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CASH OF THE FUTURE

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FOREWORD

Dear readers,

The poet Wilhelm Busch once wrote: "Paying is how you get shot of most money." Of course, during the poet's lifetime, most everyday transactions were still settled with cash. And while we still like to pay with cash today, we are increasingly making payments electronically and digitally as well. Notes and coins are one of many ways to "get shot of" our money.

From a consumer perspective, this freedom of choice is naturally something to be welcomed. From a central bank perspective, a changing payment landscape raises the question as to what role cash will play in it in the future as our most visible "product". Digital transformation is just one of the many trends affecting our payment behaviour and, with it, cash. Further drivers of the ever-evolving role of cash are social, political and legal developments.

We at the Bundesbank seek to understand these developments as comprehensively as possible. In this context, we are also aware that cash fulfils important societal tasks, which include making us less dependent on technical infrastructure in crisis situations, enabling economic inclusion for all and teaching children how to handle money.

In view of all this, we decided to enter uncharted territory with this study. Employing strategic foresight methods and adopting a scenario approach, three visions of the future illustrating what the future of cash and its environment in Germany might look like were systematically developed. The conditional "might" is deliberately used here, because our aim was not to make specific predictions. Given the large number of factors influencing cash and the long-term horizon, this would also be a foolhardy endeavour.

Instead, the study presents three different and clearly delineated scenarios for the future of cash in 15 to 20 years' time. The futures presented here are designed to help identify possible paths of development and to gain a better understanding of the potential challenges facing the Bundesbank and other stakeholders in the cash cycle.

The scenarios make for exciting reading. Without giving away too much at this point, some of you will no doubt be relieved to know that cash will not disappear completely in any of the three scenarios outlined. This finding is therefore in keeping with the Eurosystem's firm commitment to cash and our clear desire to preserve cash as an attractive and reliable means of payment and store of value.

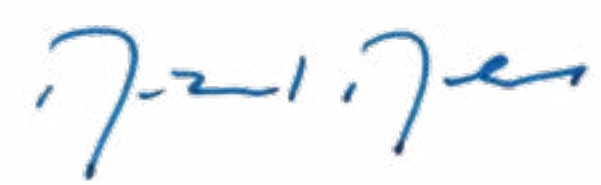
At the same time, however, the study shows that the preservation and widespread use of cash should not be taken for granted. The Bundesbank is already making a number of efforts to continually improve the cash cycle in Germany and increase the visibility of cash. The scenarios now open up a major opportunity to devise further plans of action and in doing so also tread new ground.

I would also like to give special thanks to the many experts who have played an active part in the study through workshops, surveys and interviews and who have thus made a substantial contribution to the final product.

As the study vividly shows, the Bundesbank cannot walk these new paths alone. This is why the Bundesbank is planning to launch a National Cash Forum this year, bringing together the main players in the area of cash payments. The forum is intended as a platform where, looking ahead, current issues relating to cash payments can be discussed regularly with the aim of keeping cash available as a cost-effective and efficient means of payment in an environment of changing payment behaviours.

All necessary neutrality to one side, we in the Eurosystem would do well to continue and boost our commitment to both cash acceptance and cash access – so that all those who want to "get shot of" their money as cash can continue to do so in the future!

Frankfurt am Main, January 2024



Burkhard Balz
Member of the Executive Board of the Deutsche Bundesbank

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SUMMARY

While the future of cash will be determined by the interplay between a number of developments, the course that each of these will take over the next 15 to 20 years is unclear. To make the future more tangible, it is necessary to go beyond what is observable in the present. The notion that the future can be predicted based simply on all of the trends emerging today has often proved to be a fallacy.

In order to nevertheless be able to strategically plot what the future holds for cash, various strategic foresight methods have been employed in this study. Using a key factor-based scenario approach, the insights gained are woven together to construct three scenarios – the "hyperdigital payment world", the "cash renaissance payment world" and the "vanishing hybrid payment world". The constructed scenarios represent possible alternate pathways for the future of cash. They are not predictions of what will actually happen in the future, but rather hypothetical visions of the future. They illustrate the consequences of possible developments and so act as an aid for decision-makers in a holistic approach to strategic planning.

Although the pathways presented differ considerably from each other, the scenarios also share similarities.

In all three scenarios, the share of cash in total transactions declines over the next 15 to 20 years compared with today. The scale of the decline varies based on the reasons outlined in the scenarios. Cash does not disappear in any of the three scenarios, though.

The scenarios show how consumers' needs, wants and demands when it comes to a means of payment could diverge to varying degrees in the future. For many, ease and convenience of use are the most important criteria for choosing a means of payment, both now and most likely in the future as well. Whether cash or cashless means of payment will be deemed by consumers to meet these criteria in the future will depend on their personal perspectives. However, there are signs that, both today and in the future, the majority of them might consider these requirements as being met mainly by cashless means of payment.

Cash is valued as a physical means of payment and as a high-quality product. There is no evidence of a desire for cash to undergo any sort of evolution, e.g. to become smart cash with electronic components, not least because cash would presumably then no longer be completely anonymous.

The main reason why cash is held in high regard is that it offers a unique combination of features: it protects users' privacy and is inclusive and resilient. It is true that cashless means of payment will not be able to fully replicate these features in the short term. That said, individual cashless means of payment will close in on cash in the medium term with respect to the level of inclusion for all groups of society and the protection of users'

privacy that they offer. Innovations such as voice-activated command capabilities or financial inclusion considerations with respect to the digital euro could play a part in this. Moreover, the digital euro promises a high degree of privacy, albeit not on a par with cash. Resilience through independence from technical infrastructures will remain a unique feature of cash even in the long term.

At the same time, a representative survey conducted as part of the study showed that, 15 years from now, two-thirds of people will want to pay in cash just as often as they do today. Many people who are very infrequent users of cash themselves are aware of its importance as a means of payment for other population groups. The freedom to choose between cash and cashless means of payment in the future is overwhelmingly supported by all social milieus.

The "hyperdigital payment world" and "vanishing hybrid payment world" scenarios outline circumstances in which the freedom of choice to make cash payments might no longer be guaranteed even though it is something that the majority of the population wants to see.

If access to and the acceptance of cash become restricted, consumers will find cash less convenient to use and cash usage will decline. Due to the high share of fixed costs for the cash infrastructure, the cost per transaction will go up. As a result, access to cash and cash acceptance could further decrease – a downward spiral could be set in motion.

If cash were hardly used anymore in everyday life, it is debatable whether it could still fulfil its function as a fallback solution in the event of cashless means of payment becoming unavailable. Preserving freedom of choice and the cash infrastructure for precautionary reasons is therefore also an important crisis prevention instrument. The scenarios suggest, however, that consumers' freedom of choice regarding the use of cash should not be taken for granted and will not automatically be maintained.

