

# Digital Receipt Study

## Drivers and Barriers to Adoption of Digital Receipts

A look into the future of digital receipts in Switzerland.

 KLAUS FUCHS, FABIAN SCHMID  
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### INDUSTRY PARTNERS

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# About the Authors

**KLAUS FUCHS**

Associate Research Director  
Auto-ID Labs ETH Zurich / HSG  
Klaus.Fuchs@autoidlabs.ch

**FABIAN SCHMID**

Candidate Master of Arts in Business Innovation HSG  
Master Thesis Student at Auto-ID Lab ETH / HSG  
Fabian.Schmid@autoidlabs.ch

## ABOUT THE AUTO-ID LABS ETH/HSG

The Auto-ID Lab based at ETH Zurich and at the University of St. Gallen conducts research in the field of next generation Internet of Things (IoT) technologies that will enable interfaces between users and objects, will revolutionize global commerce and provide previously unrealizable consumer benefits. Our current research topics include: AI Support for Health & Nutrition, Consumer IoT, Home Commerce, Industrial IoT. Learn more about our research activities in Switzerland: [www.autoidlabs.ch](http://www.autoidlabs.ch)

The Auto-ID Labs are an independent network of currently six academic research labs that research and develop new technologies for revolutionizing global commerce and providing previously un-realizable consumer benefits. The global Auto-ID research alliance includes ETH Zurich & University of St. Gallen, MIT, Cambridge University, Keio University, Fudan University and KAIST University. The Labs are run by the Auto-ID Labs Board of Directors which assembles the Labs research directors. Currently the board is co-chaired by Prof. Sanjay Sarma and Prof. Elgar Fleisch. The GS1/ EPCglobal Board of Governors serves as primary advisor. Learn more about our global research activities: [www.autoidlabs.org](http://www.autoidlabs.org)

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# 1. Why now?

While the Swiss retail landscape is still not yet adopting digital receipts on a large scale, other countries like Sweden or United Kingdom indicate that the adoption of digital receipts is finally happening. In Switzerland, especially the still large role of cash-based payments and low incentives for retailers seem to be primary barriers towards introducing digital receipts. Nevertheless, other European regions that are closer to becoming cash-less societies are already setting standards for the digitalization of the paper-based receipt.

As a result, new service providers all over the world are emerging and building new solutions for providing and processing digital receipts. In addition, there is a new political momentum towards increasing consumer rights through digital receipts (e.g. right for a digital receipt), as well as mitigating climate change by reducing the number of trees used for the production of billions of paper-based receipts that usually end up in trash cans. Also, case studies suggest that retailers can indeed benefit from the introduction of digital receipts as they allow for faster checkout times and reduced workload at the point of sale. Even from a health perspective, research on toxicology suggest that regular exposure to chemicals contained in paper receipts that contain bisphenol can amount to serious health issues for cashier personnel and consumers. Finally, the electronic invoice (also called e-invoice) which is inherently similar to digital receipts, has experienced strong adoption growth over recent years after successful standardisation, indicating that a similar international standardization is possible for digital receipts.

In today's world that experiences a constant merging of physical retail and e-commerce, where consumers are already used to a fully digitalised process, paper-based receipts seem outdated, inadequate and impractical. Therefore, one could expect that digital receipts will be adopted around the globe over the next decade. But even as we experience these early-stage pivotal moments in the adoption of digital receipts, the pace and diffusion of digital receipts in Switzerland still remains very difficult to assess. Therefore, the Auto-ID Labs ETH/HSG, a cooperation between ETH Zurich and University of St. Gallen (HSG), have conducted this research study on "Drivers and Barriers to the Adoption of Digital Receipts" and have been assessing various topics related to the current and expected adoption of digital receipts. In this study, we present our findings from a user survey of 239 Swiss consumers, interviews with 12 (international) domain experts, an interactive focus group workshop and a lot of desk research.

We wish you an interesting read,  
Klaus Fuchs & Fabian Schmid

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# 2. Motivation

## 2.1. STUDY CONTENT

In the context of this research study significant desk and literature research, an online user survey of 239 Swiss consumers, personal interviews with 12 (international) domain experts and an interactive focus group workshop were conducted. The goal of the study is to identify current drivers and barriers to adoption of digital receipt and to anticipate future developments in the Swiss retail industry in regard to the adoption of digital receipts.

## 2.2. DEFINITION: DIGITAL RECEIPTS

In this study, the following definition is used to define a digital receipt: We understand digital receipts (also referred to as eReceipts or electronic receipts) as machine-readable, electronic substitutes for their contemporary paper-based printed counterparts. Typical technical implementations store purchased products as line items, transaction time and location, basket size and corresponding value-added taxations within a structured file (e.g. XML format). A digital receipt can for example be received after the payment e.g. by credit card or mobile payment, or in also after a cash payment and subsequently identification of a consumer (e.g. via loyalty card). Digital receipts promise significant advantages in regard to environmental footprint (Varghese, 2018), mitigating tax evasion (Caicedo, 2018; Cathy Koch, 2016) and offering superior advantages and transparency for consumers (Johnson, 2014), e.g. via digital guarantees that can be redeemed even if a paper receipt has been lost. Non-machine-readable, unstructured receipt data, e.g. in word format or as digital photos of paper receipts are not considered to be digital receipts.

## 2.3. DEFINITION: E-INVOICE

Although defining a similar construct as the digital receipt, the term electronic invoice (e-invoice) is clearly different to digital receipt. E-invoicing is defined as the invoice exchange between supplier and buyer (usually B2G or B2B) in an integrated electronic format. The standard most frequently used is PDF/A (data online provided) and within the German speaking area usually follows the ZUGFeRD or Factur-X standard (which are also increasingly interoperable). Similar to (digital) receipts, e-invoices must also follow compliance standards and contain details on value added taxation (VAT), transaction timestamp and details on the ordered products and services and their origin. E-invoices are in this sense quite similar to digital receipts, as they contain similar details, yet they are inherently different, as an invoice has usually not yet been paid (in contrast to a digital receipt). Further, a digital receipt is usually exchanged in a B2C transaction, while e-invoices are today usually exchanged in B2B or B2G transactions. Scanned paper based or unstructured invoices are unsuitable for e-invoices. (Dieter Pfaff, Ursula Sury, Yves Gogniat, 2016).

### 3. Current Drivers to Adoption

In this chapter, we will identify the current drivers to adoption of digital receipts in Switzerland. Besides general enablers like the increasing share of cash-less and mobile payments and an increasing regulation to protect consumer rights (e.g. general data privacy regulation (GDPR)), concrete, current dynamics stimulating adoption of digital receipts are explained herein forth.

#### 3.1. CONSUMER RIGHTS FOR DATA PORTABILITY

The previous paradigm that consumer data is only accessible to retailers and not shared with the individual consumer, is changing as regulators are introducing new data protection laws that equip consumer with the right to access their own data. Today, brick and mortar as well as online retailers collect consumer data and conduct analytics for business process and customer experience optimization. Such analyses can support product design and personalized recommendations based on transaction data (Nati, 2018). While in the past, consumers did not have direct access to their data traces, a shift in the minds of consumers and regulators has taken place, such that consumers today demand increased transparency regarding their personal data (Nati, 2018). Especially with the introduction of the European General Data Protection Regulation (GDPR) which is also further discussed in the chapter regulatory trends (see chapter 6). Consumers can nowadays request and receive their own personal data in machine-readable electronic form (data portability). This shift represents a major regime change in the power dynamics between consumers and retailers, and allows consumers to request their data, including digital receipts from retailers (via a three-corner model, e.g. loyalty card program). Examples of consumer applications that already manage digital receipts in the name of consumers include for example Kivra, the mobile application in Sweden.

This aspect creates new opportunities to build novel applications that process consumer data outside the original data generating services that understand consumer behaviour better and deliver additional value on existing data. Important aspects of managing consumer data (internally and externally the original service), covering digital receipts, include providing the purchaser with consent management and an option for the customer to review and select the data shared. Lastly, the enterprise collecting the data should return value to the consumer in a way that the shopper remains willing to share their data (Schoop, 2016). An example of an advantage of digital receipt would be providing a digital warranty and thereby improving the ability for the consumer in product warranty management. Such service could remind the buyer before the end of the guarantee period (example from the EU digital guarantee paper). Another potential advantage would be eliminating receipt loss - a study by Capital One shows that 42% of people did not reclaim

their money due to lost receipts, which resulted in an average loss of £ 168 per worker per year of London worker working for Capital One (Guryakov, 2012). Another possible use of a digital receipt for enhanced consumer rights are automated processes of claiming tax-free refunds, travel expenses and processing warranties, thus make the process of claiming expenses more efficient and faster than scanning paper receipts.

Whether the right to consumer data will be extended in the near-term to single transactions (e.g. single payment with a credit card) and include the respective digital receipts, remains unclear. This would indeed have potential to bring digital receipts to the masses. Albeit this 'right to a digital receipt' is currently debated in the Swedish parliament and also mentioned in the EU paper on digital warranty, there is no clear timeline for the introduction of such a 'right to digital receipt' for single transactions, nor has it been introduced in any country yet, mentioned by the expert.

#### 3.2. SUSTAINABILITY

In times, where climate demonstrations and strikes are becoming increasingly frequent, a likely permanent shift in the mind of consumers has taken place. Sustainability and the environmental impact of our consumption is gaining importance for more and more citizens (Taylor, 2019). Also, in early-adopting regions like Sweden, sustainability and protection of the environment are definitely key drivers to adoption of digital receipts.

The production of paper receipts requires different natural resources, including wood and bisphenol. In Sweden which has a population of ten million inhabitants and therefore is of similar size when compared to Switzerland, an estimated 60,000 trees are cut per year to provide consumers the currently required 1.5 billion paper-based receipts (Sarenmalm, 2016). This equals three central parks every single year. Another study estimates that in the UK there would be annual savings of 53,000 trees and 1.2 billion of paper-based receipts when adopting to digital receipts (Abernethy, 2019). Finally, a similar US study expects saving of 12.4 million trees every single year when adopting digital receipts (Moghe, 2018).

Moreover, paper receipts usually contain bisphenol A (BPA) and bisphenol S (BPS), which is used to produce a long-term print through a fast process via heat induction at the point of sale. Unfortunately, bisphenol A is also a harmful chemical. Bisphenol influences the production of oestrogen, negatively influencing reproductive health and development (Leutert, Mavromati, & Stallmann, 2010). The absorption of bisphenol happens through the skin when touching the thermo paper receipts, and therefore effects cashier personnel as well as all consumers (Porras, 2014). The thermo paper is the number one source of the health threatening bisphenol. Recent studies in which researchers analysed the impact

of bisphenol in various contexts, support this hypothesis. Furthermore, thermal paper receipts which were collected at 58 sites in the USA were tested positive for bisphenol and in 94% of the samples their concentration was high (Liao, 2011). In addition to being unsustainable and harmful, the thermo paper fades away quickly, potentially making it unreadable for warranty purposes or product recall (Sorensen, 2019).

