.

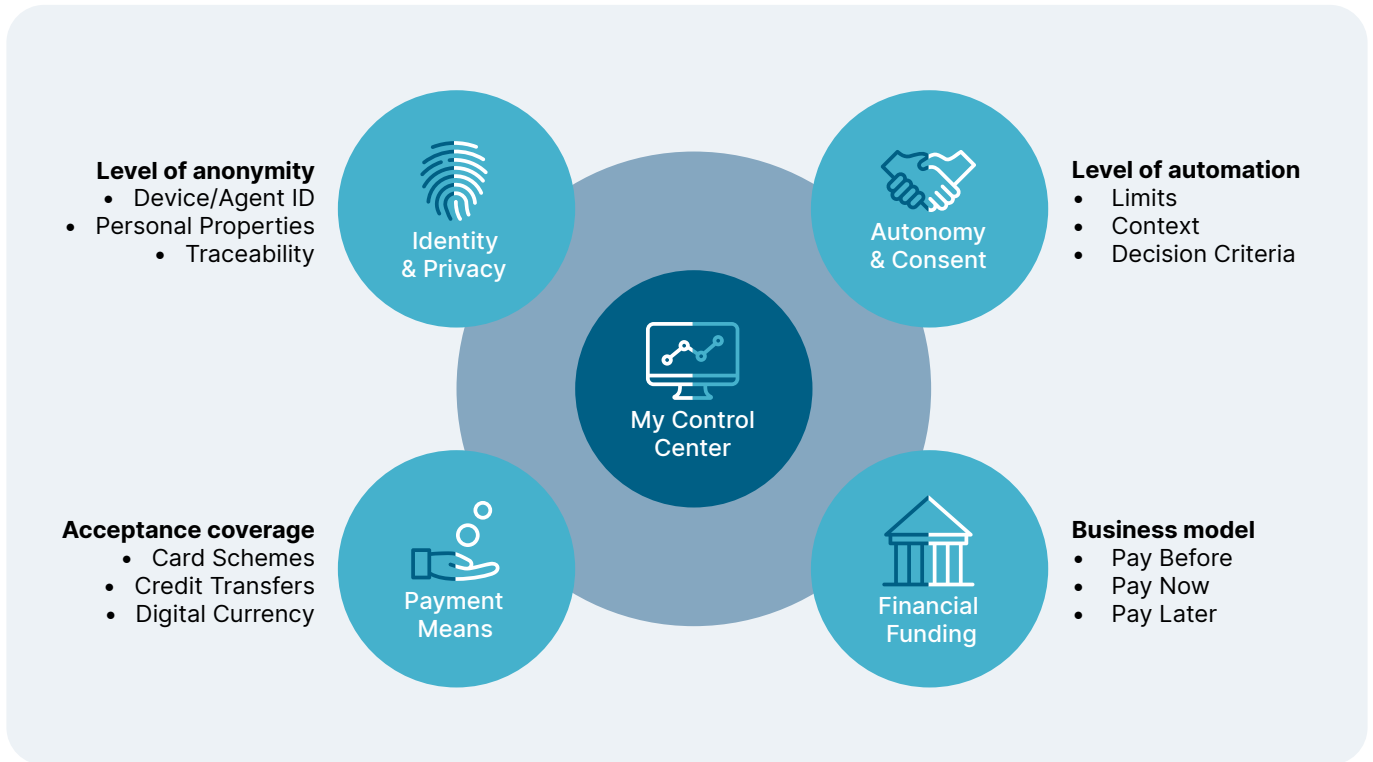


Figure 25: Key solution aspects of autonomous payment.

Identity and privacy - Smart devices can be seen as an extension of a consumer's perimeter, adding their ID to the consumer's personal identity. Identifying the consumers through their devices (with or without strong authentication) and what personal or device data can be shared are determined by the desired level of privacy. As a consumer, one should be able to determine which data can be known and shared for a specific usage by a specific autonomous device or agent. The devices that are used for experiences that are totally unrelated, should not necessarily be interlinked. For example, a "MyWasher" washing machine avatar that is known to have its soap delivered at my house with access to my address and a completely unrelated "MyTV" entertainment avatar to watch TV shows and movies on my TV and tablet which has details of my age and "MyCar" avatar which has details of my driving license.

Figure 26 depicts the different avatars that can be generated and used for different use cases, dependant on the minimum essential data required to authorise usage of a service.

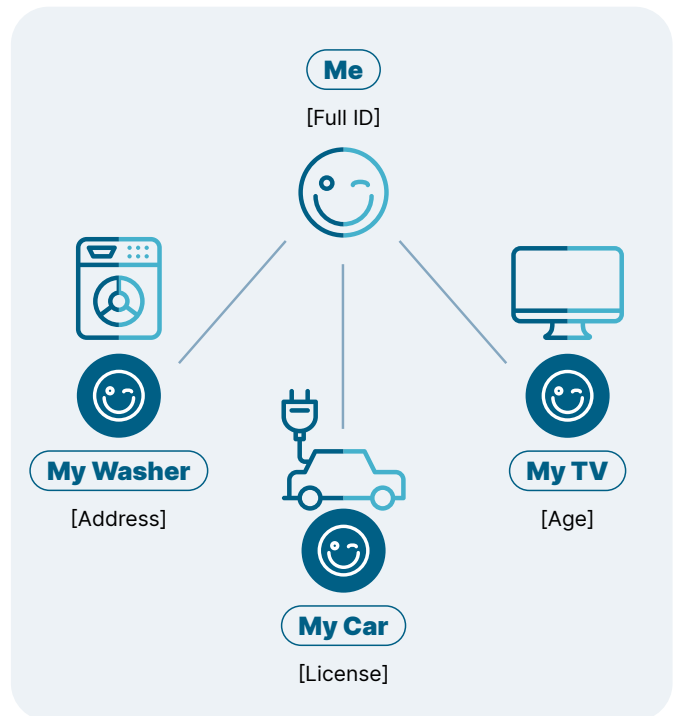


Figure 26: Avatars for different identities.

Autonomy and consent – Consumers want to control the level of autonomy granted to a device or an agent, deciding what degree of automation they are prepared to accept without explicitly approving a transaction themselves. Limiting the amount and conditions under which a transaction can be made independently is one method of control and risk mitigation. Making a device or an agent a trusted beneficiary in the payments world comes with the transactional decision power that is delegated.

Payment means – A more traditional “wallet like” approach is to link a payment means to the autonomous devices or agents. A consumer can choose a payment means depending on the environment and the device ecosystem’s acceptance network. Ranging from the high merchant reach of credit cards, to the interoperability of an open banking account transfer, to optimised IoT payment token solutions or future digital currencies like the Digital Euro.

Financial funding – The way the consumed products or services are financed has a tremendous impact on the service provider’s business model and the consumer’s perception. Using smart devices allows service providers to introduce “Pay-as-you-use”⁹² financing to markets where this would previously have been unmanageably complex.

To materialise each of the solution aspects elaborated above, micropayment use cases might be an interesting

starting point. Typically, the small amounts involved reduce many risks and regulatory compliance requirements. The advantages of micropayment include (but are not limited to): low financial risks, no need for multifactor authentication and simple transactional decision logics. As a result, it would help consumers to get quickly through the learning curve which, in turn, could remove barriers to adoption and create the network effects needed for autonomous payments.

The future of autonomous payments

Once autonomous payments are established, what could come next? Could we see autonomous bi-directional payments (i.e. paying and earning)?

For example, someone could earn loyalty points by sharing their connected car data and recharge their car with the points they have earned autonomously. Or could someone receive autonomous payments for sharing contextual data such as meteorological information (e.g. air temperature, soil temperature, sun light, air quality, noise level, rain, wind direction and force) which would then be used by merchants to improve the autonomous payment experience for their customers? Or could autonomous payments facilitate seamless sharing of excess private solar energy or other green energy with neighbours?