Targeted measures are necessary to ensure freedom of choice for all, not just in theory but also in practice. Besides the legalities surrounding access to cash and cash acceptance, which are currently being discussed at the EU level, reducing fixed costs by optimising the cash cycle – potentially also with the aid of government support for research – could be a measure to keep cash attractive and thereby support freedom of choice.

The Bundesbank can help set the right course for this. However, it is only in an alliance with all stakeholder and interest groups in the cash cycle that, even in 15 years' time and beyond, it will be possible to maintain the position of cash as an attractive, reliable, competitive and generally accepted means of payment and store of value and to safeguard its infrastructure.

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MOTIVATION AND AIM

2.1 Starting point and research questions

The overarching questions of the study were how, even in 15 years' time and beyond, the position of cash as an attractive, reliable, competitive and generally accepted means of payment and store of value could be maintained and the necessary infrastructure safeguarded. These questions were posed by the Bundesbank. The study's starting point was the Eurosystem's cash strategy (European Central Bank 2020, 2), which is driven by the vision to preserve cash in the long run. As development cycles in the design of cash, especially banknotes, and making possible changes to the cash cycle can be drawn-out affairs, the Bundesbank had deemed it necessary to make a forward-looking assessment of the potential futures of cash in Germany. The aim of the study is to be able to use it as a basis for devising plans of action now so that any changes that may be necessary can be made in good time.

When the "Cash of the future" study was launched at the start of 2022, cash use in Germany had just experienced an unprecedented decline. The then latest Bundesbank study on payment behaviour in Germany showed that the public was now only settling 60% of transactions (32% in value terms) in cash (Deutsche Bundesbank 2021, 18). In 2017, this had stood at 74.3% (47.6% in value terms) (Deutsche Bundesbank 2018b, 24-25). The COVID-19 pandemic occurred between these two reference periods. The rapid global spread of COVID-19 and the measures taken to contain the virus accelerated digitalisation in all areas of life and massively changed the way in which people work, spend their free time and pay for things. In particular, contactless payments and online commerce experienced a remarkable uptick. Contactless payments by debit and credit card as a percentage of total transactions increased from 0.6% in 2017 to 14.3% in 2020 and to 18.3% in 2021 (Deutsche Bundesbank 2022c, 26). Business-to-consumer (B2C) e-commerce recorded sales of €72.8 billion in 2020 and €86.7 billion in 2021; in 2019, they had amounted to only €59.2 billion (Handelsverband Deutschland 2023).

The Bundesbank could not have known how lasting the effects of the COVID-19 pandemic on cash use would be when it started working on its conceptual considerations for a study on the cash of the future at the end of 2020. Even before the pandemic, the Bundesbank had already perceived a downward trajectory in the use of cash. Between 2008 and 2017, this decline amounted to around one percentage point per year in terms of transactions and value.

Initial ideas for boosting the appeal of cash as a physical payment medium issued by the central bank that centred on modifying banknotes and coins themselves were also floated – specifically, transforming cash into "smart cash".[1] As work on this study progressed,

1 One example of "smart cash" is cash with technical features enabling it to interact with the digital world.

however, the considerations regarding a transformation of cash into smart cash were dismissed in the scenarios, at least over the study's intended time horizon, based on the knowledge gathered.

To make it possible to answer the overarching question concerning the status of cash in the future, various facets of the question were broken down into a subset of individual research questions:

- What current and future trends in society, the economy and technology will shape cash?
- What role will cash play in the future?
- Under what framework conditions will the cash cycle (be able to) exist in the future, and what are the challenges that it will face?
- What requirements will the various groups in society want payment instruments to meet in the future – and will cash be able to meet those requirements? Will cash continue to be used by all segments of the population in the future, or will it be the preferred means of payment and store of value only for a certain set of consumers?

The aim of the "Cash of the future" study was to provide guidance on how to answer these research questions in order to devise plans of action and aid in strategic decision-making.

2.2 Scenarios for looking at the "futures"

Physician Niels Bohr is quoted as saying that prediction is very difficult, especially if it is about the future (Pillkahn 2007, 5).

Answering the questions raised about the cash of the future must be based on more than knowledge and insights gained from the observation of past developments alone, because the future has not happened yet (Pillkahn 2007, 30-35, 193).

Given the study's lengthy time horizon of 15 years and beyond, linear forecasts based on existing data are unsuitable. This is because they assume that the future can be reliably predicted based on past developments. Additionally, humankind currently lives in a world marked by volatility, uncertainty, complexity and ambiguity, also known as the VUCA world. A different method is therefore needed to present a full picture that also captures factors such as the uncertainties surrounding the pathways for the future of cash.

The authors of this study therefore look ahead to the future by taking a key factor-based scenario approach. Quantitative and qualitative strategic foresight methods were employed to achieve this (Chapter 4). Foresight offers the option of addressing the uncertainties and challenges of the VUCA world as well as incorporating overarching global developments and trends. This enables the complexity of environmental influences on the cash of the future in Germany to be viewed through a forward-looking lens.

The scenario approach yielded three scenarios, each depicting a clearly distinct potential future for cash in Germany (Chapter 3).

Scenarios are intended to provide decision-makers with guidance (Opiela et al. 2018, 4) if their basis for reaching a decision is uncertain. This generally applies to decisions that affect future developments and the way in which these interact. In addition, scenarios are intended to make potential future developments more tangible and to prompt discussion based on a common understanding of developments. Although there is no universal definition of the term "scenario", many definitions lean in a similar direction.

Herman Kahn, who worked after the end of the Second World War for the RAND Corporation, a US think tank specialising in military consulting, co-established modern scenario planning. In his words, scenarios represent a hypothetical sequence of events constructed for the purpose of focusing attention on causal processes and decision points (Pillkahn 2007, 168).

Scenarios are hypothetical visions of the future on a set topic (Pillkahn 2007, 168). They do not represent the future as a whole, nor do they represent the future "as such", but rather as a possible, future-oriented construct of certain key factors (Kosow and Gaßner 2008, 10). They describe alternate futures and outline the pathways that might lead to them.

They combine qualitative and quantitative statements. Multiple scenarios are always developed to draw attention to the fact that the future is undetermined and that alternate futures are therefore conceivable (Pillkahn 2007, 168).

Creating scenarios is a process of construction (Kosow and Gaßner 2008, 10): although the selection of key factors and the development of future assumptions in this study were heavily led by data and expert opinions, the authors' experiential knowledge and subjective assumptions were also incorporated. Assumptions are made, for example, about the stability of or shifts in trends, changes in the scenario context and the attitudes of groups of people in the scenarios.

The descriptions of each of the key factors make it crystal clear which individual variants of the key factors are based on which data and assumptions (Chapter 5).