Also in Switzerland, a member of the national council in Switzerland recently handed in a first interpellation with the aim to avoid paper waste by reducing the number of printed receipts at the cashier desk (Eymann, 2019). Globally there are different developments on motivating digital receipts for their environmental advantages: Legislation in California is now promoting digital receipts due to health concerns for cashier employees, with the aim of becoming a paper receipt free state (Daniels, 2019). Also, there are two petitions in the UK (Beattherceipt) and the US (Skiptheslip) that are demanding the ban of paper-based receipts for their environmental burdens. These examples show that ecological concerns about paper receipt are rising in Switzerland, Europe and around the world. Whether the direct consequences of the environmental debate are the immediate mid-term introduction of digital receipts remains to be seen. In the US, New York is aiming to ban all bisphenol A from paper receipts, and in Switzerland, Lidl as a pioneer abolished the default printing of paper receipt all over Switzerland. Lidl Switzerland now only provides a paper receipt if requested by the customer (Iseli, 2016). Still, the environmental debate continues with digital receipts having a clear advantage when it comes to ecological footprint.

### 3.3. FASTER CHECKOUT AND REDUCED LABOUR COST

Digital receipt and e-invoices are expected to also have a positive impact on labour cost and transaction cost due to more efficient processes at the point of sale. Today, transaction cost includes preparing, sending and receiving printed receipts or invoices. A study found out that the adoption to e-invoice and digital receipts has huge potential for financial savings. The researchers estimate cost savings of e-invoices over all industries (B2B relation) in Belgium of approximately 2 billion Euros per year (Poel, Marneffe, & Vanlaer, 2016). Similarly, also digital receipt as an evolution of e-invoice are expected to have an impact in the B2C industry. Also in the B2C domain, e.g. in the retail context, labour cost can be saved and transaction speed increased by omitting the preparation (i.e. replacing rolls and ink), handing over and receiving the paper-receipt. A Finnish report quantifies the potential savings to approximately 800 million euros for companies in Finland alone (5.5 million population) due to digital receipt adoption (Valtiokonttori Statskontoret State Treasury, 2019).

### 3.4. MITIGATING TAX FRAUD

Taxes are the base of every government and therefore, a reliable tax collection process is needed. The digital transformation changes the interaction between tax authorities and taxpayers. There are some industries, for example the gastronomy industry, where tax fraud is frequently happening. One known example are manipulated cashier sales in Germany (Fröhlingsdorf, 2019), (Schubert, 2015), (Rudzio, 2014). These restaurants manipulate their revenues to avoid paying value-added tax. Overall, 30 billion euros per year in tax is lost due to manipulated point of sales systems in Germany alone (Fröhlingsdorf, 2019). In Switzerland, the fraud risk by manipulated cashier registers in gastronomy is not nearly as high, as mentioned in the gastronomy magazine (Bachmann, 2017). France for instance loses an estimated 3 billion euros in tax per year due to manipulated point of sales (Schubert, 2015). To counter tax fraud, different countries like Poland, Germany, Croatia are introducing digital receipts by law (albeit not on the end consumer level). In the future, point of sale systems must send sync their transactions with a central governmental register that will allow authorities to assess revenues and related taxes remotely. This development leads to upgraded, internet-connected, digital receipt supporting point of sale infrastructure across Europe and is estimated to increase tax revenues and tax compliance (Cathy Koch, 2016). In the future, this infrastructure could well support the introduction of consumer-directed digital receipts.

### 3.5. DRIVERS FOR DIGITAL RECEIPTS

With the introduction of the European General Data Protection Regulation that allows users to retrieve their own transaction data in 2018, the first building block on the road towards digital receipts seems to have been paved. An increasing number of politicians (e.g. in EU, Sweden, California, but also Switzerland) and petitions (USA, UK) are now calling for a transition away from paper- to digital receipts. The expert mentioned the example of the Kivra mobile app that is distributing over 1 billion digital receipts per year for Sweden's largest retailer ICA to consumers indicates that digital receipts will be shared via three-corner models first (e.g. via loyalty identifier), before four-corner models become adopted (e.g. via credit card). Still, the necessary infrastructure is being rolled out, also because a growing number of regulators require points of sale to be online and to sync their transaction data in order to prevent tax fraud. Finally, the globally increasing call for sustainability to mitigate climate change calls for a shift away from paper- to digital receipts. Still, there remains uncertainty to when a 'right for a digital receipt' law, or even a ban for paper-receipts can be expected. Based on our expert interviews and research, there is no region that currently yet actively mandates digital receipts for single transactions. Therefore, it seems unrealistic to expect such a digital receipt regulation within the next two years, despite the fact that there are many current drivers that accelerate the adoption of digital receipts.

# 4. Current Barriers to Adoption

In the following chapter, the report focuses on the consumer's and partner's ecosystem perspective and on currently still existing barriers towards the adoption of digital receipts.

## 4.1. RETAILER RESISTANCE

In the past, there existed a strong resistance amongst retailers to share transaction data with external organizations, which might hinder digital receipt adoption in the near future. The transaction data is usually used to forecast and analyse the consumer's behaviour, and in addition sold in aggregated form to companies like GFK and Nielsen for providing market research related services. In Switzerland, there are mainly two retailers, Coop and Migros, who have a combined market share of over 60% of the swiss market of retail sales in 2017 (GfK, 2018). Similar to other retailers, also they prefer to have their own database about their customer, attempting to tie them with the company (Diginno, Republic of Estonia, 2019). It will likely take increased competition and potentially regulatory mandate, until digital receipts become a de-facto standard like they seem to become in Scandinavia.

## 4.2. DATA PRIVACY

Fearing misuse of private data, consumers expect transparent communication and intuitive consent options to give, review and withdraw their approval for processing their data. For example, consumer might hesitate to insert their email address or mobile phone number at the point of sales, e.g. when wanting to identify a consumer for sending a digital receipt after a cash payment. The fact that people have doubt to share personal information with strangers might make ubiquitous digital receipt adoption very hard or even impossible when consumers cannot be identified automatically, e.g. via login, credit card or mobile payment (Moghe, 2018). As most digital receipt setups digital receipts require an identification of a consumer, without identification at the point of sales no digital receipt can be sent. Additionally, companies are afraid of data leakages which could damage their image and existence and therefore might refrain from introducing digital receipts, as they require means of contact, such as email address, telephone number or identification in an application (Reisinger, 2019), (Pero, 2019). Furthermore, cyber-attacks are much more possible threats in a digital world than with common paper-based receipts, further hindering adoption of digital receipts (Diginno, Republic of Estonia, 2019).

## 4.3. LACK OF STANDARDIZATION AND INFRASTRUCTURE

The retailer industry is in a significant transformation phase, with traditional retailers being challenged by online retail and a lot of stores closing down ('retail apocalypse'). This development was mentioned by the expert. Therefore, retailers are currently focussing on core projects centred around maintaining revenues and profitability, rather than setting up digital receipts. Regarding adoption of digital receipts, retailers have usually two concerns: Firstly, this means investment in infrastructure and training, and secondly, this results in the loss of the monopoly on the collection of consumer data. Providing the consumer with digital receipt needs compatible infrastructure. Adoption means high investments and a lot of time to adopt. As a consequence, the motivation for the retailer to invest in digital receipt is relatively low, unless the receipts are distributed via the retailer-controlled mobile applications or customer emails. Additionally, the service does not generate revenue directly, but could be seen as a risky investment per se. While the customers might benefit from digital receipts, they are not expected to be willing to pay for the added service. In Switzerland the digital receipt sent are mostly appearing in the e-commerce sector and associated with PDF-based receipts. In the e-commerce industry, the purchase payment process is already digitalized enabling digital receipt to be implemented more quickly. Digitec Galaxus for example, maintains user-specific digital receipts for the provision of digital guarantees. Plus, the current lack of a Swiss-wide or European-wide standardization of digital receipts compounds the issue of adoption. Many retailer chains still rely on old, outdated point of sales software resulting in missing application programming interface (API) or integration capabilities (Moghe, 2018). The crucial challenges remain in the fragmentation of the point of sales system provider market, resulting in weak cooperation and lack of cross-border standards (Diginno, Republic of Estonia, 2019).

#### 4.4. PREFERENCE FOR PAPER-RECEIPTS

The use of digital receipt requires a change in consumer behaviour and a lot of consumers still seem to favour paper-receipts over digital receipts. Changing habits of the population is a slow process and needs time. In the field of payments for many years people paid with cash and exchanged goods for cash. Through the digital transformation new ways of payments came up, e.g. credit cards and, later, mobile payment. In Switzerland, the population still prefers to pay in cash, with about 70% of all transactions being cash payments (Torcasso, 2018). The anonymity of cash payment prevents an identification method to generate a digital receipt. As such, cash payment hinders the adoption of digital receipt, and as a consequence, a paper receipt is much simpler to generate as proof of payment. In the US, a majority (83%) of people over 55 years old prefer the paper receipt to new solutions (Ballard, 2018). Overall, there are still 68% of the population who would rather have a physical receipt than a digital receipt (Ballard, 2018). Another aspect is the fact that some citizens still do not have the knowledge about or even the access to mobile devices such as smartphones which could provide the possibility to access digital receipts (Diginno, Republic of Estonia, 2019). The described missing critical mass acceptance of digital receipts might result in a slow adoption of digital receipts.

#### 4.5. BARRIERS FOR DIGITAL RECEIPTS

In summary, the most relevant barriers in the adoption of digital receipts are retailer resistance, lack of standardization and infrastructure, data privacy and the fact that a lot of consumers still prefer the physical receipt over a digital one. It can be expected that retailers will mass-adopt the distribution of digital receipts, once they are required by regulation or when they become a de-facto standard for cashless payments. Before that, stakeholders using a three-corner distribution model (e.g. loyalty card based) and selected retailers wanting to support digital receipts could introduce them as optional alternative to paper-receipts. It is clear that there is the need of a multi-country digital receipt standard, which should be focused on by the ecosystem partners (Diginno, Republic of Estonia, 2019). Further, digital receipt stakeholders should implement data privacy compliance and security measures into their infrastructure, as it remains a high priority and barrier towards adoption. Finally, with not every consumer having a preference for digital receipts, it should be clear for which retailers a consumer receives a paper- and for which a digital receipt will be sent. The digital receipt introduction should therefore follow an opt-in process at first, before digital receipts become an opt-out standard. This could be achieved by asking consumers to actively connect loyalty cards to payment means, or by having them to opt into digital receipt distribution per retailer, similar to selecting eRechnung (eBill) providers to be connected to a bank account today in Switzerland.

## 5. Selected Service Providers

In this chapter existing providers are introduced, evaluated and categorized in order to present an overview of the international digital receipt ecosystem.

#### 5.1. CURRENT STATUS

Digital receipts are still a niche solution in the overall digitalization process of payment in retailer chains. While digital receipts are still not a main focus of retailers or payment providers yet, there exists quite a number of solution providers and start-ups active in the space and there are early adopting retailers that are already providing digital receipts to their consumers.