Autonomous Payments		
Changes	Challenges	Choices
<ul style="list-style-type: none"> We are seeing an increase in the number of IoT devices, higher bandwidth, ubiquitous connectivity and increasingly diverse payment options Customer behaviours are changing in favour of access over ownership 	<ul style="list-style-type: none"> Consumers will not adopt autonomous payment solutions unless they can trust them Regulations still need to evolve further to support autonomous payments Consumer concerns around the ability to identify every purchase they make and how this will impact their privacy 	<ul style="list-style-type: none"> What trade-offs might your customers be prepared to accept between a loss of control and sharing of their data in return for a reduction in payment friction? What new business models could become viable in your sector by using autonomous payments?



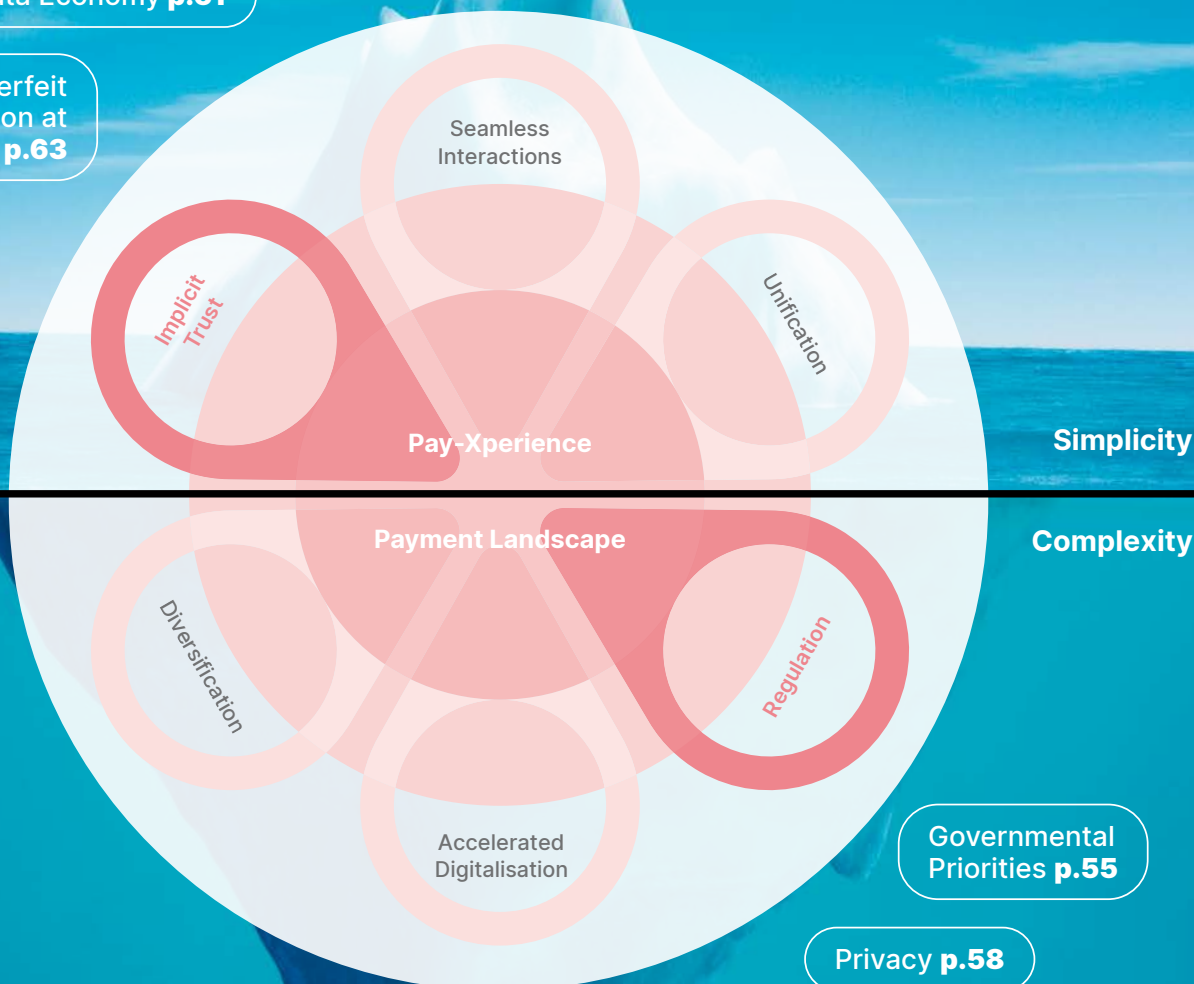


Implicit Trust from Regulations

Trust underpins business. Understanding the details of the multiplicity of payment regulations is essential; the challenge is how users can implicitly trust every transaction.

The Data Economy **p.61**

Counterfeit Detection at Scale **p.63**



Governmental Priorities

The actions of governments provide an insight into their current and future priorities. In particular, the ways in which existing legislation is being applied and adapted, and what new regulations are proposed, indicate which topics are likely to be key. From our assessment of the regulatory landscape, we see four dominant themes emerging, on which we believe all governments will put a strong and increasing focus in the coming years:

- Sustainability
- Protection
- Sovereignty
- Innovation

In the following sections we explore each of these in more detail.

Sustainability

The [Green Payments by Design](#) chapter (p.33) highlighted the urgent need for action to address the environmental crisis. Not only are scientists insisting on the urgent need for action (with some, for example, concluding that it poses “an existential threat to civilisation”⁹³) but there is now also clear and increasing global political convergence on this issue. President Biden brought the US back into the Paris Agreement on his first day in office⁹⁴. More recently, John Kerry (the US Special Presidential Envoy for Climate) stated that, in his view, the 2021 COP26 conference would be the “last best chance” for the world to come together and avoid the “worst consequences of the climate crisis”⁹⁵.

In 2020, China launched a National Green Development Fund to support the “green transformation” of the Chinese economy⁹⁶, raising \$12 billion in phase 1. And, through the European Green Deal, the EU is striving to make Europe the first climate-neutral continent⁹⁷.

In some countries (Denmark, France, Hungary, New Zealand, Sweden, UK) governments have already passed laws to mandate net-zero carbon emissions by 2050⁹⁸ and, through the European Climate Law, the European Commission is seeking to make it a legal requirement across the European Union. Many other countries are also committed to this target (even if not yet in law), producing policy documents and proposing legislation.

This global political convergence is likely to lead to significant shifts in how governments legislate and how they tax and spend

One example of legislation that is designed to drive sustainability is the EU's Sustainable Finance Disclosure Regulation. This regulation specifies the disclosure obligations for manufacturers of financial products and financial advisors toward end-investors, so that investment decisions can take into account sustainability considerations.

Also on the horizon is the new Corporate Sustainability Reporting directive which will introduce stricter requirements on which companies must report information related

to sustainability, what they have to report and how the information provided will be verifiable. We can foresee that sustainability related reporting will soon be held with the same regard as financial reporting, not only in the eyes of governments, but also investors. We can also imagine that gradually the requirements to report this information may also be complemented with certain minimum standards that companies must meet in order to operate.

In terms of taxation and spending, we see that the US plans to repeal certain oil and gas tax benefits whilst extending and enhancing those for clean energy⁹⁹. And in “The Made in America Tax Plan” they are aiming to fund a “\$2 trillion infrastructure and clean energy plan”¹⁰⁰. In Europe, the EU's Taxonomy for Sustainable Finance entered into force in July 2020. This classification system establishes a list of environmentally sustainable activities, with the goal of helping to scale up sustainable investments. We believe that in the coming years there will continue to be more government spending and tax incentives to stimulate businesses to be more climate-friendly. We can also envisage that any incentives for non-green businesses will disappear and potentially be replaced by disincentives.

Protection

Most would agree that protecting the safety and security of their citizens has always been a high priority for governments. However, as more and more activities are conducted digitally, and as technology has continued its rapid advance, the area where we are seeing the most change in the focus of governments is in the digital domain.