The intended purpose of scenarios is not to tell the truth about the future (Kosow and Gaßner 2008, 10). Unlike forecasts, they do not aim to precisely predict events (Pillkahn 2007, 170).

Against this background, neither the "hyperdigital payment world" scenario nor the "cash renaissance payment world" or "vanishing hybrid payment world" scenarios will probably come to pass exactly as described. They are not visions of desired futures either, but rather exploratory, present-based descriptive visions of the future of cash and its use in Germany in 15 to 20 years' time.

The scenarios are intended to enable the Bundesbank to strategically explore various different ways in which cash could develop in the future. Decision-makers can assess for themselves which of the developments outlined in the scenarios they would welcome, which developments are risky from their perspective, where counteractive intervention is needed and which developments could be supported by measures (Opiela et al. 2018, 4-5). In this respect, the scenarios can help ensure that the right course for cash is set today so that, even in 15 years' time and beyond, it will remain an attractive, reliable, competitive and generally accepted means of payment and store of value with a sound infrastructure.

Owing to the complexity of the factors influencing the cash of the future, a scenario approach applying a wide range of foresight methods was taken. This report focuses on the final scenarios and the main influencing factors, the key factors. All other study contents are available to the Bundesbank. The future scenarios are described in Chapter 3 from the perspective of the year 2037 and present the pathways for the future of cash up to that point in time. The methods used in this study are explained in Chapter 4. The key factors, whose future pathways form the basis of the scenarios, are described in Chapter 5.

A large number of interviews with experts from various fields were conducted as part of this study, with the content being incorporated throughout this report. Where input has been drawn from an interview, this is signalled by an in-text citation supplemented by the corresponding list of respondents. We would like to thank the experts involved in this study who, through their methodological and specialist knowledge, have contributed to the success of this foresight process.

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THREE SCENARIOS FOR CASH UP TO 2037

The hyperdigital payment world

Artificially intelligent, convenient and vulnerable

The hyperdigital payment world – artificially intelligent, convenient and vulnerable

Germany in the 2020s

Russia's attack on Ukraine in February 2022, which was described by then Chancellor Olaf Scholz as a "turning point", acted in many policy areas as a catalyst for transformation processes aimed at safeguarding peace and prosperity in Germany and the European Union. The central dialogue between the Federal Government and high-ranking representatives from the business community, trade unions, associations, academia and civil society shaped policy in the 2020s. This formed the basis for the restructuring of society in response to looming geopolitical shifts, the necessary move towards climate neutrality, and digitalisation. The modernisation of government and administration as well as the promotion of digital and technological innovations were explicit objectives of this "Alliance for Transformation".[2]

There was also a clear shortage of skilled workers in many sectors at the end of the 2010s, which intensified in the 2020s. As a result, digitalisation and the increased use of general-purpose artificial intelligence (AI) such as ChatGPT were seen by most as less of a threat and more as an underwriter of prosperity and – through productivity gains – as paving the way for the four-day week, which was a frequent topic of discussion in the 2020s. At the start of the 2030s, virtual worlds such as the metaverse also opened up completely new opportunities for business, work and society.

Although Germany initially had difficulties in responding adequately to the structural change associated with the three Ds (demographic change, decarbonisation, digitalisation), there were some signs at the end of the 2020s that the transformation could succeed in some areas. Reasons for this included a specialist skills drive targeting what had been shortage occupations, supported by AI-based qualification programmes, augmented learning and simulations in the metaverse, as well as the successful establishment of energy partnerships. By contrast, the country's foreign recruitment policy was less successful, which made digitalisation and automation even more pressing in some sectors.

Back in 2020, the COVID-19 pandemic had already triggered a perceptible push towards digitalisation in all areas of life, including payments. At the start of the 2030s, however, the politically motivated and economically necessary proliferation of existing digitalisation technologies and the achievement of technological advances in the field of AI made it possible to reach completely new digitalisation dimensions. Unlike previous economic transformation processes, which had mainly brought about changes in job profiles in industry and production and eliminated entire fields of human work, the dissemination of AI-based applications now hit the services sector, the creative sector and knowledge work, in particular. For

2 Alliance for Transformation

the first time in their professional lives, some members of the established and progressive segments as well as the modern middle class went through profound changes, experiencing shifts in their career profiles and even job losses, although highly skilled workers quickly found their way back into the labour market. However, the negative impact of AI on people's jobs did not cause those in these segments, especially members of the Performer Milieu, to rethink their fundamental faith in progress. They quickly integrated AI-based innovations into their everyday lives.

The European Union adopted an AI regulation that classified different AI applications by risk category and regulated them accordingly. As a result, the majority of the population was already under the impression that AI was under control and that the new technology could be used for the benefit of all. There was general confidence in the ability of governments and authorities to solve problems.

Difficulties with the new dimensions of digitalisation were experienced mainly by members of the traditional segment, who found the increasing digitalisation of processes and infrastructures to be of little benefit and threatening in all areas of life and did not wish to have details about their lives laid completely bare.

Cash is hardly used as a means of payment anymore

In this highly digitalised world, cash acts as a store of value at most – alongside other instruments such as crypto-assets, non-fungible tokens or book money as savings deposits at commercial banks. Cash has practically disappeared from everyday payment situations and payments between individuals (P2P), as it cannot be integrated into digital systems and processes. The vast majority of people belonging to the traditional segment, those within a high age bracket (people 80 years and older) and people with a low level of formal education, who tended to use cash more frequently than other groups in the past, consider this development to be a double-edged sword. For these people, the extensive renouncement of cash entails both disadvantages (cashless means of payment are perceived as complicated to use, concerns around data protection) and advantages (shopping can be done in unstaffed micro-markets in rural areas) at the same time. In rare cases, however, they also completely reject the new payment reality. No efforts are made to address this rejection at a policymaking level. In any case, the key problem facing many members of these groups is the question of whether they can cover their living expenses on the income they have at their disposal rather than what payment methods they use.

Almost no way to pay in cash at public authorities anymore

In the wake of the digitalisation campaign in public administration launched at the beginning of the 2020s, most members of the public are accustomed to accessing administrative services digitally. Cashless payment is integrated into the checkout process when ordering an administrative service.

Everyone is entitled to a basic bank account, for which legislators have now set a low rate of fees. The authorities administering social security pay the fees for recipients of social security benefits. Thus, almost all people in Germany can access a cashless means of payment. In view of this, legislators see no legal need to require local governments and authorities to accept cash. At the same time, the digital euro provides an alternative to private cashless means of payment that is legal tender and is also accessible for people without a bank account. Individuals who do not have a digital euro account with a credit institution can access central bank digital currency via public entities and postal offices. The digital euro is geared not only towards a high degree of inclusion, but is also designed to be as accessible as possible.