For example, retailers and solution providers in Sweden seem to be leading in regards to digital receipt adoption and solution providers. This is little surprising, as the Swedish population is tech-savvy, much more open towards mobile and card-based payment, and more supportive of environmental protection (e.g. CO<sub>2</sub> taxation, Greta Thunberg), resulting in a higher motivation to use digital receipts was mentioned by the expert. In Switzerland the main grocery stores, Coop and Migros, are providing the customer with digital receipt through their loyalty card networks. Both have their in-house solution and are using different channels to their consumer. During our research, also providers from other regions such as United Kingdom, Australia and USA were identified. In these regions, the existing digital receipt solutions are mostly end-consumer oriented, indicating interesting alternative architectures towards the current Swiss digital receipt approach that is only loyalty card based. There exist even implementations on four-corner, credit card based digital receipt infrastructure (e.g. Flux, UK). In such a four-corner infrastructure, that digital receipt is produced at the point of sales and sent to the acquiring bank along with an anonymous token from the paying card. The issuing bank can then use the receipt and token to distribute the digital receipt to the chosen application of the end consumer. There exist very different methods for the identification of the end consumer, ranging from automatic identification via credit card, loyalty cards, and to manually entering one's telephone number or email at the point of sales.

## 5.2. CURRENT PROVIDERS

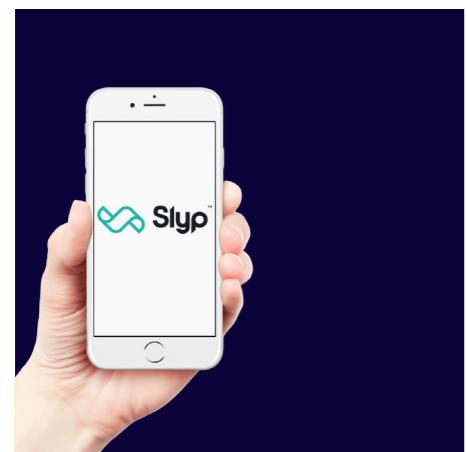
In this chapter the current provider and their services are discussed. Overall, more than 30 providers were identified, and their service models were analysed. These service providers are operating in different industries, including in-house solutions for retailers, loyalty / cash back cards, third-party solutions, receipt storage services and mobile payment services. Additionally, technical features, localization in the four-corner model (see chapter 8) and the identification are described. Providers are using the possibility of sending the receipt directly to an app, by email or SMS to the registered customer. The following service provider are examples of existing and well-developed solutions.

### Flux



Flux is a service provider established in the United Kingdom in 2016. They are offering a service to integrate your digital receipt directly in your banking app. The identification occurs via credit card at the point of sales. In the four-corner model, they are integrated into point of sales/retailer and capture the credit card token as well as the digital receipt, which they then share with issuing banks (e.g. Sterling's, Barclay's, Monza).

### Slyp



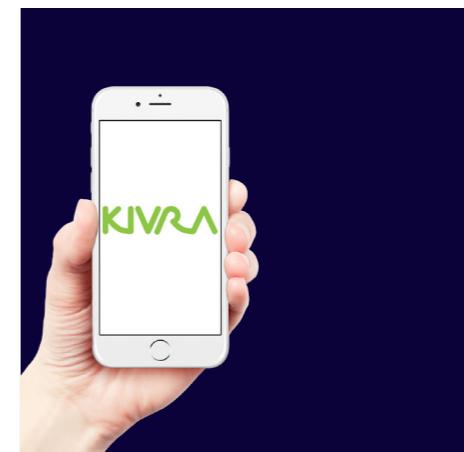
Slyp is a service provider that was founded in 2017 in Australia, Sydney. The identification is also linked to the consumer's credit card. Slyp created a network among the four biggest banks in Australia, offering a smart receipt, which is automatically stored in the banking app. In the four-corner model they are integrated into point of sales/retailer and capture the credit card token as well as the digital receipt, which they then share with participating issuing banks.

### Migros Cumulus



Migros as one of the biggest retailers in Switzerland is offering digital receipt in their own Migros Application. The identification is done at the point of sale by scanning the Migros Cumulus card, a loyalty card (three-corner model). At the cashier, there is still a paper-based receipt printed. Additionally, consumers can access to recent purchases in the application.

### Kivra



Kivra was founded in 2011 in Sweden. Kivra is a digital hub that allows users to create a digital mailbox to receive, upload and store mails including digital receipts. Once linked to the e-banking the receipts are paid with one click. In the four-corner model they are acting as a new provider besides acting as a digital mailbox they are connected to an issuing bank.

We listed selected providers in the table below. In the last column, providers are rated based on their technical maturity and overall solutions regarding the provision of digital receipts, offering added services or providing infrastructure (terminals at point of sales).

### 5.3. SOLUTION PROVIDER LANDSCAPE

Many service providers are emerging aiming to substitute paper-based receipts with digital alternatives. While the trend towards digital receipts seems clear, a dominant channel to distribute digital receipts has not been established just yet. Still, banks seem to play an important role in the digital receipt development, as the examples of Flux (UK) and Slyp (AUS) indicate. KPMG mentioned in an article that banks could generate new revenue streams by providing services to the retail and dining checkout industry (Davidsen, 2016). Banks could leverage their position of having already existing relationship with customer with new services and offer start-ups or retailers to integrate digital receipts into their banking applications. Such a service could be paid by the merchants and guarantees added post-purchase value to customers.

**Table 1** Overview Selected Service Providers

Name	Focus	Web	App	Email
adminapp	The adminapp directly feeded from the POS network partner. The app enables digital receipt management / archive.	No	Yes	No
Apple Card	Creating a new Credit Card in cooperation with Goldman Sachs providing lowest interest rate in the industry.	No	No	No
bitsaboutme	Bitsabout.me enables an overview about your purchases and your generated data in the internet. Thanks to digital receipts bitsabout.me creates a nu	Yes	Yes	No
Cardivation	Cardivation offers digital receipts and loyalty offers to customers plus insights to merchants eg. petrol industry.	Yes	No	Yes
Coop Supercard	Loyalty Card, which identifies the customer at the till by their loyalty card. The service offers digital receipt .pdf sent by email.	Yes	No	Yes
digibon	digibon is providing a smart receipt when paying at the cashier when paying by credit card. The receipt is stored where the user wishes (App, ebanking). Digibon provides a QR code at the cashier to scan and download the receipt for other payments.	No	Yes	No
Digital Receipt Exchange	Enables through loyalty card, bank card, RFID, account number, email or phone identification a digital receipt. The digital receipt is sent directly to the customers app.	No	Yes	Yes
EcoSlips Digitisation Service	EcoSlips enables digital receipts when entering the EcoSlip PIN at the till.	No	Yes	Yes
erebbo	Real-time delivery of digital receipts from any point of sale to the customer. Enabling an easy integration of customer data for the merchant.	No	Yes	Yes
eQtiq	eQtiq - Receipt 2.0 a secure, easy and eco-friendly digital receipt archive – your purchasing history is stored automatically and is always accessible.	No	Yes	No
Flexengage	flexEngage's electronic receipts are a smarter, more engaging alternative to paper receipts. Our dynamic email receipts feature rich html data and are easily customizable.	No	No	No
Flux	Get full digital receipts automatically in your banking app as you pay with your bank card at any store in the Flux network. Never forget your loyalty card again. Get stamps in your banking app automatically as you pay. Get personalised offers sent straight to your banking app when you opt in.	No	Yes	No
foreceipt	foreceipt is the easiest way to turn your receipts, bills and invoices into digital data you can use. Through scanning your receipts or directly processing your email receipts a expenses report is created.	No	Yes	No
Google Pay	Google Pay is enabling payments online and instore with the app or on the desktop, including purchase items (e.g. apps, subscriptions, movies, products)	No	Yes	No
Hadley	Hadley is a consumer-facing assistant that uses artificial intelligence (AI), machine learning and natural language processing (NLP) to facilitate conversations with your shoppers after they make a purchase in-store and online. Hadley powers Live Receipts and Returns, two solutions that work together seamlessly thanks to a single platform and synced data.	No	No	Yes
ID24	This digital receipt solution combines in store customer facing hardware via a 2nd display to collect the customers information and feed directly into a digital receipt. It also has the added benefit of the digital receipt software running on the retailers POS as an alternative to remove the need for more hardware in store.	Yes	No	Yes
Index	Provider of till payment solutions. Index offers a digital receipt solution sent by the email, for further purchases the email address is linked to the credit card.	No	No	Yes
itemize	itemize offers an app based solution to analyse the personal expenses. AI reads the receipts or the digital email receipts are uploaded automatically.	No	Yes	No
iZettle	Infrastructure provider - When the payment has been completed through the app the customer can send the receipt via email, sms or print the receipt.	No	Yes	Yes
Kvira	Kvira is a digital hub that allows users to create a digital mailbox to receive, upload and store mails including digital receipts. Once linked to the E-Banking the receipts are paid with one click	Yes	Yes	No
kwick Receipts	kwick Receipts provides the customer with digital receipt when paying with your payment card.	No	Yes	Yes
Migros Cumulus	Provides the loyalty card holder with complementary services of digital receipt over the last 18 month. The digital receipts are included in the retailer's app.	Yes	Yes	No
NCR	Offers a complete solution for retailers which is easy to roll-out. Providing the choice of a digital receipt over the traditional paper receipt will open up new opportunities for you and your customers	No	No	Yes
Oxebox	OxeBox is a digital receipts solution that helps users earn reward coins to save paper and email receipts on OxeBox mobile app. To earn reward coins users need to snap a picture of receipt and submit on OxeBox app. Frequent active participants also become eligible for bonus opportunities including short surveys, custom offers etc. All of which earn you even more coins and real money.	No	Yes	No
Proximant	Combines the receipts with coupons and sales from the stores	No	Yes	No
receiptHero	ReceiptHero delivers receipts automatically from merchants to your banking & accounting apps or other third party apps.	No	Yes	No
reebate.de	Stores your digital receipt and automatically gets you cash back	No	Yes	No
Sensibill	Enables digital receipt storage in the banking app. Managing warranty, different expenses private / business. Digital receipt are directly added to the app or paper based receipt are added by taking a picture.	No	No	No
SLYP	Slyp's proprietary retail technology enables an interactive and intuitive smart receipt (digital receipt) to be automatically delivered to a customer's Banking app post-purchase, without collecting customer data at point-of-sale.	No	No	Yes
Storebox	Application which enables the storage of digital receipt. The app is integrated into the merchants app and generate automatically a digital receipt.	No	No	No
Tail	Tail connects to your bank account and uses transaction data to personalize offers and give you cashback everytime you shop at one of retailer partners. By simply paying with the credit card the cash back goes directly to the account at the end of each week	No	Yes	No
TillBilly	TillBilly offers a solution for merchant to accept new payments (Cryptocurrency) and provides the merchant with digital receipt.	No	No	No
Transaction Tree	TransactionTree, Inc. is a provider of digital receipt solutions for the retail industry as well as other transaction-oriented enterprises.	No	No	Yes
Walmart	Walmart is providing you with a digital copy of your latest purchase.	No	Yes	No
Yreceipt	Yreceipt enables sending digital receipts to the customers by email, Sms, apps and other platforms. Different possibilities regarding identification are offered.	No	Yes	Yes