In Europe, we have already seen how the General Data Protection Regulation (GDPR) has sought to enforce “fair play” in how businesses use people's personal data, as well as ensuring that they take adequate steps to prevent it being stolen via data breaches. We now see other legislation in progress that seeks to provide similar protection in other domains. For example, the EU's proposed Artificial Intelligence Act¹⁰¹ suggests that AI-based systems will need to be classified depending on the level of risk they pose, with strict requirements for how high-risk systems must be developed and used. They also propose a category of “unacceptable risk” which will be banned (except for ethically conducted research).

There are also regulations in-progress to further control providers of online services and platforms. The Digital Markets Act and Digital Services Act are two such regulations that are aiming to promote a safe online environment for users, define responsibilities and accountability for a range of service providers, empower users, reduce barriers for businesses, foster innovation and growth, and protect fundamental rights¹⁰². The Digital Markets Act in particular seeks to implement specific controls for large online platforms that are considered “gatekeepers” to ensure that consumers and businesses using these platforms are treated fairly. This is not only a European concern. In China, for example, the State Administration for Market Regulation (SAMR) has drafted regulation that seeks to prevent monopolistic practices by internet platforms¹⁰³.

93 https://easac.eu/fileadmin/user_upload/EASAC_Commentary_COP26_COP15_August2021.pdf

94 <https://www.state.gov/the-united-states-officially-rejoins-the-paris-agreement/>

95 <https://www.bbc.co.uk/news/world-us-canada-55836163>

96 <https://www.reuters.com/article/us-china-environment-idUSKCN24T0E0>

97 https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

98 <https://www.visualcapitalist.com/race-to-net-zero-carbon-neutral-goals-by-country/>

99 <https://www.kirkland.com/publications/kirkland-alert/2021/06/biden-administration-budget-and-green-book>

100 <https://home.kpmg/uk/en/home/insights/2021/04/tmd-proposed-us-tax-reform-2-0.html>

101 <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1623335154975&uri=CELEX%3A52021P.C0206>

102 https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/digital-markets-act-ensuring-fair-and-open-digital-markets_en

103 <https://www.cnbc.com/2021/01/11/chinas-tech-regulation-part-of-bigger-push-to-become-a-superpower-.html>

Governments are also seeking to ensure that critical services remain available, especially during times of crisis

Beyond ensuring that businesses and consumers are treated fairly, governments are also seeking to ensure that critical services remain available, especially during times of crisis. An example of this for financial services in Europe is the planned Digital Operational Resilience Act (DORA), which is expected to apply not only to the whole financial sector, but also to firms captured under the term “critical ICT third-party service providers”¹⁰⁴.

In payments, there are already well established standards and legislation which seek to protect citizens and businesses from fraud and theft. The EMV specifications cover technologies that support card-based payment, including contact, contactless, mobile, payment tokenisation, QR codes, secure remote commerce and 3-D secure¹⁰⁵. These standards are administered by EMVCo, but they are independently enforced by payment networks (who may also add additional requirements, sometimes varying by region). The PSD2 regulation in the EU also sought to reduce fraudulent transactions by introducing requirements for Strong Customer Authentication (SCA). These standards provide vital protection for consumers. However, innovative approaches are needed to ensure that the customer experience is not negatively impacted. One such innovative approach is Worldline’s partnership with FinTech A3BC to provide fast and frictionless online payments fully compliant with SCA without requiring a single touch of a button by the end user¹⁰⁶.

An area of particular concern for nation states is the prevention of money laundering. In the US, the Anti-Money Laundering Act became law at the start of 2021¹⁰⁷. This legislation is highly aligned with the EU’s 4th and 5th Anti-Money Laundering (AML) directives. In turn, the EU is itself proposing strengthened AML regulations, as well as the creation of a new AML authority which will have direct supervisory power over institutions¹⁰⁸.

Sovereignty

Political blocs are carefully considering the level of dependency they are willing to have on other political blocs (and on which ones). Especially with regard to critical infrastructure, governments have become more aware that they must be able to deliver services to their citizens which cannot be disrupted at the whim of another country’s government.

With this heightened awareness, politicians in Europe are now “convinced that a European payments system is a question of sovereignty”¹⁰⁹. This has led to political will behind the creation of the European Payments Initiative (EPI) as a way to reduce dependence on US-based firms for payment services. Worldline has warmly welcomed this initiative and was the first non-bank acquirer to become a founding member of EPI in November 2020¹¹⁰.

In the Digital Currencies chapter (p.25), we describe the rise of Central Bank Digital Currencies (CBDCs). In the US,

the progress that China has made with CBDCs is stirring “worries that it could undermine the dollar’s position as the global reserve currency”¹¹¹. This is prompting the US to accelerate its CBDC plans, whilst, in the EU, the European Central Bank has started work on the creation of a Digital Euro.

Politicians are now convinced that a european payments system is a question of sovereignty

A specific subset of sovereignty is digital sovereignty:

“The concept (...) has become a powerful term in political discourse that seeks to reinstate the nation state, including the national economy and the nation’s citizens, as a relevant category in the global governance of digital infrastructures and the development of digital technologies.”¹¹²

Indeed, in July 2020, it was the “central theme” of Germany’s EU Presidency programme. More than 100 countries now have data sovereignty related laws in place¹¹³. And, in India, 59 Chinese apps were banned in 2020 due to concerns around “sovereignty and security”¹¹⁴.

The often rapid (and sometimes uncontrolled) adoption of new tools like Zoom or WhatsApp by companies, driven by the pressures of the Covid-19 pandemic, has caused some to ask whether digital sovereignty was also infected with coronavirus¹¹⁵. And some see that action is needed. For example, Guillaume Poupard, director general of France’s National Agency for Information Systems Security (ANSSI), said this:

“We can’t do everything, but we can continue along the ridgeline that can keep us inside the circle of sovereign countries. But to do this, we must turn our backs on global easy-to-use and easy-to-access — and often cheaper — solutions, at least in the beginning.”

We believe that sovereignty will continue to be a key priority for governments in the coming years, and we expect that the topic of digital sovereignty is a specific aspect of this where there will continue to be rapid change.

Innovation

We observe that governments are keen to stimulate innovation for the benefit of their citizens. For example, more than half of the €806 billion NextGenerationEU recovery plan (agreed at the end of 2020) will support modernisation, including research and innovation and digital transitions¹¹⁶. And, in 2021, President Biden announced a \$325 billion research and innovation plan¹¹⁷. Direct funding of research and innovation is one lever of influence that governments can deploy. However, regulations can also promote innovation, often by making it easier for smaller, more agile companies to enter markets.

We expect that open banking regulations will expand into open finance regulations

104 https://www.ey.com/en_be/financial-services/how-will-the-digital-operational-resilience-act-impact-your-organization

105 <https://www.emvco.com/about/overview/>

106 https://worldline.com/en/home/pressroom/press-releases/2021/pr-2021_07_07_01.html

107 <https://www.regulationtomorrow.com/africa/part-7-the-biden-presidency-and-new-and-improved-anti-money-laundering-tools/>

108 <https://www.lexology.com/library/detail.aspx?q=12cbfd3b-363d-4e7a-bf86-51856f5212ed>

109 <https://www.ft.com/content/61295d18-c77c-4c50-83a2-15e9ff0c4f4c>

110 https://worldline.com/en/home/pressroom/press-releases/2020/pr-2020_11_25_01.html

111 <https://www.cnbc.com/2021/05/20/the-fed-this-summer-will-take-another-step-ahead-in-developing-a-digital-currency.html>

112 <https://policyreview.info/pdf/policyreview-2020-4-1532.pdf>

113 <https://www.bloomberg.com/quicktake/how-cybersovereignty-is-fracturing-the-world-wide-web>

114 https://economictimes.indiatimes.com/tech/ites/india-important-digital-power-wont-compromise-on-data-sovereignty-prasadn/articleshow/76840586.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cpsst

115 <https://blog.bluemind.net/en/its-digital-sovereignty-infected-with-coronavirus/>

116 https://ec.europa.eu/info/strategy/recovery-plan-europe_en

117 <https://sciencebusiness.net/news/biden-unveils-historic-325b-research-and-innovation-plan>

In payments, we have already seen how Open Banking regulations around the world (e.g. PSD2, OBE, UPI, CDR and others¹¹⁸) are enabling and forcing new ecosystems to flourish as opportunities are created for a bigger variety of actors to have access to banking data. We expect that Open Banking Regulations will expand into Open Finance Regulations which will enable innovative services to be built through permissioned access to all aspects of a person's financial life – not only personal bank accounts, but also areas such as insurance, investments, accounting, financial advice and pensions.