Furthermore, the *Regulation of the European Parliament and of the Council on the legal tender of euro banknotes and coins* adopted in the mid-2020s sets out conditions, such as efficiency reasons, under which the public sector is not necessarily required to accept cash payments. Having a cash register system, cash supply and collection and keeping the cash register secure come with a comparatively large price tag, and those still expressing a wish to pay in cash are few. As a result, local governments, authorities, public enterprises and institutions generally no longer offer cash payment options, unless the composition of the local population necessitates it. In municipalities where the share of people within a high age bracket is above average, there is still usually a cash register.

Disappearance of cash from its former strongholds

Cash no longer plays much of a role in its former strongholds, either. Mobile payment terminals are being used at weekly street markets, flea markets and in the food services sector. Payments between individuals are now made almost exclusively via payment apps, which differ when it comes to meeting needs such as data protection, convenience and ease of use.

Metaverse, online shopping and markets with low or no staff

Trading in the metaverse is gaining momentum and conventional online commerce continues to see strong growth. People are increasingly ordering groceries online, too, especially in urban centres, and in some cases these can be sold at lower prices than food from bricks-and-mortar shops. The use of AI in warehouses and in ordering systems plus the lower rental costs for warehouses and storage facilities in industrial areas mean cost advantages can be leveraged compared with business properties in central locations. The services sector, too, is increasingly set up on platforms via which tradespeople, for example, can offer their services.

When it comes to bricks-and-mortar retailers, the increasing technological maturity of pick&go systems (linking camera and sensor technologies) and the expanded functionalities of self-checkout systems are spurring on the rapid spread of unstaffed or low-staff shops. Since cash is no longer necessary for payment transactions in everyday situations and

cashless means of payment are ubiquitous, only a scarce few self-checkouts still accept cash payments. Hardly any checkouts are staffed anymore. In rural areas, too, unstaffed micro-markets are becoming more common and are viewed positively by the general public because they are the only option for obtaining day-to-day essentials locally. Since these micro-markets only take cashless payments, those groups of the population who previously paid in cash relatively frequently have also changed their payment habits. When individuals weigh up the costs and benefits, the personal benefit and the need to shop locally – especially for older people with reduced mobility – outweigh their "trepidation" regarding cashless payments.

Comfort and convenience when paying

In this highly digitalised environment, comfort and convenience are the core motives driving decisions on how to pay for almost all groups of society – apart from the traditional segment, those within a high age bracket and the few remaining people who pay in cash. When surveyed, members of the public continue to stress the importance of data protection and protecting their privacy, but this only rarely plays a role in specific everyday situations involving a choice about the means of payment. Trust in private providers of cashless payment instruments is also quite high among the vast majority of consumers and any concerns are pushed into the background. The choice of payment instrument is determined by the question: what is the fastest, simplest and most convenient way to make this payment? The answer is usually one of the cashless instruments.

Demographic change is also having an impact: in the 2010s and early 2020s, older people especially clung onto cash for reasons of sentimentality, habit and scepticism about cashless instruments in particular and digital solutions in general. This group's share in the population contracts sharply at the end of the 2030s due to demographic shifts. And, thus, not only do the above-mentioned attitudes disappear, but also the relevance of the argument that the needs of digitally unfamiliar, older population groups have to be considered – aside from the needs of those in a high age bracket. By the end of the 2030s, the older members of society will have already learned how to use digital services in the decades prior (digital immigrants).

Resilience and uncertainty

However, as digitalisation increases, so, too, does the vulnerability of society. In response to this, the government and enterprises significantly expand their cybersecurity measures and capabilities for fending off cyberattacks, allowing many, but not all, attacks to be prevented. Attackers are both private and state actors who seek financial gain (ransomware attacks) or wish to wreak havoc and massively disrupt everyday activities. Extremist groups seeking to bring about regime change across Europe are also, in some cases, able to carry out cyberattacks.

Providers of cashless payment solutions and their systems are a tempting target for all these attackers. Yet, the population responds with equanimity when cashless payment systems become temporarily unavailable, as there are numerous cashless alternatives and any losses are compensated for by providers. To date, there has been no prolonged period in which multiple cashless instruments are down – either through cyberattacks or power outages. Power outages due to supply bottlenecks or imbalances in the grid are rare anyway, as Germany has managed its energy transition relatively well. Data leaks, including of sensitive payment data, occur repeatedly but only briefly cause any concern. However, the majority of the general public believe that data leaks are the price to be paid for digitalisation and the prosperity it brings, and so consider them tolerable. In an extreme emergency, the majority of people also have cash at home.

Cashless means of payment: practical and inclusive

The share of total transactions and of sales accounted for by cashless means of payment grows considerably up to the end of the 2030s. In 2037, cash payments make up a mere 15% of total transactions (7% in value terms). Besides the heavy digitalisation of all facets of life, this is because of a further significant improvement in cashless instruments in terms of their convenience and security given the biometric authorisation of payments. AI applications are integrated into payment apps, and read and evaluate the online account's data. Using seamlessly captured payment data, they recommend financing and investment strategies or suggest ways to optimise a person's daily habits and consumption patterns.

Voice-activated banking solutions and other assistance systems also help to ensure that cashless means of payment become highly inclusive for people with various impairments. Private providers of these solutions use large-scale social washing campaigns to market themselves as inclusive, diverse and socially conscious. However, economically disadvantaged people are not an attractive customer group for providers of private cashless payment solutions, especially as they are rarely creditworthy.

Similarly, homeless people also face initial difficulties in this highly digitalised world since barely anyone carries cash anymore for spontaneous street donations. From the mid-2020s, though, sellers of magazines benefiting the homeless are increasingly seen to carry mobile payment terminals provided to them by the organisations that publish the street newspapers. Other social organisations also provide homeless people with payment terminals so that they can accept donations.

The digital euro, which was introduced by the Eurosystem as the 2020s gave way to the 2030s and was later expanded to include an offline function, penetrates the market fairly gradually. It has virtually no impact on cash usage, which has, in any case, already fallen sharply in the hyperdigital world.

Access to cash deteriorates

The main cash access points are banks and savings banks, though these have massively trimmed their ATM network. In the 2020s, the main reason for cutting down on ATMs was the frequency with which explosive attacks were being perpetrated. The more relevant reason at the beginning of the 2030s was that there was virtually no more demand for cash services among retailers and customers. With the disappearance of staffed checkouts in the retail sector and the decline in cash payment options for customers, cashback and cash-in-shop services have vanished.

Cost pressures in the cash cycle

As a result of the push towards digitalisation and the corresponding spread of cashless means of payment, cash acceptance points are disappearing and cost pressures on the cash cycle increase considerably up to the end of the decade. This is also exacerbated by the fact that the Bundesbank, which had already started to trim its branch network years ago, is now paring it back even further. On the one hand, it does so in response to the decline in demand for cash within Germany, and on the other, it is due to a self-imposed restrictive spending policy. After years of expansionary fiscal policy to fend off crises, all public authorities are now required to cut costs. Although the Bundesbank is not bound by this instruction, it follows the now widespread restrictive approaches. This fact is all the more relevant given the sharply contracting volumes of cash in circulation domestically and drives up the costs of supplying and disposing of cash even further.