Customer facing Interface	Position Four-Corner Model	Year	Identification	Geographic	Quality Scale
Yes	other Provider	2020	Loyalty card	Germany	5
Yes	Processor	2019	Credit Card / Debitcard	USA	4
Yes	Provider digital receipt management	Not given	Visualization of all digital payment of one person	Switzerland	5
Yes	other Provider	launched in Sweden in 2015	Credit Card / Debitcard	UK	5
Yes	Merchant	2017	Supercard / Loyalty Card	Switzerland	4
Yes	other Provider	2018	Credit Card / QR Code scan	Netherlands	5
Yes	other Provider	Not given	Credit Card - Payment app	Sweden	2
Yes	other Provider	2018	Scan at the till	South Africa	2
Yes	other Provider	2009	not given	UK	3
Yes	other Provider	2019	other Provider	Switzerland	3
No	Merchant	2011	not given	USA	3
Yes	Bank	2016	Credit Card / Debitcard	UK	6
Yes	other Provider	not given	Scan the receipt or feed email receipt	Canada	3
Yes	mobile Payment	2015	Credit Card / Debitcard	USA	5
Yes	other Provider	2017	Scan at the till	Australia	2
Yes	other Provider	2008	Scan at the till	USA	3
No	other Provider	2012	Register at the till email - credit card	USA	4
Yes	other Provider	2010	Scan the receipt / upload email receipt	USA	3
Yes	POS Provider	2011	not given	Sweden	4
Yes	other Provider	2011	a digital post office box sourced by digital email	Sweden	6
No	other Provider	2011	not given	Sweden	2
Yes	Merchant	2010	Cumulus / Loyalty Card	Switzerland	5
Not given	POS Provider	as a company 1884	POS	USA	3
Yes	other Provider	2018	Snap receipt / forward email receipt	India	4
Not given	Not given	2011	not given	USA	2
No	other Provider	2018	Credit Card / Debit Card	Finland	5
Yes	other Provider	2016	none	Germany	4
No	Bank	2013	Snap the receipt	Canada / UK	3
Yes	Bank	2017	Credit Card / Debitcard	Australia	4
No	Merchant	2016	none	Denmark	4
Yes	other Provider	2016	Credit Card / Debit Card	UK	4
No	Merchant	2017	tillbilly card	Australia	3
Yes	other Provider	2009	not given	USA	3
Not given	Merchant	2014	POS - Telephonenumer	USA	2
Not given	other Provider	2009	none	UK	4

# 6. Current Regulatory Trends

In this chapter, the focus lies on the regulatory developments. First, the data protection law and regulatory trends in Switzerland are presented. Second, the General Data Protection Law (GDPR) is highlighted and the regulatory relationship between the EU and Switzerland are highlighted. Third, overall examples are given in a Swiss, European and worldwide context.

## 6.1. REGULATORY TRENDS IN SWITZERLAND

In Switzerland, there is not yet any special legal basis that mandates or regulates digital receipts for end consumers. There are also no clear indications that this would change in the near future. Based on our research, there are no relevant research papers dealing with this specific topic. However, even in the absence of a digital receipt regulation, any provider of a digital receipt service must of course still comply with the applicable laws that regulate the facilitation of receipts in the traditional sense. At first glance, the Data Protection Law (FADP) is of particular importance. In Switzerland, the Data Protection Law (FADP) aims to protect the personality and fundamental rights of the persons whose data are processed (Art. 1 FADP). In principle, the Data Protection Law must be observed by all (natural and legal) persons and also by federal bodies that process personal data (Art. 2 FADP). Art. 3 FADP defines the relevant terms in a relatively self-explanatory manner. Most importantly, these include:

- **Personal data:** all information relating to an identified or identifiable person.
- **Personal data notably worthy of protection:**  
including data on the health of the person concerned.
- **Personality profile:** compilation of data that allows an assessment of essential aspects of the personality of a natural person.
- **Processing:** any handling of personal data, regardless of the means and methods used, in particular the collection, storage, use, adaptation, disclosure, archiving or destruction of data.
- **Data collection:** any set of personal data structured in such a way that the data can be accessed by data subjects.

Providers of digital receipt services process data within the regulations of the Data Protection Act and must comply with its requirements. FADP contains the general data protection provisions which must be observed by the digital receipt providers.

**Art. 4** FADP outlines general principles concerning data processing, which must be observed by all people: in principle, personal data are processed lawfully, proportionately and in good faith. To put it simply, this means that the provider may only use the data within the legally permissible limits.

**Art. 4 (5)** FADP then states the principle according to which the user must voluntarily and expressed consent to the processing of the data. This applies in particular to the creation of personality profiles and also the processing of personal data particularly worthy of protection, such as health data.

**Art. 7 para. 1** FADP also obliges data processors to ensure adequate protection of user data by appropriate technical and organisational measures against unauthorised processing.

In addition, the FADP contains further requirements, e.g. in the event that the data is processed abroad or by third parties.

Concluding, there are no findings of any regulatory efforts that would specifically address digital receipts. The recent changes introduced in the EU and Switzerland regarding e-invoice are not to be considered for end consumer oriented digital receipts, as they only concern the invoicing process for public contracts. In the expert's view, it is unlikely that the subject of the digital receipt will be regulated independently for the following reasons: The three- or four-corner model is primarily a relationship under private law in which the state is basically not involved. In Swiss private law, the principle of private autonomy applies, which gives the parties the freedom to structure their legal relationships as they wish.

It is possible that certain new developments may be subject to regulation if this is necessary to fulfil certain protection obligations of the state. With regard to the digital receipt, however, the subject area is already relatively comprehensively investigated by the FADP and, according to the expert, digital receipt issue does not really give rise to problems that have never been encountered.

If authorities plan to work with digital receipt and include it in the transaction, this is less common that it would be instituted as the sole method of receipt (e.g. for the VAT statement), instead it is more common that the digital receipt will first be offered in addition to paper based receipt (e.g. e-invoice process).

But perhaps the following scenario is also conceivable to be extended towards digital receipts: According to Art. 88 OR, the buyer can demand a receipt from the seller. The buyer is entitled to it (i.e. has the right to it). However, future developments in the field of data protection must certainly be taken into account. The introduction of the General Data Protection Regulation (GDPR EU)<sup>2</sup> has only recently led to a relatively comprehensive and far-reaching reform in this area and will likely have similar developments in the future. Future providers of digital receipt services will likely have to adapt to the legal changes or requirements.

## 6.2. REGULATORY TRENDS IN EUROPE

In addition to the FADP of Switzerland, the General Data Protection Regulation (GDPR) offers private individuals more extensive rights and extended obligations for data processors. GDPR liberates the data sharing between the different players in the three- and four-corner model. GDPR enables consumers to request their own transaction data as data stream for the integration of their digital receipts, e.g. in a three-corner model.

Through GDPR, the data is available for the consumer and with data portability, a consumer's transaction data can be merged via consumer consent in the three- or four-corner model, e.g. for providing more transparency for the consumer. As a result, the consumer owns his own data and can share it with third parties to access value-added services. This regulatory development accelerates the development to digital receipt due to data interoperability and accessibility. In Switzerland, companies that process (store, collect, etc.) data in the EU are subject to GDPR, and with Switzerland ratifying GDPR in the near future, this circumstance is likely to be extended to Swiss consumers as well.

Overall the same applies as for FADP: both laws do not conflict with digital receipt applications, they simply have to be observed. This is done in consideration of the fact that the collection of such a volume of data (personality profile) is subject to strict data protection regulations.

Directive 2014/55/EU<sup>3</sup> states that it is binding for all EU member states to begin using e-invoices in the public sector after 18 April 2019. Applicable for cross-border e-invoices is the EU Norm semantic model using the UBL 2.1 or UN/CEFACT standards. These decision result in appropriate change in e-invoicing use. A limited number of member states allow the possibility of digital receipt as proof of purchase. These included Estonia and Finland which require that the proof of purchase is provided and archived electronically (Diginno, Republic of Estonia, 2019).

Based on the directive 2014/55EU, the Polish government introduced a requirement that the European public administration is able to receive electronic invoices from suppliers. The portal's name is "Platforma Fakturowania Elektronicznego" (PEF). The platform was introduced in April 2019 and targets the digitalization of the public procurement process and standardization of public procurement (edicom, 2018)

In Estonia digital receipt services enable the Estonian Money Laundering and Terrorist Financing Prevention act to achieve the goals set. Through digital receipt the cross-border accounting transactions are more transparent. Digital receipt enables better detection of suspicious transaction by accountants who are playing an important role in the fraud detection (Diginno, Republic of Estonia, 2019).

In Italy, B2B e-Invoicing is mandatory since 2018. Document digitalization within Europe is necessary for many reasons including to fight against tax fraud, allow more administrative flexibility and reduce bureaucracy complexity. In 2014, Italy introduced e-invoicing for B2G transactions and subsequently, in July of 2018, the ability for B2B transactions. In the beginning of this year, the B2B e-Invoicing became mandatory for all companies. As an incentive, Italy offers tax benefits when the organizations are guaranteeing the surveillance of payments higher than 500 euros (eespa, 2019).

In Croatia, a central platform was introduced in July 2019, which is mandatory for procurement procedures. Through the platform irregularities can be observed by the government. All intermediaries of e-Invoicing are obliged to connect (three-corner model of e-invoice exchange). The platform enables a standard for the protocol exchange due to a single connection to the access point (Ministry of Economy Entrepreneurship and Crafts, 2019).

Obligation for the retailer to provide a digital receipt could be mandated. Through the obligation to provide a digital receipt a critical mass of participants could be reached much easier. Using the public sector as a model for digital receipt and raising awareness for digital receipt would facilitate the adoption of digital receipt (Diginno, Republic of Estonia, 2019).

## 7. Expert Interviews

In the future, cross border digital receipt service could be the next evolution in the field of digital receipt. This development is supported by the initiatives in the EU, particularly by The Once Only Principle (TOOP). TOOP refers to the sharing and reusing of various data from businesses and citizens within the public administration. Regulation for the free flow of (non-personal) data would allow every organization to be able to process and store data in Europe. The authorities retain the data even though the data is stored in another state (Diginno, Republic of Estonia, 2019).

### 6.3. REGULATORY TRENDS AROUND THE WORLD

In the United States, the data protection law is different than in Switzerland and EU, namely consumers do not have a right to access their data in machine-readable format yet. Also relevant for digital receipts, a Californian lawmaker is discussing the potential introduction a new law for 2023 which would ban the retailer from printing out paper receipt unless the customer requests one (Daniels, 2019).