In *The Data Economy* chapter (p.61), we will describe in more detail how businesses can derive more value from data. Governments are also recognising that the use and sharing of data can bring benefits (for governments, citizens and businesses), provided that it is done in a trusted manner. For example, in the EU, the proposed Data Act will seek to “create a fair data economy by ensuring access to and use of data, including in business-to-business and business-to-government situations”¹¹⁹ whilst also seeking to “enable trust and facilitate the flow of data across sectors and Member States while putting all those who generate data in the driving seat”¹²⁰. We also expect that more sector-specific proposals

will unfold regarding how data can be used and exchanged, such as the European health data space initiative¹²¹.

There are already initiatives that seek to foster innovation by making certain foundational components available as standard building blocks. Trusted identification of individuals is one such domain, where many business require a mechanism to verify who someone is, as well as check certain characteristics (e.g. that they are over 18).

Thus, we are seeing digital wallets starting to be used to house digital ID. For example, some US states will soon allow people to store their driver's license or state IDs in their Apple Wallet¹²². In the EU, the proposed amendments to the eIDAS regulations will require member states to issue a European Digital Identity Wallet which all private services will be required to accept and which will provide a high degree of interoperability. These types of standardisation make it much easier for companies to build on these components to innovate services addressing wide geographic areas.

Another area where we see a drive towards standardisation is in the provision of cloud services, where initiatives such as GAIA-X¹²³ and the GI Cloud Initiative¹²⁴ are seeking to define what the requirements are for cloud services in specific domains.



Governmental Priorities		
Changes	Challenges	Choices
<ul style="list-style-type: none"> • Governments will continue and increase their focus on sustainability, protecting citizens and businesses, securing sovereignty and stimulating innovation • Regulations that today only specify what must be reported (e.g. Corporate Sustainability Reporting directive) may evolve to set basic minimum standards • Laws governing the exchange of data will evolve both to stimulate innovation and to protect the generators of the data 	<ul style="list-style-type: none"> • There will be an increased need to demonstrate that your business is sustainable • Regulation to stimulate innovation may require you to open up more of your systems and share more data 	<ul style="list-style-type: none"> • How could you significantly improve the sustainability of your business? • As new ecosystems emerge (stimulated by Open Finance and greater sharing of data), how will the role of your business and the value you offer need to adapt? • How secure and sovereign are your operations and how could you strengthen these aspects?

118 <https://www.bbva.com/en/open-banking-regulation-around-the-world/>
 119 <https://digital-strategy.ec.europa.eu/en/consultations/public-consultation-data-act>
 120 https://ec.europa.eu/commission/presscorner/detail/en/ip_20_2102
 121 https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12663-Digital-health-data-and-services-the-European-health-data-space_en
 122 <https://www.apple.com/uk/newsroom/2021/06/ios-15-brings-powerful-new-features-to-stay-connected-focus-explore-and-more/>
 123 <https://www.data-infrastructure.eu/GAIA-X/Navigation/EN/Home/home.html>
 124 <https://www.indrastra.com/2018/04/MeghRaj-India-s-Cloud-Initiative-004-04-2018-005.html>

Privacy

It has been said that privacy – like eating and drinking – is one of life’s basic requirements. Now, as the world evolves, one could argue that our connectivity and our devices, should be added to the list of basic requirements. Throughout history we have seen that technological advances have often given rise to questions about how people adapt to new innovations and how the technology enters their lives.

In an increasingly digital world, with more information about individuals being collected every day, it is natural that innovators start to make use of these new data sources. As these

changes occur so quickly, it is sometimes difficult for people to know how that data is being used, how and if it is protected, and, as we have seen from historical technological advances, new questions are raised about individual and societal privacy.

Furthermore, as more and more data is collected, as more services move online and as collaboration increases, systems become exponentially complex, to the point that it is difficult or sometimes infeasible to give guarantees that operations are running as expected and that no fault will occur. For this reason, it is paramount that organisations

integrate security and privacy guarantees by design and by default, not only to comply with regulation that requires that personal data is protected, but also to maintain and guarantee the security of the systems they operate.

As illustrated in Figure 27, in this chapter we look at the evolution of what privacy means. Firstly, from the perspective of legislation and, secondly, from the perspective of how technology has evolved to become more present in our lives, and how it blurs the line between what is public, private, and secret information.

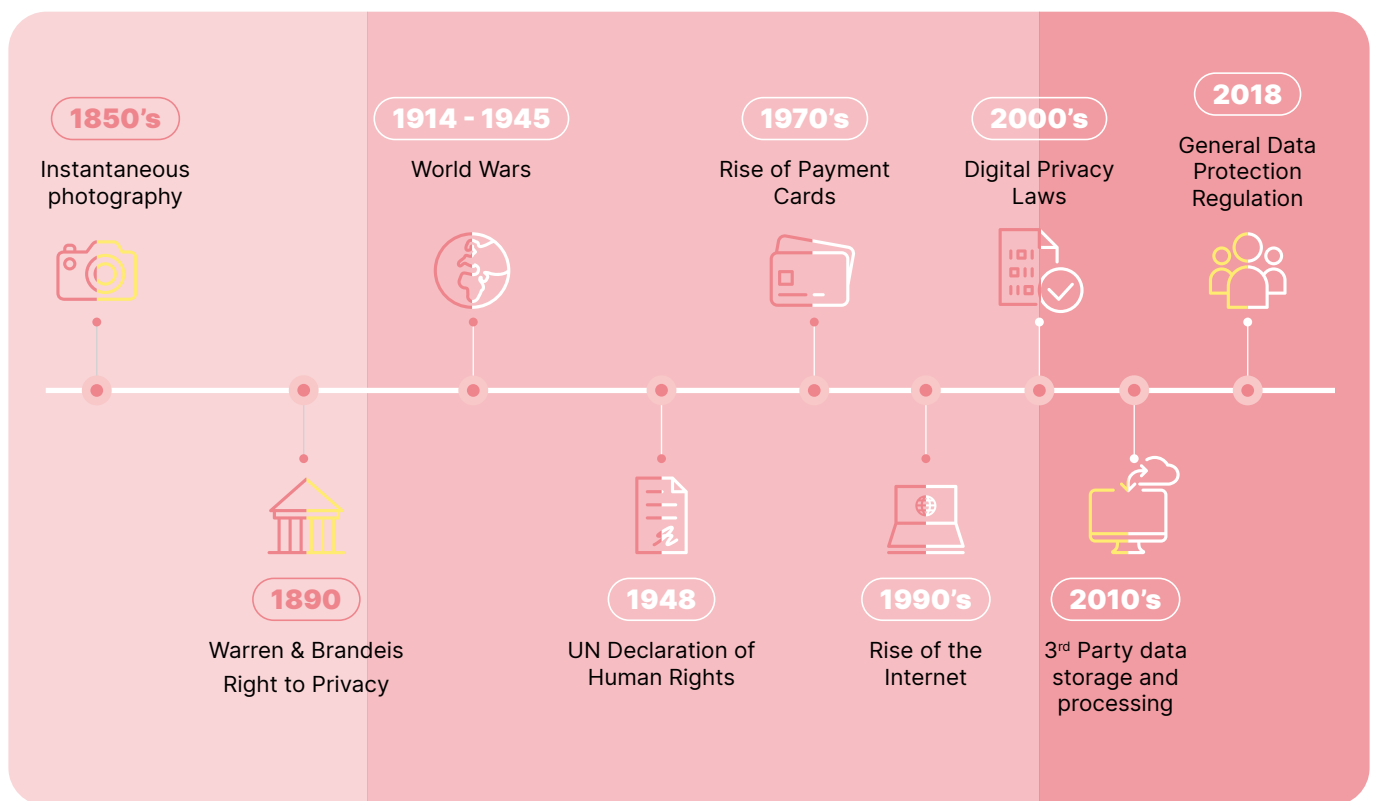


Figure 27 : The legislative and technological evolution of privacy.