Only a small number of effective cost-cutting measures are implemented in the cash cycle, such as the introduction of safe bags for loose coins instead of coin rolls. While the cash cycle does also benefit from innovations stemming from digitalisation, these are introduced too late to have a stabilising effect on cash usage.

Virtually no players in the business community still accept cash, and local governments and authorities under pressure to save only accept cash in isolated cases.

Cash is the only fallback solution in a digitalised society

As a consequence, and on the basis of the monitoring requirements set out in the EU Regulation on the legal tender of euro banknotes and euro coins, the Federal Government responds to the enormous decline in cash use and adopts legal standards to secure a basic level of cash provision for retailers and the general public. The key motive is to preserve the cash infrastructure for the event of a crisis in the highly vulnerable digitalised society – a move which is also welcomed by parts of the population. The digital euro is just as vulnerable to cyberattacks and power outages as other cashless payment instruments and is therefore an inadequate substitute for cash in crisis situations. Cash is valued for its general independence from technical infrastructure and it is able to keep hold of its unique position in this respect.

The cash renaissance payment world

Smart, self-determined and resilient

The cash renaissance payment world – smart, self-determined and resilient

Germany in the 2020s

At the beginning of the 2020s, four developments shaped politics and society like no others: the COVID-19 pandemic, climate change, advances in the development of general-purpose artificial intelligence and the war in Ukraine. As there were various phases of the pandemic in which travel and contact with people outside a person's own household were prohibited, many people once again focused on things closer to home: local leisure activities and shops, neighbourhood initiatives and support networks. A wave of solidarity expressed digitally on social networks under hashtags such as #supportyourlocal led to many people shopping locally again – partly out of fear that local businesses might not exist anymore once the pandemic was over and that some suburbs, districts and high streets would be studded with even more empty shops.

"Support your local *you name it*" was the mantra not only for solidarity during this time, but also for a more sustainable way of life associated with buying local and regional products and services. Since smaller local shops usually accepted cash at the beginning of the 2020s, the redirecting of habits towards regional and local consumption weakened the rates of decline in cash use at least somewhat.

Extreme weather events such as the flooding of the Ahr river in the summer of 2021 made it abundantly clear that the consequences of climate change would also be felt in Germany, and were a dramatic demonstration of how vulnerable infrastructures are. The COVID-19 pandemic and the war in Ukraine also showed the public how dependent the German economy had been on smoothly running, globalised and extremely undiversified supply chains.

Policymakers and parts of society therefore thought more deeply on how Germany and the European Union could become more independent: in the payments landscape, cash and the digital euro introduced as the 2020s gave way to the 2030s promised greater European autonomy. To ensure that Europeans can reliably use legal tender at all times and to throttle the market power of mainly US private payment service providers in Europe, the European Parliament and the European Council adopted a package of measures to strengthen the euro in the mid-2020s. A regulation set forth the legal framework for the introduction of the digital euro. At the same time, the euro area for the first time defined binding standards for the acceptance of and access to cash, thus underscoring the importance of euro cash as legal tender. There is a high level of trust in the government and its subordinate authorities. Past crises have proven the government's ability to act.

The COVID-19 pandemic initially led to increasing digitalisation in almost all areas of life. In terms of payments, one way in which this manifested was the widespread use of contactless payments in shops and also at market stands. However, the huge advances in artificial intelligence (AI) soon raised doubts among many people as to whether all-encompassing digitalisation is actually a good idea.

Many people were well aware of the benefits of the surge in digitalisation triggered by the COVID-19 pandemic – from the option to work from home to the ability to participate in numerous events online when previously they had been reserved purely for those who could attend in person. Nevertheless, many people began to have an uneasy feeling of heteronomy and of being controlled by self-learning AI systems trained on mass data.

Anonymity, digital sovereignty and the right to analogue life

Ambitious individuals tending towards alternative lifestyles advocated more for the right to an analogue life from the mid-2020s, drew attention to the dangers of AI and called for data minimisation and digital sovereignty. Their trust in providers of private cashless payment instruments deteriorated. They deliberately switched off their smartphones or other smart devices for hours at a time and enjoyed their analogue freedom. At that time, people in the Expeditive and Neo-Ecological Milieus consciously began to pay with cash more often so that providers of cashless instruments would not be able to feed their business models with their customers' data.

Alongside social and political factors, lifestyle aspects were also important: groups who had previously rarely used cash associated cash with values such as sovereignty, independence, constructive rebellion and a way of casually setting oneself apart from the mainstream. As a result, cash became a symbol setting them apart from the rest of society, which they deemed to be in thrall to technology. Some members of the Expeditive and the Neo-Ecological Milieus also used the offline digital euro, which was introduced as the 2020s gave way to the 2030s, as a low-data payment method in addition to cash. For members of milieus who have always preferred cash for reasons of privacy, the offline digital euro is still not considered an alternative to cash.

The high inflation which set in in 2022 and only came down again in the mid-2020s saw many younger people, in particular, rediscovering the "good old" budget book. In order to manage with their small budgets and avoid over-indebtedness, they set aside cash for their planned spending. This phenomenon was referred to as "mindful cash stuffing". At first, one way it spread was on the social media platform TikTok which was then primarily used by younger people, and in time it carried over into analogue life.

Benefits of cash are rediscovered

Starting from the generally trend-setting Expeditive Milieu, greater awareness of the benefits of cash gradually spread to the other social milieus. With the exception of the traditional segment and the Precarious Milieu, they had tended to pay with cash infrequently up until that point, but now became more critical of the disappearance of cash payment options ("Only cards accepted!"). Although the right to an analogue life was not such a deeply entrenched value in these milieus, their members, too, began to rethink and refocus on the benefits of cash. It helped that the use of cash was also seen to be simpler and quicker now, thanks to the abolition of 1 and 2 cent coins, the introduction of rounding rules and the increased use of payment machines (machines that count and check cash and automatically issue change) at staffed registers.

As a result of this – depending on the payment situation and the desired goods and services – even milieus that had previously been less keen on cash now deliberately used cash or relatively low-data cashless instruments such as the digital euro, data from which the ECB did not use to make a profit. The trend set in motion by the COVID-19 pandemic of buying from small shops close to home, which generally, and in many cases only, accepted cash payments, continued. Online commerce continued to grow, but cannot match the surges in growth seen in the past. As a result, the share of cash payments in total transactions fell much more slowly than in the early 2020s.