In Taiwan, a national e-invoice system was introduced in 2010. The platform allows for data exchange among multiple value-added companies and helps to build an eco-system suitable for e-invoice transmission. In 2011, the platform enabled consumers to manage and receive e-invoices and access to lottery results digitally. Additionally, participating companies can exchange e-invoices with public agencies. The newest generation includes various interfaces such as point of sale, kiosks, mobile devices and other institutions.

To further assess the current drivers and barriers to digital receipt adoption, interviews with twelve experts from different fields relevant to digital receipts were interviewed, including representatives from retail, technology, banking and payment processing as well as government institutions and lawyers from Switzerland. The interviewees were all based in Europe, with the exception of one expert who lives in Australia. The experts' backgrounds include technology in retail, supply chain and standardised logistic information systems, financial expenses monitoring, digital financial products, software engineering, digital retail, consumer protection and data protection law. The interview design was semi-structured, allowing to explore the experts' field of experience, while still capturing quantitative data as well.

### 7.1. SELECTED KEY STATEMENTS

All of the twelve interviewees were familiar with digital receipts. Most knew digital receipts from the e-commerce industry which are received by email, but almost all were also accustomed with store-based implementations of digital receipts. For example, in Germany the retailers Real and Rewe provide digital receipts options at the cashier. Another retailer in the B2B field is Metro (a retail store similar to Prodega in Switzerland), where customers access the store with member cards that are scanned at the point of sale and the corresponding receipt is then provided electronically. In Sweden, Kivra is an encrypted digital mailbox storing tax invoices, e-invoices and digital receipts. Kivra is the market leader in Sweden and achieved a big breakthrough for digital receipts, now planning to distribute over one billion receipts digitally per year.

In Switzerland, the digital receipt solutions of the big retailers Coop and Migros were stated enabling a structured PDF sent by email (Coop) and digital receipts within a mobile application (Migros) (see chapter on Selected Service Provider). In e-commerce, digital receipts are more adopted and established, as the whole checkout process is digital, and consumers are identified throughout the entire process. In Switzerland, retailers that were mentioned by the experts include Digitel, Brack and Microspot (all e-commerce companies) which provide digital receipts, including digital guarantees for purchased electronics (that were purchased on their own platform).

In the United States, a solution provider called Flexreceipt enables retailers to integrate their solution into the point-of-sale process to send email-based receipts to their consumers. Flux, which cooperates with United Kingdom banks and focuses on gastronomy and loyalty awards, is a four-corner model implementation of digital receipts and has integrations with credit cards from Barclay's, Starling and Monzo.

Several benefits of digital receipts were identified by the experts. From a retail perspective, possible financial savings are mentioned through the introduction of digital receipts. A relevant Finish study estimates the potential savings on the retailer side to amount to over 800 million EUR in Finland alone, as digital receipts allow for faster checkouts and reduced labour cost (Valtiokonttori Statskontoret State Treasury, 2019).

Legal experts identified the possibility of recall and storage associated with digital receipts. Interviews of experts from the fintech industry identified the possibility of future added services for customers, ranging from digital guarantee to automated product recalls.

Beyond the benefits mentioned above, the twelve experts mentioned several other benefits through the introduction of digital receipts relevant for both, consumers and retailers, e.g. environmental and monetary benefits as a consequence of reduction in paper waste and ink printing. Please find the corresponding benefits (and risks), including the number of experts who named these corresponding items in the semi-structured interview (in total 12 experts).

When interviewing experts from the retail industry, the main concern was losing their monopoly of storing and processing customer data. More concretely, retailers fear that competitors (e.g. online vs offline, direct competitors) could gain historic consumer data and benefit from that knowledge, for example by converting consumers via targeted offerings.

The most significant risks on the consumers side are risks related to data protection. For example, processing data for different purposes other than the receipt handover, or even misuse of customer data, were highlighted by legal experts.

The fintech expert highlighted the issue of a fragmented point of sales systems and industry, which makes the implementation of digital receipt difficult, e.g. for creating an internationally interoperable, cross-industry digital receipt standard.

In Switzerland particularly, the experts identified the high share of cash payments as one of the biggest barriers for adopting digital receipts.

Besides the identified benefits and risks, the interviews also gave an answer about the expected timing of digital receipt adoption. Overall, the experts consider that digital receipts will be provided for 10% of all transactions in the retail industry within less than 2 years (1.83 years). The experts also assume that 10% of sales providing digital receipts has already been implemented in e-commerce. Based on the expert interviews, it is likely that digital receipts will become integrated into the market soon. The current, public debates on climate change and the potential impact of banning paper receipts on reducing waste could also provide stimulus for this change.

**Table 2** Benefits and Risks of Digital Receipt Adoption for Consumers and Retailers (N=12 experts in total)

RETAILERS		CONSUMERS	
BENEFITS	RISKS	BENEFITS	RISKS
Increased Transaction Speed (N=3)	Losing the Data Monopoly (N=3)	Digital Guarantee (N=8)	Losing Anonymity / Less Data Protection (N=7)
Real Time Data Analysis (N=3)	Missing financial Incentives (N=3)	Increased Transparency (N=7)	Having to Switch from Habit of Cash Payment (N=3)
Customer Profiling (N=2)	Missing Signature for Tax Authorities (N=2)	Automated Product Recall (N=5)	Losing Access to Digital Receipt Wallet (N=1)
Reduced Labour Cost (N=2)	High Investments (N=2)	Environment (N=5)	Complexity of Consent Management (N=1)
Reduced Expenses on Paper and Printing (N=1)	Missing Infrastructure / Standards (N=1)	Personal Spending Tracking (N=4)	Unwanted Behaviour Monitoring (N=1)
Increased Customer Satisfaction (N=1)	Effectiveness of Consumer Protection (N=1)	Mitigating Tax Fraud (N=3)	Missing the Preferred Paper-based Receipt (N=1)
		Track Nutritional Quality of Purchased Groceries (N=3)	
		Increased Transaction Speed (N=2)	
		Automated Tax-free Re-imbursement of VAT (N=1)	

↑ more relevant

↓ less relevant

The experts have also evaluated how the possible solutions will manifest. Overall the experts identify a fintech start-up as the most realistic solution acting as a data intermediate to merge the data from the retailer and the customer.

According to the experts, regulatory developments are not hindering the introduction of digital receipts. The European GDPR is important when processing data in the EU and will be important in building the framework for a digital receipt solution. In Switzerland, there are other data laws that will have an impact, however there is a tendency towards following EU regulations in the next years.

# 8. Technical Standards

From a technical perspective, digital receipts are a standardized, structured and machine-readable data entity. These digital receipts are usually transferred in a three-corner or four-corner model. The possibility of building a new real-time economy on top of digital receipts, as suggested by the Finish government, becomes feasible when digital receipts follow an internationally interoperable standardization. In this chapter, possible technical architecture and data transmission are explained. The current e-invoice standard, which could be duplicated for the adoption of digital receipts, and existing digital receipts standards are discussed as well.

## 8.1. ARCHITECTURES

In the following, potential architectures are introduced that can be leverage when introducing digital receipts in the retail domain.

### Three-corner Architecture: Integration via Loyalty Card Systems

With the introduction of the European General Data Protection Regulation (GDPR) which allows users to retrieve their own transaction records via data portability, the first building block on the road towards digital receipts seems to have been paved, as GDPR enables third parties to integrate digital receipts via the three-corner model and consumer opt-in. For example, an app that aims to enable users to benefit from tracking expenses could ask users to opt-in and request their own individual data from a respective retailer's loyalty card scheme via data portability. The corresponding identification is solved via presenting a loyalty card that identifies the respective consumer. The corresponding machine-readable data export (including details on purchased products, timestamps, prices, location) could then be integrated into such an application. This architecture usually requires three stakeholders, i.e. consumer, retailer and solution provider (i.e. application), and is therefore also referred to as three-corner architecture for digital receipts. Kivra in Sweden follows this architecture in their integration of digital receipts from the Swedish retailer ICA.

### Four-corner Architecture: Integration into Card-based Payment Systems

Alternatively, consumers could be identified via using their personal credit card (or potentially debit card) at the point of sale (POS). In this case, the transfer of a digital receipt from the retailer's POS system to the buyer in a structured form is possible through (interoperable) architecture interfaces between the stakeholders in the payment scheme and a digital receipt standardization. To understand the payment scheme, the four-corner model is introduced herein forth.

**Acquirer:** The acquirer is affiliated with the merchant and provides him with the payment processing and is responsible for the card acceptance infrastructure at the point-of-sale (POS). The acquirer generates revenue by receiving a transaction fees and by lending or selling the terminal infrastructure.

**Issuer:** The issuer is connected to the consumer and responsible for issuing the cards. The issuers revenue stream originates from two sources. Firstly, the consumer pays an annual fee for the credit card and secondly, the acquirer pays the issuer via an interchange fee on a transaction basis for maintaining and generating new cardholders. The issuer is liable in the event that the cardholder defaults and therefore the issuer monitors the cardholder's creditworthiness. Depending on the transaction volume the issuer pays a fee to the card scheme (Maurer, 2009).

**Processor:** The processor acts on behalf of the acquirer or the issuer who outsource the processing of the transactions to the processor (Maurer, 2009).

**Merchant:** The merchant primarily pays a fee which is a percentage based on the amount of transactions to the acquirer. Secondly, for participating in the card system the merchant pays to the card schemes a fixed amount (Maurer, 2009). In return, the merchants have several advantages when participating in the credit card network. There is a higher checkout speed with non-cash payments, greater transparency and cash management is reduced or is omitted. Through the system the merchant is protected from card fraud and customer default.

**Consumer:** The consumer is purchasing from the merchant with the credit card, which can be used to identify the consumer (also in anonymized or pseudonymized form via a (hashed) transaction identification token). For using the payment service, he pays an annual fee for using the credit card.