The evolution of privacy legislation

At around the turn of the last century, the invention of photographic film and new portable designs for cameras, enabled photographers to quickly and easily take photos anywhere and anytime. This was a great step for innovation, but not necessarily for privacy. The new portable cameras gave rise to the first paparazzi – journalists who would snap pictures of socialites for publication in the gossip

pages of newspapers. Court cases quickly followed and brought about the first questions asking what “privacy” may mean in terms of the law and how it should be protected. An article written by Samuel Warren and Louis Brandeis¹²⁵ entitled “The Right to Privacy” appeared in the Harvard Law Review in 1890 aiming to find commonalities in the cases in a bid to develop a uniform understanding. The conclusion at the time was that a right to privacy was the right to be left alone.

After the turn of the century, we saw two world wars followed by the establishment of the UN Declaration of Human Rights, which, in article 12 states that:

“No one shall be subjected to arbitrary interference with his privacy, family, home or correspondence, nor to attacks upon his honour and reputation.”¹²⁶

125 Brandeis, Louis, and Samuel Warren. “The right to privacy.” Harvard law review 4.5 (1890): 193-220.
 126 Assembly, UN General. “Universal declaration of human rights.” UN General Assembly 302.2 (1948): 14-25.

It is largely believed that the inclusion of privacy as a human right was a conscious effort to ensure that racial and religious atrocities such as those witnessed during the wars would not happen again. However, there is no explicit mention of nor discussion about a right to privacy anywhere in the drafts of the Declaration. As such, scholars conclude that it is an inherent trait in all people, the one thing we do not question in ourselves, or anyone else¹²⁷. We all just expect it to be there.

After the Declaration of Human Rights was adopted, many nation states passed their own laws to protect the privacy of their citizens. These laws largely followed the guarantees aimed for by the UN and by Samuel Warren and Louis Brandeis. However, as technology advanced and as the world became more digital, the line between public and private lives started to blur. The rise of the Internet meant that people all around the world could see into each other's living rooms and see behind the closed doors where once people had a private refuge. Building on the Internet, appealing products and services arose and, suddenly, private companies got their first view into what once were people's private spaces. Previous privacy protection measures did not take account of this new digital world, so it became necessary to revise them.

Previous privacy protections did not account for this new digital world, so it became necessary to revise them

Thus, in the early 2000's, the first laws aiming to protect privacy online emerged to cover the cases that arose at the time. As technology advanced, it became clear that a new systemisation of privacy laws was needed. The first effort towards this was established in Europe through the development of the General Data Protection Regulation (GDPR) and we now see a global effort to follow suit¹²⁸.

One of the core aims of GDPR is to allow citizens more freedom in relation to their personal data. Personal data is most often harvested and processed by private enterprises and there had been a lack of transparency for citizens as to what their data was being used for. GDPR sought to remedy this by requiring fairness and transparency in the use of personal data, by limiting the purpose for which data is collected and processed. Beyond this, the principle of data minimisation is also stressed to limit the scope of what data can be used for in the long term. Data should be kept up to date and accurate, and only stored for the length of time for which it is reasonably needed. Security and privacy by design are paramount, and, beyond that, organisations collecting, storing, or processing personal data are held accountable to meet the requirements of GDPR.

The Impact of technology on privacy

New ways of collecting and communicating information gave rise to the first modern privacy concerns. We saw from the turn of the last century that the development of portable cameras gave rise to a new debate about what privacy may mean. With the development of computers a few decades later, privacy concerns increased. Not only was there a

new way to capture and store information, but there were also ways to automate tasks so that information could be processed faster than any human could have done previously. Although used only for military purposes in the beginning, it was clear that privacy of communication was lost.

In the early 1970's, Electronic Fund Transfers grew greatly in volume, but scepticism of their use followed due to the recession in the mid 1970's which then gave rise to data protection laws governing payment information. Suddenly there was an industrial need to protect consumer data, and we saw the first development of cryptographic algorithms (DES) to protect payment information. This was a moment when technical developments, coupled with economic and social developments, led to new privacy concerns.

The development of the Internet, and the spread of personal computers in the early 1990's, brought the first possibility for the public to communicate electronically across the globe. This is the point where the line between our personal and private lives became less clear. For the first time, via services on the Internet, people at home could interact with enterprises from the comfort of their own home. Then, with the rise of social media, people's digital selves began to emerge. Given more access to information, people could more easily learn if there were data breaches and the awareness of privacy online began to grow.

The past decades have seen people's lives become increasingly digitised, far beyond the realms of social media. Now, people's health and wellbeing, education, shopping, and civic activities, are often carried out online, and this has only been further exacerbated by the Covid-19 pandemic. With such a maze of information and services now online, there is a need to organise it and present it in a way that enables users to find the appropriate information for their needs.

In the 1970's the main concern about digital data privacy was in communication – for example, how could payments be sent in a secure manner?

However, with the need to organise information and extract value from it, there is now a need to perform computation on personal data. And, therefore, a new privacy concern arises: how can these computations be performed in a secure manner?

How can these computations be performed in a secure manner, retaining the desired functionality while protecting the privacy of an individual?

Additionally, the size and complexity of the digital ecosystem has grown substantially. On the one hand, this is positive: enabling new products and services, new ways to pay, and new ways to live. On the other hand, this can lead to major intrusions into privacy. Extending the question regarding computation: how can these computations be performed in a secure manner, retaining the desired functionality while protecting the privacy of an individual, and all in a seamless and simple way?

127 Diggelmann, Oliver, and Maria Nicole Cleis. "How the right to privacy became a Human Right." *Human Rights Law Review* 14.3 (2014): 441-458.
128 <https://insights.comforte.com/13-countries-with-gdpr-like-data-privacy-laws>

Trends and challenges

The cat-and-mouse game between regulatory protection and technological innovation is continuing. In parallel, it has spurred a number of innovations that aim to yield the functionality desired in a digitised world, yet still providing the protection guarantees that citizens expect when sharing their personal data.

The key advances in the past decade, both in terms of regulation and technology, that we expect will continue to gain momentum, are:

Privacy by design - There is a responsibility, due both to regulation and business interest, to build products from the principles of privacy by design. As new services are designed and built, privacy is embedded into their foundations.

Automated regulation - To comply with regulation, to increase efficiency, and to protect the trust of a brand, regulatory rules should be included in the construction of new services, and their computational flows.

Advanced functionality (traceability, auditing, and accountability) - New methods allow the balancing of the need for privacy and regulatory control. Should something go wrong in a process, the data can be protected, while also tracing the cause.

With each passing year, there are also more tools that can be leveraged to ensure that products protect privacy. Some of the most noteworthy emerging tools include the following:

Differential privacy - Allows the addition of some randomly selected noise to data in a bid to compute privacy preserving statistics. Although the resulting statistics will not be exact, they will be close to the true value and we gain the guarantees that no individual can be identified from the result.

Advanced encryption: homomorphic encryption - As already mentioned in the Digital Theft and Fraud chapter (p.39), this allows computation directly on encrypted data, meaning that an analyst will never see the underlying personal data.

Advanced encryption: functional encryption - This allows computation of *certain functions* on encrypted data thereby granting fine grained access control to the person or team conducting the analysis.

Multiparty computation - This allows computation on encrypted data stored in multiple locations. This gives greater security and privacy guarantees, given that no one person will be able to see the underlying personal data.

Privacy-preserving machine learning and federated learning - These aim to protect the security, privacy, and confidentiality of data, while still allowing useful analytics or predictive models to be developed.

Combining these tools allows complex systems to be built that enable privacy preserving computation that was infeasible just a few years ago.