At the beginning of the 2020s, clear resistance to the displacement of cash from its former strongholds emerged for the first time. A number of transport companies got rid of cash payments in public transport, and public toilets in some cities could only be used after paying with cashless instruments. The protest was mainly supported by older people, members of the traditional segment and people living in precarious conditions, and met with solidarity from the vast majority of the population, leading to many of these measures having to be reversed.

Commercial banks see added value in providing cash services

Another factor behind the slower decline in the share of cash payments in total transactions was that access to cash did not deteriorate significantly. The trend towards branch closures among savings banks and banks continued, and the ATM network was not maintained at the early 2020s-level either, but the decline in both areas slowed again from the mid-2020s. Commercial banks were quick to take account of the potential impact of the EU regulation on access to cash and feared that further reduction in infrastructure might result in them being forced to undertake the costly task of rebuilding. In addition, since the Bundesbank started publishing statistics on the supply of cash broken down by banking group, as called for by consumer protection organisations, providing cash services has increasingly been regarded as an investment in customer loyalty.

The public prepares for emergencies

Cyberattacks on cashless payments and power grids are on the rise. In addition, flaring conflicts within and outside Europe meant that consumers used higher amounts of cash as a store of value at home, as the government and the Federal Office of Civil Protection and Disaster Assistance (BBK) also exhorted people more strongly to hold cash for a crisis. All in all, recent experiences had raised public awareness of the need to prepare for disasters and crisis situations.

The Federal Government strengthens cash as a societal good

Despite the above-described stabilising effects on cash use, cash made up less than 50% of transactions at the end of the 2020s.

The EU regulation now in force on ensuring access to and acceptance of cash prompted the Federal Government to take regulatory steps to strengthen cash as a means of payment. Cash was seen as an important fallback solution in the event of cyberattacks and had already proven itself as such when certain private payment service providers were temporarily unavailable after such attacks. It had also been able to help stabilise the situation when extreme weather events occurred and regional infrastructures failed. The Federal Government was aware that cash would only be a good fallback in the event of cyberattacks and power outages if it were used in normal times as well and appropriate infrastructures were in place. Under no circumstances did the government want to end up in a situation where the cash infrastructure, having been largely dismantled, had to be rebuilt at great cost in order to ensure a desired minimum supply of cash.

The government's actions were shaped not only by considerations around resilience and autonomy in payments. Many policymakers were aware of the public's desire for freedom of choice when it came to the available means of payment, for simplicity and an ability to keep track of spending, as well as the importance of cash for economically disadvantaged people, the share of whom had risen on the back of the inflation in the mid-2020s. Cash is the only means of payment that can fully perform a combination of important social functions (safeguard privacy, inclusion, independence from technical infrastructure).

A broad PR campaign showed society how a cashless future would impact on people who are reliant on cash. Using cash thus also became an expression of active solidarity.

Increasing acceptance of cash in retail and public administration

In the early 2030s, in light of the EU regulation, the Federal Government recommended that retailers should, as a basic principle, accept cash. Public authorities had to clear higher hurdles to prove that they cannot accept cash payments for efficiency reasons. Administrative services are therefore generally offered in online and analogue formats.

Up to that point, a number of major retail chains with digitally savvy customers had already completely stopped taking cash payments. Some of them now started to accept them again. All of the major supermarket chains offer both staffed checkouts and self-checkouts at the same time. Depending on their size, all businesses that offer self-checkouts also offer one or more self-checkouts with cash payment modules.

Since the number of cash acceptance points in retail and at public authorities is now increasing again, consumers make more frequent use of this option (supply creates demand). Retailers can expand their cash services, as they have sufficient cash takings coming in.

Supporting cash infrastructure

Due to the importance of cash for civil society, the government promotes not only the use of cash, but also research into optimising cash infrastructures. The size of the Bundesbank's branch network remains the same as in 2022. Owing to its dependence on electronic infrastructure, the digital euro is not on par with cash in a crisis situation: even if the offline function is used, there has to be a regular online exchange of data and the smartphone needs power. However, it can serve as a supplement to cash in helping to maintain payments in the event of a temporary power outage or cyberattacks.

Clear regulation for maintaining cash infrastructures gives cash cycle stakeholders greater certainty when it comes to deciding whether it makes sense to invest in innovation. As a result, AI applications and digital solutions are now increasingly being used in the cash cycle, which have been developed in accordance with the strict requirements of the EU AI Act and are classed as minimal-risk or no-risk systems.

Cash-in-transit (CIT) companies are permitted to operate on a one-person basis without obtaining an exemption, as the transport can now be technically secured. Retailers invest more frequently in sharing systems with multi-tenant vaults.

For retailers, accepting cash becomes more attractive again in the 2030s, as the costs of cash supply and removal have come back down after having increased for a time. The key drivers are regulatory support for the use of cash and the efficiency gains from innovations in the cash cycle.

As a result of these factors, demand for cash starts to stabilise in the 2030s.

The vanishing hybrid payment world

Pluralistic, segregated and indifferent

The vanishing hybrid payment world – pluralistic, segregated and indifferent

Germany in the 2020s

In the 2020s, there is significantly greater individualisation and pluralisation in peoples' living standards, lifestyles and personal environments compared with the 2010s. This is due to a wide variety of causes, trends and countertrends. In some social milieus, the liberalisation of values leads to broader acceptance of different lifestyles. Individual identities develop irrespectively of social background, gender or religion. By contrast, in other social milieus, there is a certain tendency to return to traditional roles owing to a general sense of uncertainty regarding social transformation processes. In an increasingly complex modern world, people feel overwhelmed and seek clarity and security.

The transition in energy and mobility, the restructuring of industry towards decarbonisation, and advancing digitalisation result in different winners and losers in the transformation. Social inequalities are growing and can be mitigated only to a limited extent by the government. This is because spending in previous crisis situations and current crisis-like challenges has already brought government debt burdens to a high level and there is no majority political support for a policy of redistribution.

In milieus that reject social change or suffer from economic change, the crisis of trust between the public and policymakers that was already apparent in the 2020s intensifies. In general, members of the consumption and participation-oriented segment have little faith in state actors. In the better-off milieus, confidence in the state is comparatively stronger. Members of the traditional segment are sometimes suspicious of both government and private actors if they feel such actors are intervening too much in people's private lives.

Recurring conflicts within Europe and beyond, which also lead to new migratory flows and discussions about new security architectures and higher spending on security policy measures, are variously perceived as a threat, ignored or considered manageable by the different milieus.

Milieus continue to diverge; milieu membership key determinant of preferred means of payment

Membership of one of the increasingly diverging milieus, with their disparate values and lifestyles, is a key determinant – but not the only one – of which means of payment and stores of value consumers prefer in the 2030s. The same principle as in the 2020s continues to apply at the turn of the decade and beyond: economically restricted or disadvantaged individuals favour cash over cashless means of payment. People who are suspicious

of the government or private and/or digital providers also prefer cash. The same goes for people looking for simplicity and a good overview of their own expenditure and who would like to or need to monitor their spending behaviour.