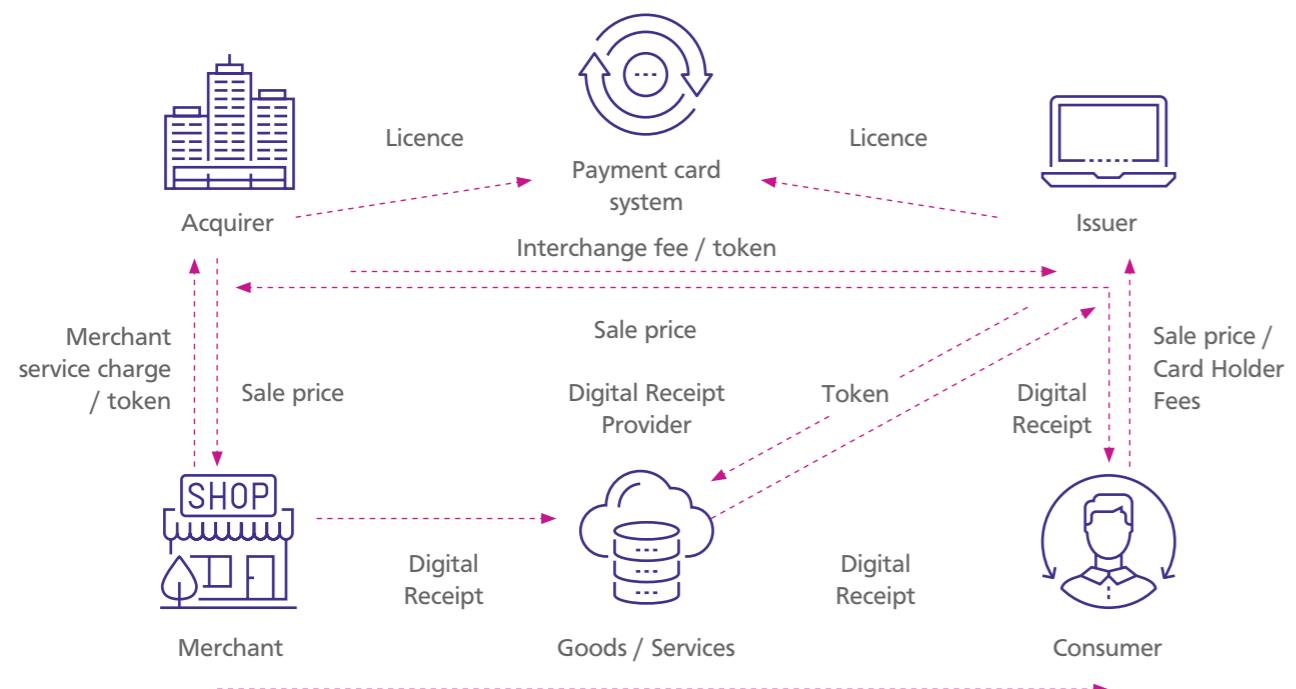
**Card Scheme:** The card schemes set the standards and interchange fees as well as provide the infrastructure (Maurer, 2009).

For example, Flux in the UK implemented their digital receipt distribution solution into the four-corner payment scheme with several credit card issuing banking institutions (e.g. Barclay's, Monzo). In this architecture, each participating retailer integrates Flux's digital receipt solution that enables matching of card-based transactions and basket data. Eventually, the respective issuer (e.g. Barclay's, Monzo) can retrieve the digital receipts for their transactions via the acquirer that passes along the digital receipt from Flux's infrastructure. Finally, only the issuer can correlate the respective digital receipt and consumer identity in order to distribute the digital receipt to the end user (e.g. via the Barclay's mobile application). In the following, the corresponding architecture including the digital receipt distribution is depicted.

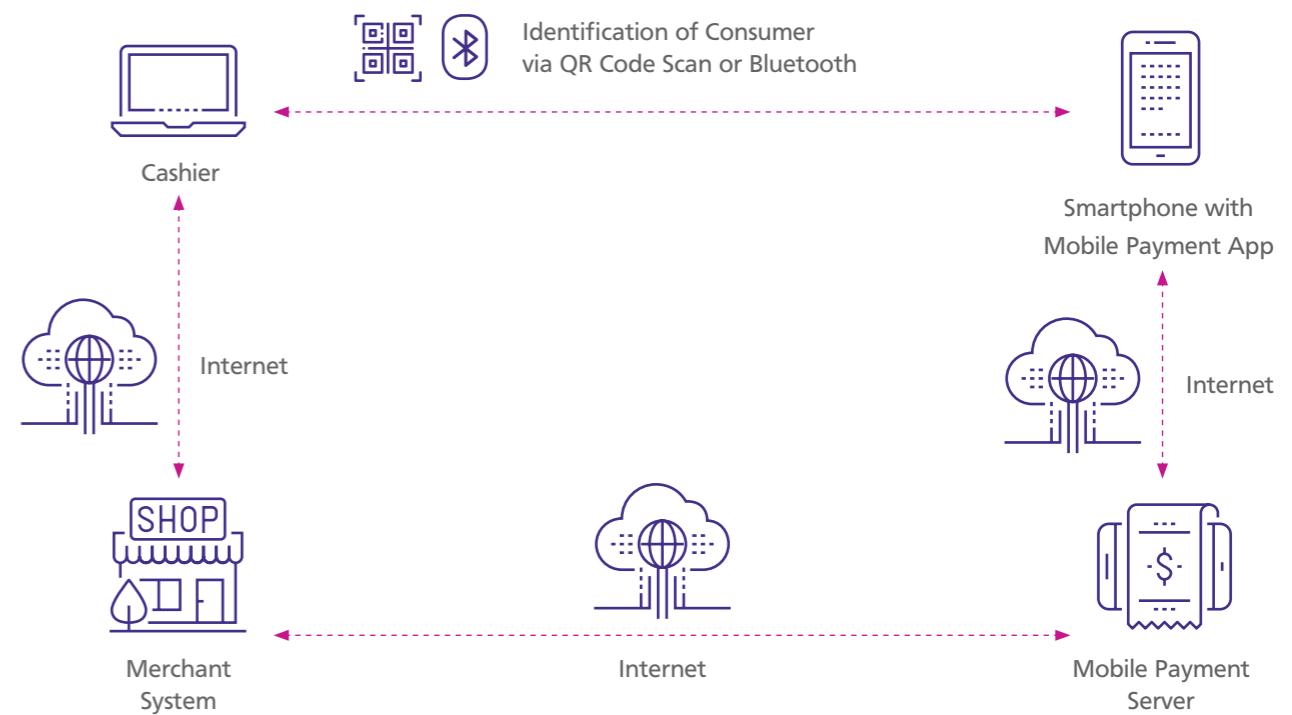
#### Integration into European Mobile Payment Scheme

In Sweden, there is a possible development where merchants and consumers move away from the existing credit card-based payment infrastructure towards using new (and cheaper) payment methods based on mobile services and PSD2, bypassing the global credit card companies. Unlike Apple pay and Samsung Pay, such European mobile payment applications are operated by European banks and transfers money directly between bank accounts (e.g. Swish used by almost 80% of all Swedes). The mobile payment applications are now increasingly starting to be used also in physical and e-commerce stores alike. Finally, there is now a network of existing similar mobile payment services across Europe (<https://empsa.org/>), that plan to establish interoperable payment interfaces. Digital receipts could become part of this international, interoperable payment infrastructure.

**Figure 1** Four-corner credit card payment model. Adapted from Maurer (2009)



**Figure 2** Digital Receipt Integration within European Mobile Payment Solutions



## 8.2. STANDARDIZATION OF THE DIGITAL RECEIPT

In order to enable the flow of digital receipts between retailers, consumers, banks and other ecosystem stakeholders, possible standardisations of the digital receipt data object should be discussed.

The standards of e-invoices that have already been implemented and could be extended towards digital receipts. By 're-using' the e-invoice standards also for digital receipts, the implementation would be faster and easier, as most retailers are already using the same standards for their B2B and B2G invoices.

In Switzerland, the most relevant standards for e-invoices include ZUGFeRD (Zentraler User Guide des Forums elektronische Rechnung Deutschland) and Factur-X. These standards allow the exchange of invoices between supplier and receiver without any definition of the format before. ZUGFeRD is different to other standards like EDI (Electronic Data Interchange), with ZUGFeRD being applicable to any size of enterprise and any industry. ZUGFeRD 2.0 was introduced in March of 2019 based on the European Norm EN 16931 of June 2017. The invoice is composed of one rendered visualization and a structured machine-readable XML presentation. The visual representation is encoded as one or more PDF documents that comply with the PDF/A standard. The attached XML (Extensive Markup Language) invoice data are implemented into the PDF document (PDFlib GmbH, 2019). Factur-X is original a French and German standard enabling a mixed invoice and is composed of a PDF for manual use and an XML attachment for automated processing. This standard is also based on the European semantic norm EN 16931. Today, ZUGFeRD 2.0 and Factur-X are interoperable. Overall the goals of both standards are to add value to the invoices by including as much information as possible in a structured form and to allow automatic processing of incoming and outgoing e-invoices. Because of the shared similarities between e-invoices and digital receipts, digital receipts could re-use the same or similar standardizations.

## 8.3. SWEDISH DIGITAL RECEIPT STANDARD (SDRS)

The Swedish Digital Receipt Standard (SDRS) is based on the XML using the ARTS-DR-SE standard. ARTS-DR-SE is used in the document to reference the ARTS DR200 standard including the Swedish extension. The digital receipts include a header which including the header text of the physical receipt text. Further, the business unit reference, the address and the details of the merchant are included in the SDRS. The ARTS customer element contains information about the customer and is used as an identifier. The customer identification is due to ARTS Customer given. By generating a receipt code and the integration of a barcode, the transition between digital and paper receipt is possible. Such a system may be

useful for the sales company or the digital receipt service provider. The standard includes an operator ID that is matched with the operator type (cashier, online). When applicable, the corresponding currency code is visible in the XML format. Basket size and line items are seen in the trailertext that is defined in ARTS DR200. The transaction must include a timestamp based on the date/time format used in ARTS. The retail transaction contains specific details about the purchase and sales order. Including sub-elements of the transaction like customer and loyalty account elements. Additional information is included in the SDRS standard such as Lineitemstender (payment related e.g. deposit, giftcard), Lineitemtax (representing the total tax amount) and attachment (warranty, insurance document and assembly instruction) (Lars Bergström, 2018).

## 8.4. DATA EXCHANGE

ZUGFeRD invoices XML Metadata must contain four entries from the ZUGFeRD schema. These entries describe the type of document and the dataname must be match the name of the embedded PDF document. ZUGFeRD XML contains a Syntax, Syntax rule XML Naming and design rules (NDR) and semantics CEN MUG and Core Component Library (CCL).