Finally, the technique that could be most disruptive in the coming years is the zero-knowledge proof. Although zero-knowledge proofs are not completely new in the field of cryptography, they have gained a lot of attention recently, which has resulted in advances in efficiency and their use in a broader scope of scenarios. A zero-knowledge proof is a cryptographic protocol which allows users to prove their knowledge of a certain piece of (potentially secret) information, without conveying anything other than the fact that *they know* the information. For example, when registering to access websites online, a lot of personal information (name, age, address) is needed to create an account. The argument for requiring so much information is often to prove some attribute (e.g. most social networks require users to be over the age of 13). A zero-knowledge proof would allow a user to provide a "proof" that they are over 13, without needing to reveal their date of birth.

We consider that zero-knowledge proofs could be one of the most disruptive techniques

Privacy		
Changes	Challenges	Choices
<ul style="list-style-type: none"> • People's lives will continue to be increasingly online and digital and new regulations will emerge to protect this • Technology advances will create new ways to offer security and privacy guarantees 	<ul style="list-style-type: none"> • Innovation will need to be stimulated in a way that still offers protection of the personal information of citizens • Privacy will need to be protected in a cost-effective way that is not to the detriment of the end-user experience 	<ul style="list-style-type: none"> • What could be the benefits or consequences of deploying a particular privacy protecting technology in your business? • As identity becomes increasingly digitised, how can you balance the needs of privacy with the needs to check people's credentials and prevent fraud?

The Data Economy

Most would now agree that data is incredibly useful in allowing businesses to become more efficient, to make better decisions, to strengthen relationships and to understand more about themselves and their position in the world.

As we saw in the introduction, a combination of diversification, accelerated digitalisation and a rapidly changing regulatory landscape, mean that the payments industry is changing quickly, growing beyond traditional players. As payments are becoming embedded into so many scenarios and different types of devices, whilst still requiring fraud and KYC protection, there will be a need for data processing on a scale never seen before.

From this situation, there are a number of issues that can arise:

- It becomes infeasible to process *all* the data, so there will be a need to select the *most valuable data* from which useful information can be derived.
- In deciding what is valuable, there tends to be a need to access data which is of a sensitive nature and thus can be harmful if not treated with care.
- Beyond this, to make optimal choices and decisions, data from multiple sources are needed to get the most meaningful insights.

In an attempt to address these, there have been major advancements in regulation on the one hand, and technology on the other. Working in tandem these advancements should yield systems allowing the benefits of data to be leveraged, but without causing negative effects within the industry or for the end user.

What is the Data Economy?

Building on the data analytics and data science of the past decades, we start to see the emergence of a data economy.

A data economy is a global digital ecosystem in which data is gathered, organised, and exchanged by a network of participants for the purpose of deriving value from the accumulated information.

Data inputs are collected and exchanged by a variety of stakeholders, including search engines, social media websites, online vendors, brick-and-mortar vendors, payment gateways, banks and financial service providers, software as a service (SaaS) companies, and an increasing number of firms deploying connected Internet of Things devices.

Businesses who remain indifferent could face being left behind and becoming irrelevant in the market

Businesses who remain indifferent could face being left behind and becoming irrelevant in the market. Now is the time to understand how your organisation can seize the opportunities that the data economy can bring.

However, it is wise to keep in mind that data by itself does not create any value. Rather, it is the innovative use of data to support a business model that leads to increased business performance. For example:

Modern sales teams employ predictive scoring technologies that crawl the web to aggregate data about potential

customers and calculate the likelihood a customer will close. Each morning, sales account executives log into their customer relationship management (CRM) software and see a list of leads prioritised by likelihood of completing a purchase.

Recruiters use data to identify the best candidates to pursue based on online profiles, blogs, social media accounts, and open-source software contributions.

Product managers record the actions of users by the millisecond to understand exactly which customer journeys exhibit confusion or drop off.

Operationalising data to improve business performance is already being done by many organisations, and we believe it will become a defining competitive advantage of the future. No longer will data be used to retrospectively evaluate an organisation's trajectory (sometimes referred to as driving by looking in the rear-view mirror). Instead, new data infrastructures and sharing ecosystems powered by next-generation databases and data-exploration tools will expose information to people and organisations on the front line, helping them take decisions and actions in minutes rather than in weeks or months.

Achieving data enlightenment and data sharing

People who are graduating from school now grew up with the Internet; they are digital natives. If they have a question, they want to look up the answer immediately. And if the answer is not at hand, their natural reaction is to think how a bit of code could solve problems big and small.

In fact, digital natives are data-driven. They naturally seek opportunities to operationalise data. They consult data before developing new products, speaking to customers, or designing a new idea.

Innovative companies find great ideas through experiments which are pushed into production and then data is gathered to assess whether the experiment resulted in a positive outcome. Data empowerment is driving their innovation process.

Within the EU there is an urge to establish a fully functioning data economy, and to do this in a way that supports SMEs and emerging businesses¹²⁹. As we discussed in the *Governmental Priorities* (p.55) and *Privacy* (p.58) chapters, certain regulations constrain exactly how this data economy should be formed, the most noteworthy points being data minimisation and protection of personal information. As such, large and rich (in terms of data) organisations are encouraged to open their data sources to smaller businesses to encourage innovation and an efficient data economy.

Globally, and especially in the technology world, business leaders are now often from a generation that were exposed to technology much earlier than previous generations. They are the first generation to grow up with technology – they are not afraid of it, they are highly conscientious, they have built communities and they know how to get the best out of advanced technology. They have done this by working openly and sharing, leading to an appetite for open sourcing, decentralisation, peer engagement and involvement. This requires that the state of the community as a whole is more open and supportive and, at the same time, more aware than ever of what advances are being made by peers and the competition. As society and business become more technology and data driven, the responsibility of maintaining

129 https://ec.europa.eu/info/sites/default/files/communication-european-strategy-data-19feb2020_en.pdf

the reputation of an organisation falls increasingly on the technologist, rather than on the businessperson.

Opportunities arising from the data economy

Opportunities for merchants -

There are a number of ways in which merchants can benefit from the data economy by leveraging both operational and consumer data. Consider the scenario where a merchant can perform collaborative analytics with other local services or merchants. In this way the merchant can have a clearer view of the locale in which they are operating, and of their customers. Beyond this, secure data sharing allows merchants to gain a full view of customer activity, both online and in physical stores.

Opportunities for banks - Some of the greatest data challenges that banks face are that of fraud detection and management, and implementing good anti-money laundering and know-your-customer (KYC) practices. Taking fraud as an example, within a data economy, several banks could collaborate and contribute data to train better fraud detection models [such as those discussed in the [Digital Theft and Fraud chapter \(p.39\)](#)].

Opportunities for consumers -

The rise of a data economy raises questions about who controls data, what is consent and how transparent are the processes, amongst other things. At the same time, building an infrastructure to facilitate a data economy lends itself well to fine grained control in answering the above questions. With the establishment of a data trust, there is a choice over who should be the custodian of the data. One of the key trends is for the

end-user to be the custodian of their own data, having greater transparency over where it is shared and how it is being used. Data sharing can also enhance financial inclusion by allowing consumers able and willing to share data across services to access banking products where previously they may have been restricted.

The most effective solutions can only be realised through the secure sharing and processing of increasing amounts of data from different sources

Opportunities for society - The data economy aims to bring many benefits to society, notably for medical research, efficiency in smart cities, promoting innovation, reducing inequality, but perhaps the most pressing, for sustainability efforts. The most effective solutions can only be realised through the secure sharing and processing of increasing amounts of data from different sources.

Core Considerations

In growing a functional data economy, there are a number of core considerations that will need to be taken into account.

Regulatory frameworks - Considering that the emergence of a data economy will influence our personal, social, civic, and industrial lives, the way regulatory frameworks are established will have a strong influence on our payment experience and of technology going forward. As we saw in the [Governmental Priorities chapter \(p.55\)](#), nations are recognising the potential of the data economy and proposing legislation to stimulate it whilst also seeking to protect

citizens and businesses [as discussed further in the [Privacy chapter \(p.58\)](#)].