A person's age, by contrast, plays barely any role anymore in choice of payment instrument. In 2030, people born in 1960 will be 70 years old. They learned how to use payment cards as young adults and were probably on the internet for the first time in their mid-30s (digital immigrants). The crucial factor for a person's preferred choice of payment instrument is their attitude towards digitalisation rather than their knowledge about it: informed and sceptical consumers prefer means of payment that require little data or are anonymous, such as cash or the digital euro, which was introduced as the 2020s gave way to the 2030s. Consumers that are happy taking risks and those seeking convenience readily try out new cashless payment methods offered by private providers; those who have no strong feelings on data protection are more open to them anyway. Members of the progressive segment, in particular, are regarded as early adopters when it comes to innovations in cashless payment instruments. The salient feature of these new cashless payment options is easier and more convenient authentication of payment transactions; they also link payment data with various analytical tools to optimise one's own lifestyle.

With societal living standards diverging to a greater degree, providers of cashless means of payment are compelled to tap new customer segments as well, making their products more inclusive in the process. Although cash is still highly inclusive, for certain groups, such as persons with motor impairments and increasingly for persons with impaired vision, they are the better alternative. This is due mainly to improved speech input and output technologies. In addition, cards and apps are proliferating that enable older children and young people to manage their pocket money in the digital sphere under parental supervision whilst at the same time helping them to learn how to handle money.

Digitally savvy milieus undaunted by cyberattacks

While cyberattacks and other disruptions to cashless payment systems continue to occur, they are only temporary and are not perceived as concerning by milieus that tend to prefer cashless payment methods, even when they result in data leaks.

As members of these milieus, too, often still carry cash as a fallback in the form of an "emergency stash" of a few notes in their smartphone case, bag or pocket and even still use it in certain payment situations, they are ready for anything.

Cash persists in some strongholds and as a store of value

Even at the end of the 2030s, like at the beginning of the 2020s, cash is still being used by a large part of the population to pay street vendors, when tipping, as a gift to friends or family and when paying smaller amounts. Parents and teachers continue to regard it as

a tried-and-tested means of teaching young children, in particular, how to handle money and to give them their first experience of shopping independently. However, cash is used less and less frequently to pay at vending machines, for children's rides in front of supermarkets or in shopping centres, for votive candles or donations in churches and for the use of public toilets. This is primarily because near field communication (NFC) technology is now also widely used in these settings. Whilst in the early 2020s there was resistance, mainly from older people, to the proliferation of card payments at public lavatories, this generally did not lead to the reintroduction of coin payments, but instead to a certain contingent of free toilet facilities in public spaces.

Almost every milieu still also uses cash as a store of value. However, the share of cash in their portfolio varies. Wealthy people, members of the progressive segment and people who tend to use cash less also tend to use other stores of value. By contrast, cash continues to play a comparatively important role as a store of value for risk-averse and economically disadvantaged people, people with a low level of formal education, members of the traditional and consumption and participation-oriented segments, and frequent cash users.

Freedom of choice is restricted by developments in access and acceptance

At the beginning of the 2020s, just under three-quarters of the population still regarded cash as a popular payment method – even though, ostensibly for reasons of hygiene, many shops requested during the COVID-19 pandemic that cashless payment methods be used. At the time, well over one-half of the public were critical of diminished cash acceptance. In particular, members of the traditional segment, people with a low level of formal education and those aged over 70 at the time greatly appreciated the ability to pay in cash. Although back then all social milieus had a desire for a hybrid payment reality regardless of their personally preferred means of payment, genuine freedom of choice was gradually eroded by various developments in access and acceptance.

In 2037, cash makes up 31% of all transactions (16% in value terms). This represents an average annual decline of 1.7 percentage point in terms of transactions and 0.87 percentage point in terms of value since 2021. Although there were no sudden declines in the share of cash in total transactions of the kind seen during the COVID-19 era, there was no return to moderate declines akin to those of the pre-pandemic era, either, when the cash share declined by an average of 1 percentage point in terms of transactions per year.

Decreasing cash acceptance in retail and public administration

One of the reasons for these developments was that online commerce continued to grow in the 2020s and that branches of large retail chains closed – first due to falling sales and second because the retail sector was constrained in its ability to hire skilled labour at the wages on offer.

The remaining bricks-and-mortar retailers are aware of the preferences of their customer base, which may be made up of people from different milieus depending on product portfolio and brand positioning. Accordingly, there is huge variation in terms of cashier system facilities. In addition to businesses that offer staffed checkouts and self-checkouts at the same time, there are stores that only offer staffed checkouts and those that have no staff at all. In shops where parts of the clientele like to pay in cash, there is at least one self-checkout with a cash payment module, depending on the size of the store. Although bricks-and-mortar retailers with a cash-inclined customer base continue to make cash payments possible, customers are encouraged to pay using cashless means of payment in many of these outlets, too.

This has been true particularly since the digital euro was introduced as cashless legal tender around the turn of the decade. It has an offline function and is not completely anonymous. Milieus that are already eager to try out innovations in payments use it more than cash. Owing to its dependence on electronic infrastructure, it is not on par with cash in a crisis situation, but can be a supplement to cash in helping to maintain payments in the event of a temporary power outage or cyberattacks.

As the share of cash is shrinking, less and less cash is coming into shop tills, meaning that customers wanting cashback cannot always get the amount they want whenever they want it. Generally speaking, the universal nature of cash is declining. Customers have to ask more frequently whether they can actually pay with cash. Some people feel too awkward about doing this, meaning that they prefer to use a cashless means of payment from the outset.

Public authorities are also coming to favour cashless means of payment. As some government services have been offered digitally since the mid-2020s, and it is therefore becoming increasingly less and less necessary to appear in person at offices, any fees for these official services can be paid online using cashless means of payment. The vast majority of the public very much welcomes the simplified access to government services. Public authorities can reduce the number of NFC terminals provided and maintain only a very small number of cash registers. However, it is still possible to pay for administrative services in cash in at least one municipal administration office throughout the city.

Costs in the cash cycle barely fall; ATM network gets scaled back

The reason why retailers and public authorities enable cash payments but only offer them on a restricted basis is the high cost of cash supply and removal. Private banks – but also, to a lesser extent, cooperative banks and savings banks – continued to significantly reduce their number of branches by the turn of the decade. As a result, only a few of the existing branches offer cash supply and collection services for retailers. As cash usage declines, thought is given to whether the Bundesbank's branch network might need to be reduced further.

Moreover, the fixed costs of cash have hardly fallen. Although a number of innovations were introduced to the cash cycle – examples being the technical monitoring of ATM fill levels across Germany to fit supply and removal of cash around demand, the establishment of local cash cycles, the increased proliferation of smart safes, cutbacks to the frequent repackaging stages in the cash cycle and the abolition of 1 and 2 cent coins – they have had only a small amount of leverage on the cost structure.