Figure 3 PDF and XML visualization Source: PDFlib GmbH, 2019



RECHNUNGSERSTELLER	RECHNUNG
Lieferant GmbH Lieferstrasse 20 80333 München Deutschland	Rechnungsnummer 471102 Rechnungsdatum 05.06.13 Leistungsdatum 03.06.13 Referenz (bitte bei Zahlung angeben) GE 2020211-471102 GLN: 4000001123452
RECHNUNGSEMPFÄNGER	Kundennummer GE 202021
Kunden AG Mitte Hans Muster Kundenstrasse 15 69876 Frankfurt	Beträge in EUR  Hinweis Rechnung gemäß Bestellung Nr. 2013-471331 vom 01.03.2013 Es bestehen Rabatt- und Bonusvereinbarungen.
GLN: 4000001987658	<pre> &lt;BuyerTradeParty&gt;   &lt;ID&gt;GE2020211&lt;/ID&gt;   &lt;GlobalID schemeID='0088'&gt;400001987658&lt;/GlobalID&gt;   &lt;Name&gt;Kunden AG Mitte&lt;/Name&gt;   - &lt;DefinedTradeContact&gt;     &lt;PersonName&gt;Hans Muster&lt;/PersonName&gt;     &lt;DefinedTradeContact&gt;       &lt;PostalTradeAddress&gt;         &lt;PostcodeCode&gt;69876&lt;/PostcodeCode&gt;         &lt;LineOne&gt;Kundenstraße 15&lt;/LineOne&gt;         &lt;CityName&gt;Frankfurt&lt;/CityName&gt;         &lt;CountryID&gt;DE&lt;/CountryID&gt;       &lt;/PostalTradeAddress&gt;       - &lt;SpecifiedTaxRegistration&gt;         &lt;ID schemeID='VA'&gt;DE234567890&lt;/ID&gt;         &lt;/SpecifiedTaxRegistration&gt;       &lt;/BuyerTradeParty&gt;     &lt;rsm:HeaderExchangedDocument&gt;       &lt;ID&gt;471102&lt;/ID&gt;       &lt;Name&gt;RECHNUNG&lt;/Name&gt;       &lt;TypeCode&gt;380&lt;/TypeCode&gt;       &lt;IssueDateTime format='102'&gt;20130605&lt;/IssueDateTime&gt;       - &lt;IncludedNote&gt;         &lt;Content&gt; Rechnung gemäß Bestellung Nr. 2013-471331 vom 01.03.2013. &lt;/Content&gt;       &lt;/IncludedNote&gt;       - &lt;IncludedNote&gt;         &lt;Content&gt; Es bestehen Rabatt- und Bonusvereinbarungen. &lt;/Content&gt;         &lt;SubjectCode&gt;AAK&lt;/SubjectCode&gt;       &lt;/IncludedNote&gt;     &lt;/rsm:HeaderExchangedDocument&gt;   </pre>

Depicted above, is a paper-based invoice, as well as its e-invoice counterpart, which could be embedded into e PDF file, which is still machine-readable and structured. Information about buying and selling party are given, including addresses, names and tax registration numbers.

## 9. End User Acceptance Survey

### 8.5. INTERNATIONAL INTEROPERABILITY

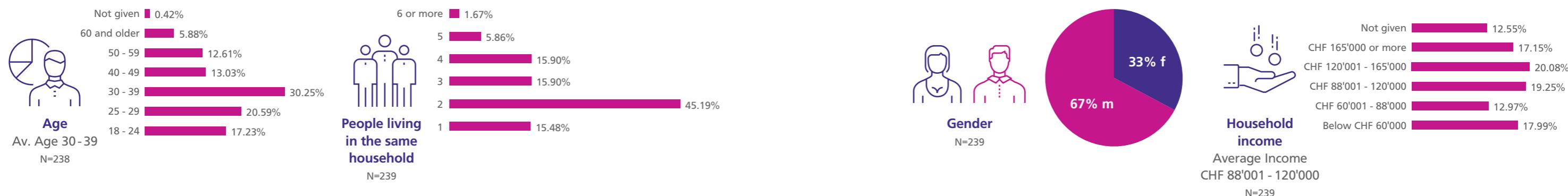
In the best-case electronic invoice including digital receipt are generated, sent, transmitted, receipted and processed automatically. Therefore, only machine-readable receipt is seen as compliant with the European standard of electronic invoices. Full interoperability means to interoperate on three various levels semantic (content of the invoice), the format or the language used (syntax) and the method of transmission. Semantic regarding interoperability means that the electronic invoice contains an amount of necessary information resulting in clear understanding of the exchanged information independent of physical or digital transmission. Syntactic interoperability means that between the sender and the recipient the data elements of a digital receipt are automatically processed (The European Parliament and the Council of the European Union, 2014). In Scandinavia, there already exists a first pilot implementation for cross-border distribution of digital receipts, for example between Finland, Sweden and Estonia (operated by Nets across the Baltic countries) (Diginno, Republic of Estonia, 2019).

In this chapter, the results from the conducted end user acceptance survey are presented. The survey was created to understand the requirements and concerns of the Swiss population with respects to digital receipt and focuses on the Swiss market. The goal of the survey was to provide a comprehensive overview of the drivers and barriers of digital receipt from the user perspective. The survey encompasses three parts: the first part includes the demographic standard questions; the second part focuses on the existing experience with using digital receipts and the third part focussed consumer expectations in respect to using digital receipts in the future.

### 9.1. STUDY DESIGN

The goal of the non-representative survey was to evaluate the readiness and quantify possible incentive from the user's perspective. Overall 239 participants from Switzerland aged between 18 and 60+ participated in the survey. The participants were recruited via social media networks (Facebook and LinkedIn) as well as by word-of-mouth. The survey took about 8 minutes to complete and was implemented from July of 2019 until the end of August of 2019. The participants answered open and closed questions about whether they had heard about digital receipt and if they would use them in the future or if they are using them now. Further, the participants were asked about the perceived benefits and risks of using digital receipts.

Figure 4 Online Survey Sample Description



## 9.2. AWARENESS OF DIGITAL RECEIPTS

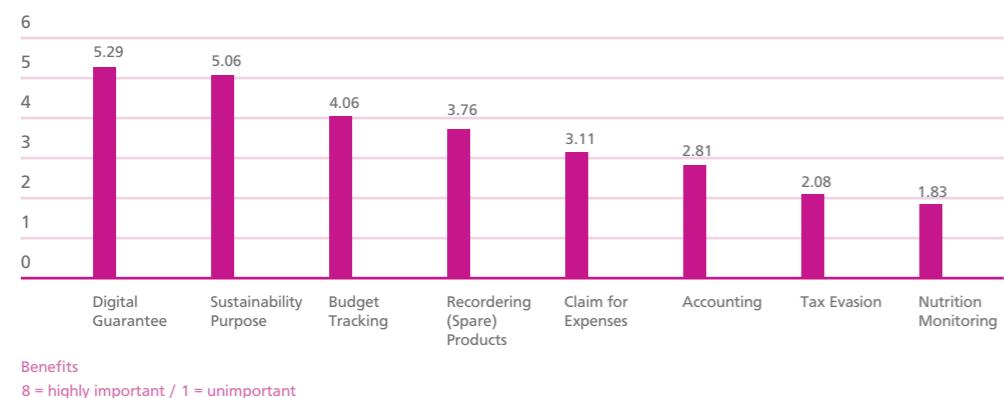
Of the 239 respondents, 59% of stated that they heard already about digital receipt. Of those that have heard about digital receipt, 61% of were using them already (e.g. via Migros Cumulus). As such 36.4% (87 of 239) of respondents were familiar with digital receipt today. While most people were using digital receipt infrequently/seldom (49.0%) or more than multiple times per week (31.76%), there was a significant proportion (10.6%) of the population that were using digital receipt on a daily basis. According to the survey, only 8% of people had never used digital receipt or did not provide an answer. Regarding the existing solutions providers in Switzerland, there were three well known providers that were clearly identified by the responders. First was the solutions in the e-commerce industry providing the customer with PDF receipt sent by email (89%, N=84), followed second by the e-bill in the e-banking of the correspondent bank (82%, N=84) and third were the retailers Migros and Coop (83%, N=163).

## 9.3. INTENTION TO USE DIGITAL RECEIPTS

In our survey, the Swiss consumers seem ready for digital receipts. Exactly 98% of the participants answered yes when questioned if they would use digital receipts in the future. Possible factors that would drive digital receipt were previously identified and their relevance tested by this survey. The survey shows the main factors for driving adoption of digital receipt are added service in the field of digital guarantee and for sustainability reasons (see Figure below).

Figure 5 Consumers ranking benefits of digital receipts (0 = minimum, 8 = maximum)

### DIGITAL RECEIPTS – BENEFITS



According to the survey the potential users are concerned about their data protection, misuse of data and data theft when thinking about digital receipts.

Figure 6 Consumers ranking risks of digital receipts (0 = minimum, 5 = maximum)

### DIGITAL RECEIPTS – RISKS



The survey asked which possible providers the Swiss consumers would trust, when storing digital receipts? On one hand the participants generally responded that they were likely to trust banks to manage their data. 59% percent of all responds considered the bank trustworthy, 46% considered the payment app provider trustworthy, 36% considered the retailer trustworthy and 43% considered the credit card provider trustworthy. On the other hand, however, some participants' express explicit concerns about storing data at their bank. The reason for this development is that they do not want the data that is shared or to be controlled by a bank. Furthermore, some people did not consider data management as core activity of a bank. The most significant mentioned expected risks when digital receipt is included in the e-banking functionality are data protection, data misuse and data theft.

#### 9.4. INTERACTIVE FOCUS GROUP WORKSHOP

In this chapter the results of the focus group workshop are presented. This chapter elaborates different use-cases that could be built on the based digital receipts. These future use cases have been tested by three participants within the focus group workshop over the duration of three hours. Two of three participants heard about digital receipt before attending the workshop. Due to low number of participants, the results must be understood with caution, but there exists a promising overlap with the survey results (see chapter End User Acceptance Survey). In the future all three participants are willing to use digital receipts. The known providers mentioned were Migros and Coop both big grocery retailer in Switzerland.

##### Use-Case: Digital Guarantee

The presented 'Warry' prototype is proving the user with a digital guarantee management. Through digital receipt the Warry automatically shows the possessed products and their end of guarantee period. This service enables a transparent overview of all personal belongings and there is no need to search for paper receipts which may have been lost, irretrievable or have faded print. Overall the participants like the idea due to its overview of the product and the transparency. Through such a structure less unclaimed warranties would occur. The possibility of losing the phone or storage device of the digital receipt (and consequently the warranty) was identified as a concern but could be mitigated via backup methods (e.g. email account). Further ideas could potentially include a warranty expiry alert, automated best price order, automatic warranty extension when paying with a specific credit card and the option of transferring existing warranties from one person to another. To arrange, categorize and to find the right product, the attendees wish to have the option of a custom function (categorizing, searching). Overall concerns were mentioned regarding data and data storage. The participants identified the government as a potential data storage provider as well as retailers which are already keeping this data. The attendees wish the possibility in the field of warranty to delete the receipt for products (< 500 CHF) when the warranty expired.

The digital guarantee use-case was the best rated prototype in the focus group, as well as in the user survey.

##### Use-Case: Account overview

The presented prototype named 'Vista' was presented in the workshop and basically uses the digital receipt to create an overview in the e-banking account. This feature is already existing but thanks to digital receipt the service quality will increase. For example, in a retail store all products purchased are known. Today, the system does not allow this kind of granularity when categorizing the products. Overall, the participants like the prototype's main positive features which are the presentation, transparency (money flow, information) and control of finances. Regarding the risk, the people identify data which is stored at a third party and security issues as the highest concerns, as well as concern about the misuse of data regarding, spam and personalised advertisement. These services guarantee higher user benefits, but the customers are not willing to pay for the extra service. Further solutions extending this example would be providing this service to financial unstable people to help them getting control over their finance and budget. The participants would like a manual input options for cash payments and that other payments are not automatically linked to the e-banking account. Furthermore, customised features would be advantageous, especially of the categories was mentioned such as create and link categories to category hobby or transport. For example, people wish that in the future it would be possible to add different credit cards to merge different family members expenses.