Next generation technologies and infrastructure -

As the volumes of data increase and as technology advances, there are many ways in which the data economy can be built. The choices made as to which technologies are deployed and how they may be combined will shape the data economy and its services.

Growing data (and digital) awareness -

Although data is seen as a valuable resource for businesses, so far there has been little transparency in how it is used. This is often to protect business secrets, but it comes at the cost of the end-users having little or no view of how their data is being used. The level of transparency, the extent to which citizens can see how their data is being used and how much control is given to them, will also have a great effect on how the data economy is shaped in the years to come. Beyond this, also having transparency in and between companies will have an effect on the pace and stability of growth of the data economy.

Sustainable design -

The environmental crisis is an immediate and pressing concern, and data insights could be one of the greatest tools available to increase understanding about the world, to correct mistakes and for personkind to move forward and grow conscientiously. For example, Worldline has partnered with FinTech ecolytiq, to provide people with insights about their carbon emissions by analysing their banking transactions¹³⁰. This shows how, in the same way that data helps to support customers, society, and industry with data services, it can also enable collaboration and support the learning and sharing of sustainability insights.

The Data Economy		
Changes	Challenges	Choices
<ul style="list-style-type: none"> The amount of available data will continue to rise Businesses who understand how to share and leverage data will out-compete those who do not New regulations and new technologies will enable a new economy to emerge: the data economy 	<ul style="list-style-type: none"> Data sharing must be conducted in a way that is compliant with legislation and maintains the reputation of the companies involved Leveraging the data economy may require a significant change in mindset for many traditional businesses 	<ul style="list-style-type: none"> Which data do you already collect or could you access and how could this enhance your existing operations or enable new business models? How could data sharing further enhance your business? If you do not do this already, how could you implement security, privacy and ethics by design?

130 https://worldline.com/en/home/pressroom/press-releases/2021/pr-2021_31_08_01.html

Counterfeit Detection at Scale

Increasingly we see that consumers want to be sure about the authenticity of the goods they purchase. Furthermore, brands are also wary of merchants selling counterfeit versions of their products.

Large corporations have built blockchain-based solutions¹³¹ to protect their brand and revenues. However, today, these individual solutions are technology, infrastructure, and resource intensive and hence not built to operate at scale.

The counterfeit goods explosion

The trade of counterfeit and pirated goods has been on the rise, and the result is a trillion-euro black market that has impacted merchants in most of the OECD countries¹³². In 2020, this has started to impact not just merchants, but also governments of non-OECD countries as well, given that this trade also leads to job losses and tax evasion¹³³.

Some known countries have dedicated markets and established

manufacturing units focussed on producing and exporting counterfeit goods¹³⁴. Traditionally, these practices have thrived on the cash economy. However, with the shift towards online shopping and the surge in the popularity and adoption of online marketplaces, it has been observed that the majority of this trade in counterfeit goods is moving to third-party seller systems on these marketplaces¹³⁵.

The product segments impacted by counterfeiting are very diverse. However, luxury goods (including watches, perfumes, leather goods, sunglasses, footwear, clothing, etc.) are the most targeted product category based on seizure statistics¹³⁶. Because they have been heavily impacted by this trade, there have been several attempts by global luxury brands to enforce anti-counterfeiting legal actions across the globe, but these have not been able to curb counterfeit activities. Owing to this, brands like LVMH, Prada, and Richemont have now partnered to build the Aura Blockchain Consortium to fight counterfeit goods¹³⁷.

The solution built by this consortium will match a Product ID against a Client ID to validate the authenticity of the product. This will also enable consumers to access trusted data about the entire lifecycle of a product, with no need for third-party verification. This is a major step towards counterfeit prevention and detection.

Conceptually, the solution is similar to the token-based infrastructure that Worldline already uses today to store card data securely so consumers can reuse them for payments again at their known merchants. We believe that a similar token-based system could provide a simplified mass-market solution for all brands¹³⁸.

In addition to the counterfeit of luxury goods, the sale of fake foods and drugs has been rising as well. Beyond the long-standing sale of illegal alcohol and cigarettes¹³⁹ we are now seeing consumers cheated with fake weight loss pills and other pharmaceutical products.

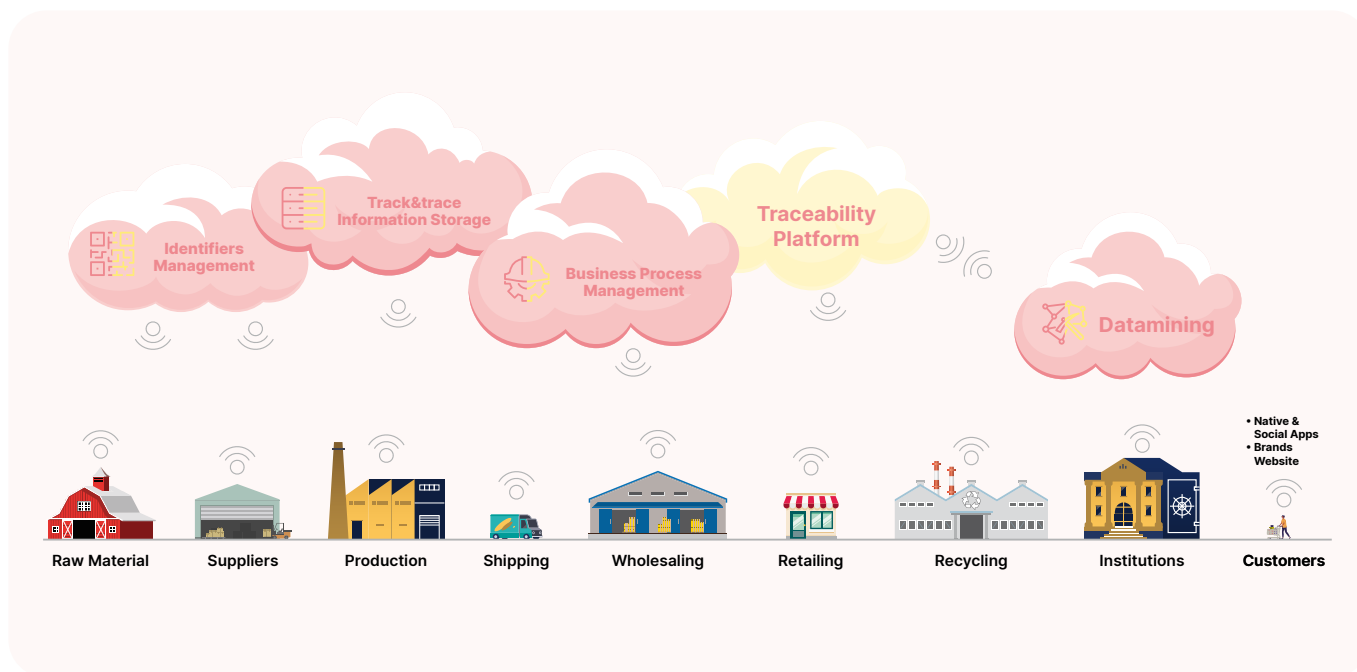


Figure 28: Worldline's traceability solution.

131 Blockchain for Business by JMLSingh Arun, Jerry Cuomo and Nitin Gaur (2019)
 132 <https://www.oecd.org/industry/global-trade-in-fake-goods-worth-nearly-half-a-trillion-dollars-a-year.htm>
 133 <https://daxueconsulting.com/counterfeit-products-in-china/>
 134 <https://www.redpoints.com/blog/turkey-the-counterfeiters-on-europes-doorstep/>
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 137 <https://auraluxuryblockchain.com/>
 138 <https://www.riddleandcode.com/tokenization-101>
 139 https://ec.europa.eu/anti-fraud/investigations/eu-revenue/cigarette_smuggling_en



Worldline has over a decade of expertise in developing traceability solutions. As illustrated in Figure 28, we have been one of the first companies to implement comprehensive product traceability systems between private and public sectors to combat illicit trade in all its forms¹⁴⁰. We have already built traceability solutions for our merchants to offer their consumers the possibility to track the origin of their products like tobacco and salmon.

The rise of NFTs

In recent times, the market for ownership rights to digital art, ephemera and media (known as NFTs), has exploded. NFT is an abbreviation for Non-Fungible Token, which is a unique digital identifier that cannot be copied, substituted, or subdivided, and is recorded in a ledger like the blockchain.

In April 2021, Zoë Roth sold her decade and a half old “Disaster Girl” photo that had turned in to a viral meme as an NFT on the blockchain. This NFT was purchased at 180 Ether [a form of digital currency that we described in the [Digital Currencies chapter \(p.25\)](#)]. The buyer of this NFT will be entitled to 90% of the royalties for future use of this meme, while Ms. Roth will still be entitled to 10% of all profits. Zoë Roth was not only able to demand a fixed fee for an easily replicable image, but also will earn recurring revenue from any royalties.

What is still not certain is whether there will be a long-term use case for all digital media currently being sold as NFTs. They are easy-to-replicate products that might be pirated easily. Nonetheless, there seem to be promising use cases around collectibles (first tweet, source code of the first website, etc.) and music that might drive the future of NFTs. Here NFTs provide a simple proof-of-ownership tracking token of a public/open-source digital media.

NFTs cross-over from digital to physical

Given that:

- There is an emerging need for a mass-market token-based solution on the blockchain for counterfeit detection
- NFTs have already been used for the same purpose but instead for digital media only

Could we soon see the use of NFTs for physical goods?

The Aura blockchain Consortium plans to implement an NFT like framework to validate the authenticity of the product and record its entire lifecycle. But the infrastructure changes required on the merchant side could yet prove to be a major blocking point in the market adoption of such a solution.

140 <https://worldline.com/content/dam/worldline-new/assets/documents/brochures/brochure-track-and-trace.pdf>



Counterfeit Detection at Scale		
Changes	Challenges	Choices
<ul style="list-style-type: none"> • The sale of counterfeit and pirate goods will continue to grow, including in the online domain • The use of NFTs to provide a proof-of-ownership for digital assets is gaining momentum • We expect there will be a need for an easy-to-adopt mass market solution (similar to NFTs) to prove the authenticity of physical goods 	<ul style="list-style-type: none"> • Solutions may not be easy to adopt, placing too high a burden on consumers and/or merchants • There is still uncertainty over the long-term use case for digital media being sold as NFTs 	<ul style="list-style-type: none"> • What is the impact of counterfeit and pirate goods sales on your business? • Should you build your own solution to guaranty the authenticity of what you sell, partner with others, or join an existing platform?



The goal is to build a simplifying bridge which shines a light into what the future holds, and enables a route to be planned for navigating digital payments.



Conclusion

When setting out on a journey, most people use a map to plan their route and then navigate their way along it to reach their destination. Nowadays, the map may be digital rather than physical, the route planning automated, and the navigation aided by satellite navigation, but the principle remains the same.

But there is no map of the future. So how is it possible to navigate digital payments, when, as we have seen, the pace of change is so rapid that today's innovations quickly become yesterday's legacy?

In the introduction, we highlighted a core dichotomy that exists in payments: behind-the-scenes complexity that is increasing, whilst consumers and merchants seek greater simplicity. This is leading to what we have called the Pay-Xperience gap.

In the rest of this report, we have analysed this from the perspective of three dualities:



Unification Taming Diversification



Seamless Interactions Amidst Accelerated Digitalisation



Implicit Trust from Regulations

For each duality, we explored the key topics where we believe there will be significant changes in the medium term, and where we believe businesses need to start their preparations now. Overleaf we provide a brief summary for each topic of the key questions we think that every organisation needs to be asking themselves today.

Through our research, exploration and discussion of these topics, we have confidently concluded that the overall trend of a payment landscape that is growing in complexity is set to continue. We also see that many innovations are aiming to improve the customer experience, making it simpler and more convenient, whilst also ensuring it is safe and secure. Even innovations that don't initially set out to achieve this, will nonetheless only be successfully adopted when they do.

At least in the immediate future, the complexity of the payments landscape will not be reduced or disappear. In fact, counterintuitively, sometimes providing greater simplicity at the point of use may even require greater operational complexity to make it work.

The goal, therefore, is not to reduce or eliminate the complexity, but to build a simplifying bridge. We believe that understanding this goal helps to shine a light into what the future holds, and enables a route to be planned for navigating digital payments.

As the European leader in payments, understanding this complex landscape is our day-to-day business. We combine this deep expertise with a passion for finding innovative ways to help our clients deliver the best possible experience to their customers. We are there to help you build the bridge: reshaping customer experience by simplifying complexity.

Unpacking Customer Experience (p.18)

- How can you use data, AI and other new technology to boost the experience for your customers?
- How can you implement an optichannel strategy?

New Business Models (p.23)

- Can you adapt your business model towards servitisation, pay-as-you-use and pay-for-outcomes?
- How can you deliver or benefit from a glocal approach?

Digital Currencies (p.25)

- How will cryptocurrencies, stable coins and decentralised finance impact your business?
- How ready are you for this change and how ready are your suppliers and partners?

Context Aware Services (p.28)

- What are the most pressing areas of your business for hyperautomation?
- What pace of adoption and degree of autonomous decision-making do you need?

Green Payments by Design (p.33)

- What is your own payment related footprint?
- How can you collaborate with other stakeholders to drive progress towards greater sustainability?

Digital Theft and Fraud (p.39)

- How much of your fraud detection can you maintain and conduct in-house?
- How will you implement and apply new ML techniques to stay ahead in the fight against fraud?

The Digital Divide (p.42)

- How will the changing expectations of younger generations impact your sector?
- How will the digital divide impact your customers and how can you minimise it?



The Renaissance of Physical Stores (p.45)

- How could personalised services and immersive experiences boost your revenue?
- Which payment experiences will best support the overall customer experience that you want to provide, not just in-store but across all channels?

Autonomous Payments (p.50)

- Are your customers willing to provide more of their data in exchange for a reduction in payment friction?
- What new business models could be enabled in your sector through autonomous payments?

Governmental Priorities (p.55)

- As new ecosystems emerge (stimulated by Open Finance and greater sharing of data), what will be the role of your business and the value you offer?
- How secure and sovereign are your operations and how you could strengthen this?

Privacy (p.58)

- What benefits or consequences are there from deploying particular privacy protecting technologies in our business?
- As identity becomes increasingly digitised, how can you balance the needs of privacy with the needs to check people's credentials and prevent fraud?

The Data Economy (p.61)

- Which data that you already collect (or could access) could enhance your existing operations or enable new business models?
- How could data sharing further enhance your business?

Counterfeit Detection at Scale (p.63)

- What is the potential impact of counterfeit and pirate goods sales on your business?
- Should you build your own solution to guaranty the authenticity of what you sell, partner with others, or join an existing platform?

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About the Worldline Discovery Hub

The Worldline Discovery Hub identifies disruptive trends in our industry and helps our clients understand what this will mean for them, so that together we can create bold, innovative solutions. The hub is personally chaired by Worldline's CEO and Deputy CEO and is made up of diverse payment experts from across the group. Find out more about them and their latest publications at:

worldline.com/discovery-hub

About Worldline

Worldline [Euronext: WLN] is the European leader in the payments and transactional services industry and #4 player worldwide. With its global reach and its commitment to innovation, Worldline is the technology partner of choice for merchants, banks and third-party acquirers as well as public transport operators, government agencies and industrial companies in all sectors. Powered by over 20,000 employees in more than 50 countries, Worldline provides its clients with sustainable, trusted and secure solutions across the payment value chain, fostering their business growth wherever they are. Services offered by Worldline in the areas of Merchant Services; Terminals, Solutions & Services; Financial Services and Mobility & e-Transactional Services include domestic and cross-border commercial acquiring, both in-store and online, highly-secure payment transaction processing, a broad portfolio of payment terminals as well as e-ticketing and digital services in the industrial environment. In 2020 Worldline generated a proforma revenue of 4.8 billion euros.

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infoWL@worldline.com



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