##### Use-Case: Purchase Ingredient Monitoring

The presented 'Nutri' prototype is using the Nutri-Score to categorize and visualize the customers grocery purchases (Stiftung Warentest, 2019). Bitsabout.me through consent with the user directly sources the information from the grocery store via digital receipt. Through digital receipt the information is machine-readable and transfer on to the app or web portal. Every purchase is categorize depending on the nutritional values into A, B, C, D. The participants overall reason to use the prototype was small or not existing. A positive feature is the awareness-raising of a healthy nutrition. Many uncertainties occurred regarding features of such an application remain — family purchases are categorized on a purchase level than on an individual level. Other consumptions such as presents (e.g. chocolate) and visits at a restaurant are not included. Future features that could be beneficial that were mentioned by the participants included for example personalized analysis, product recommendations for a healthier lifestyle and connection to a fitness app as motivation.

# 10. Executive Summary

## Use-Case: Expense Tracking and Reporting

The presented prototype 'Expensi' scenario is an automated process that supports claiming expenses via digital receipts. Nowadays, expenses are mostly paper based and processing these is time consuming and a paper-based receipt is required. Through digital receipt the provider is able to identify the products and automatically enter it in an accountancy record. As such, the accounting process as well as the payment of the expenses would be automated. The participant like the simplification of the whole expenses process. The benefits are higher for corporates and organizations than for personal use. There is no or little use for private purposes. The attendees added further ideas including 1) if it was an option to take a picture of a paper-based receipt to digitalise it or incorporate it into a digital receipt system. 2) integrating exchange rates into the system and 3) automatic categorization of the purchases. The focus group assumed that future benefits of the service could be an automated instant return of the expenses.

## Use-Case: Automated Tax-Free Refunds

The presented prototype 'Fly' tackles the topic of cross border purchases. Normally when buying products in a different country to reclaim the value added tax (VAT) you need to get a stamp at the border and then return to the same shop. This process is time consuming and the chance of returning in the exact same store is small. Through digital receipt this process becomes more efficient and faster. The customer receives a digit receipt at the cashier and just need to verify his purchase at the border. When doing so, reclaiming the cost of the VAT is automatically processed, and before the passenger has returned home the amount is paid back into his or her account.

This prototype was overall rated as the second-best future application example for digital receipt. The participants like the idea because of its efficiency. This solution incites the customer to declare even small amounts at the border. One person is still worried about the personal expenditure in time for verifying the purchase at the border. Further concern is mentioned regarding directly paying the home country VAT when using the automated process.

An idea of the verification process could be a self-service desk similar to the existing self-border control system when scanning the passport and taking a personal picture.

In this study, we present our findings on current drivers and barriers towards the adoption of digital receipts that were collected via a user survey of 239 Swiss consumers, interviews with 12 (international) domain experts, an interactive focus group workshop and a lot of desk research. We understand digital receipts (also referred to as eReceipts or electronic receipts) as machine-readable, electronic substitutes for their contemporary paper-based printed counterparts. A digital receipt can for example be received after a payment e.g. by credit card or mobile payment, or also after a cash payment and subsequently identification of a consumer (e.g. via loyalty card).

We confirm that digital receipts offer increased transparency for consumers that can allow for new services, such as personalized recommendations, immediate notification for product recalls if a consumer is affected. In that sense, digital receipts can even empower consumers, for example with improved access to digital guarantees or automatic expense tracking. Further, digital receipts offer a much lower environmental footprint when compared to paper-based receipts, with the potential to save tens of thousands of trees each year in Switzerland alone. In addition, the chemical exposure of bisphenol included in paper-receipts could be mitigated via digital receipts. Therefore, an increasing number of politicians (e.g. in EU, Sweden, California, but also Switzerland) and petitions ('Skiptheslip' in the US, 'Beattherceipt' in the UK) are now calling for a transition away from paper-to digital receipts (flux, 2019; Green America, 2019). In order to mitigate tax evasion, several countries including Germany, Poland and Croatia are introducing digital receipts for synchronization of revenues with fiscal authorities, leading to an upgraded point of sale infrastructure that might eventually also be used for B2C receipts as well. Finally, also retailers are expected to profit from digital receipts, as they allow for faster checkouts and reduced labour cost, amounting to potential savings of over 1 billion CHF per year (given similar dimensions to the Finish case-study).

In contrast, the most relevant barriers in the adoption of digital receipts are retailer resistance, lack of standardization and infrastructure, data privacy and the fact that a lot of consumers still prefer the physical receipt over a digital one. It can be expected that retailers will mass-adopt the distribution of digital receipts, once they are required by regulation or when they become a de-facto standard for cashless payments. Before that, most likely, only stakeholders using a three-corner distribution model (e.g. loyalty card based) and selected retailers wanting to support digital receipts could introduce them as optional alternative to paper-receipts. It is clear that there is the need of a multi-country digital receipt standard, which should be focused on by the ecosystem partners. Further, digital receipt stakeholders

should implement data privacy compliance and security measures into their infrastructure, as it remains a high priority and barrier towards adoption. Finally, with not every consumer having a preference for digital receipts, it should be clear for which retailers a consumer receives a paper- and for which a digital receipt will be sent. The digital receipt introduction should therefore follow an opt-in process at first, before digital receipts become an opt-out standard. This could be achieved by asking consumers to actively connect loyalty cards to payment means, or by having them to opt into digital receipt distribution per retailer, similar to selecting eRechnung (eBill) providers to be connected to a bank account today in Switzerland.

Many service providers are emerging aiming to substitute paper-based receipts with digital alternatives. Especially, in more tech-savvy regions that are closer towards a 'cashless' society, like Sweden, Australia, United Kingdom, or the United States, solution providers offer several approaches towards introducing digital receipts, ranging from email-based solutions, loyalty card based identification, towards full integrations of digital receipts within the four-corner credit card payment model. While the trend towards digital receipts seems clear, a dominant channel to distribute digital receipts has not been established just yet. Still, banks seem to play an important role in the digital receipt development, as the examples of Flux (UK) and Slyp (AUS) indicate. KPMG mentioned in an article that banks could generate new revenue streams by providing services to the retail and dining checkout industry (Davidson, 2016). Banks could leverage their position of having already existing relationship with customers and retailers to establish new services and to offer start-ups or retailers to integrate digital receipts into their banking applications. Such a service could even be paid by merchants and guarantees added post-purchase value to customers. The example of the Kivra (SE) mobile app from Sweden that distributes over 1 billion digital receipts per year for Sweden's largest retailer ICA to consumers indicates that digital receipts will be shared via three-corner models first (e.g. via loyalty identifier), before four-corner models become adopted (e.g. via credit card).

With the introduction of the European General Data Protection Regulation (GDPR) which allows users to retrieve their own transaction records via data portability, the first building block on the road towards digital receipts seems to have been paved, as GDPR enables third parties to integrate digital receipts via the three-corner model and consumer opt-in. A working group within the European parliament is currently drafting a proposal for a consumer right towards a digital guarantee, based on the right to a digital receipt. Still, there remains uncertainty to when a 'right for a digital receipt' law which is demanded by some politicians or petitions, or even a ban for paper-receipts can be expected. Based on our expert interviews and research, there is no region that currently yet actively mandates

digital receipts for single transactions. Therefore, it seems unrealistic to expect such a digital receipt regulation within the next two years, despite the fact that there are many current drivers that accelerate the adoption of digital receipts.

In Sweden, an alliance of retailers, point of sale operators and solution providers are proposing the Swedish Digital Receipt Standard (SDRS). The SDRS is an XML objects that follows the ARTS-DR-SE standard. An international, cross-border standardization of digital receipts is crucial to their success, as the digital receipt landscape is an internationally fragmented eco-system, as retailers, acquirers, issuers, solution providers need to cooperate to generate, send, transmit and process digital receipts automatically. The electronic invoice (also called e-invoice) which is inherently similar to digital receipts, has experienced strong adoption growth over recent years after successful standardisation and is already quite established in the Swiss B2B and B2G sector. Therefore, the e-invoice standards like ZUGFeRD and Factur-X are likely to be adaptable towards digital receipts and could be used a future standard, resulting in an easier adoption, as most retailers understand them already. Still, there remain uncertainties regarding digital receipts standards due to the number of cross border transaction, high fragmentation of the point of sale industry and low incentives side for retailers to support multiple standards. Nevertheless, the Scandinavian countries are way ahead in establishing a digital receipt standard (SDRS in Sweden, Finland) and are actively working on cross-border distribution of digital receipts.

Through our (non-representative) online survey of 239 Swiss consumers and an interactive focus group workshop, we shed light on the expected intention to use digital receipts and potential value-adding use-cases that will be enabled by digital receipts. The survey's results are congruent with the literature of digital receipts and indicate a high intention to use, with 98% being willing to use digital receipts in the future. Additionally, 36% of the participants already use digital receipts regularly (e.g. within the Migros mobile application). As expected, potential users are not willing to pay for future services (warranty management, budget tracking, etc.), but are definitely considering the potential added services when choosing their bank or payment provider. Participants in the survey and workshop both rated digital guarantees as the most interesting benefit of digital receipts. Next, they values sustainability, budget tracking, being able to re-order products or spare parts for previously ordered products. Using digital receipts for re-claiming expenses or accounting was interesting to freelancers and employees that frequently have to report expenses. Mitigating tax evasion and tracking of nutrients from purchased groceries were the least favoured use-cases. On the other hand, participants are afraid of loose data protection and potential misuse of data or even data theft. Only few participants mentioned that the advantages of digital receipts are too small to use them.

# 11. References

Finally, we come to the conclusion that a lot of prerequisites are in place in order to expect digital receipts in the next years. Latest, when the first region (for example Sweden) decides to introduce the 'right for a digital receipt', we expect mass adoption of digital receipts. But even before, three-corner models and four-corner digital receipt models can be implemented, if retailers pro-actively decide to support digital receipts. This hypothesis is supported by the investments that go into digital receipt start-ups like Flux, Slyp, Kivra in order to participate in the digital receipt ecosystem and their respective track records – e.g. Kivra distributing one billion digital receipts in Sweden per year. All of the twelve domain experts interviewed in this study were asked for an estimate to predict when the adoption of 10% of all B2C retail transaction in Switzerland would contain digital receipts instead of paper receipts. Their average estimate is two years, which seems too optimistic for the authors, as we expect that such a large adoption of digital receipts is still a bit further away than just two years, i.e. rather five years due to the fragmented Swiss point of sale landscape, missing standardization and remaining resistance from retailers. Still, ecosystem participants like Worldline are preparing their terminal infrastructure to become able to attribute digital receipts to credit card transactions, indicating that the pre-conditions of digital receipts are further improving in Switzerland.

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## CONTACT

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**ETH ZURICH WEV G219**  
INFORMATION MANAGEMENT  
DEPARTMENT OF MANAGEMENT, TECHNOLOGY, AND ECONOMICS  
WEINBERGSTRASSE 56-58  
8092 ZURICH

+41 44 632 48 18  
[TEAM@AUTOIDLABS.CH](mailto:TEAM@AUTOIDLABS.CH)  
[WWW.AUTOIDLABS.CH](http://WWW.AUTOIDLABS.CH)