Since 2012, physical attacks, in particular in the form of ATM robberies, increased steadily up to the beginning of the 2030s. Since 2020, the perpetrators have increasingly used explosive materials, posing enormous risks to life and limb for residents, passers-by and police and fire service personnel. For this reason, banks and savings banks have temporarily or permanently stopped operating ATMs in particularly vulnerable locations – for example, in the lobbies of branch offices in residential buildings. In order to prevent ATMs from being blown up, the manufacturers of ATMs were later even required by law to upgrade their machines with intelligent banknote neutralisation systems (IBNS). These are set off by an explosion and render the notes unusable. As upgrading machines carries costs for ATM operators, these reduced their supply structures.

Branch closures also reduce the number of ATMs, thereby making it more difficult for consumers to access cash. As described above, cashback in the retail sector cannot sufficiently compensate for the loss of ATMs either.

Cash use gradually fades away; momentum for policy action fails to materialise

The decline in the use of cash is gradual. A major crisis or disaster that could draw attention to cash as a resilient means of payment in a society where the half-life of news articles is becoming ever shorter has failed to materialise. Since a pro-cash movement among the general public cannot be orchestrated in a society that is growing ever more segregated and diffuse, there is no momentum that might lead policymakers to improve access to or acceptance of cash. The better-off milieus and the progressive segment hardly miss cash.

A contributing factor is that some societal functions which were once largely fulfilled by cash are now also fulfilled by cashless means of payment. However, cash remains the only means of payment that promotes the acquisition by children of financial literacy skills and guarantees independence from technical infrastructure.

There are only a few warning voices: consumer protection agencies draw attention to the fact that reducing the possibility of paying cash will force groups of people into using cashless payments who had so far avoided it for good reason. However, the approach to solving this problem preferred by policymakers is for the respective financial service providers to improve their education campaigns or to review questionable “buy now, pay later” services rather than to pursue policy-led stabilisation of the cash supply.

The indicators for monitoring the fundamental obligation to accept cash established on the basis of the EU Regulation on the legal tender of euro banknotes and coins, as well as the exemptions, do not lead to measures that could form an appropriate bulwark to maintain the acceptance levels of the early 2020s.

A downward spiral is created: the use of cash continues to decline as access to and acceptance of cash become restricted. The fixed costs for the supply and removal of cash appear disproportionately high as cash volumes fall. Options for accessing cash and situations where it is accepted are therefore limited further. Some consumers react to the reduced supply of cash by taking a particularly forward-looking approach to obtaining and holding cash, which they themselves perceive as a hassle. If they encounter an ATM that belongs to their bank or savings bank network, they withdraw some cash just in case, but avoid using it, as they cannot be sure whether they will easily be able to procure cash the next time they need it. In any case, it now goes without saying that cashless payment methods will be accepted. "Cash payment only" situations have become rare. It is all the more common that recipients of payments will accept only cashless means of payment. The stock of cash on one's person therefore lasts a long time. Cash has surrendered its erstwhile advantage as a universal means of payment in favour of cashless payment instruments come the end of the 2030s.

4

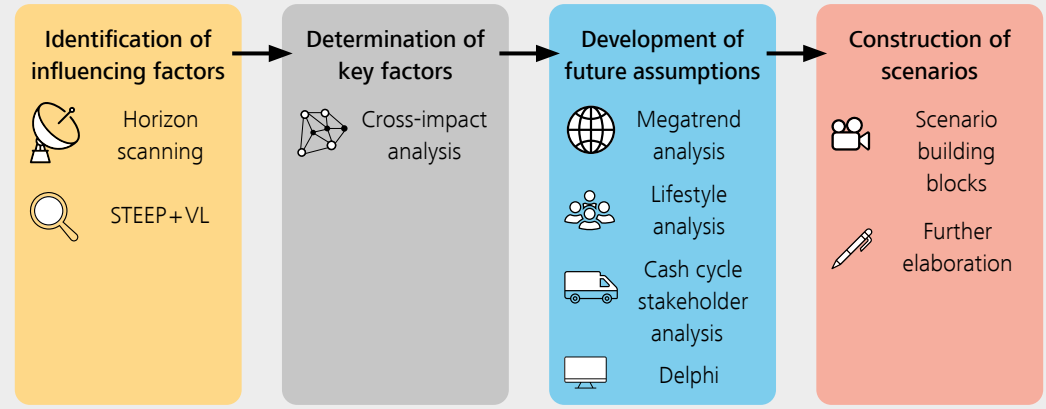
THE METHODO-LOGICAL ROUTE TO THE SCENARIOS

4.1 The key factor-based scenario approach

The "Cash of the future" study followed a key factor-based scenario approach, comprising four steps.

- Identification of 49 influencing factors on the topic of "maintaining the position of cash as an attractive, reliable, competitive and generally accepted means of payment and store of value in 15 (and up to 20) years" (What factors could influence the topic?)
- Narrowing down of the 49 factors to 10 key factors (Which factors are crucial and have the largest impact?)
- Development of future assumptions for the individual key factors (What projections arise for each key factor?)
- Construction of three scenarios by combining consistent projections (Which projections for the key factors paint a consistent picture?)

The key factor-based scenario approach of the study and the foresight methods used Figure 4.1.1



Different foresight methods were used for the individual steps. The methods in the four steps of the key factor-based scenario approach are presented and sorted based on their main thematic focus (Figure 4.1.1). In each case, the methods' position in the schema has been guided by which of the individual steps they were central to. However, as some foresight methods contributed to more than just one step, the study itself deviated from the sequence shown above. The megatrend, lifestyle, and cash cycle stakeholder analyses, for example, yielded additional influencing factors. These methods were employed ahead

of the cross-impact analysis. Horizon scanning, meanwhile, also played a role in the process of developing future assumptions.

Identification of influencing factors

To start with, a horizon scanning exercise was carried out to identify influencing factors in the form of trends, developments and technologies shaping cash payments in Germany, the main focus of research. These were supplemented by additional factors gleaned from the megatrend, lifestyle, and cash cycle stakeholder analyses. In order to ensure that the study picked up on all relevant influencing factors, a framework conditions analysis was set up and the factors systematised according to the STEEP+VL categories. STEEP+VL stands for **s**ocial, **t**echnological, **e**conomic, **e**cological, **p**olitical, **v**alues-related and **l**egal factors (Nazarko et al. 2017).

Narrowing down to key factors

The next step was to select key factors from the universe of influencing factors identified. Key factors are those influencing factors whose potency and uncertainty are decisive for the future development of cash. Ultimately, key factors are highly relevant non-directional factors.

A cross-impact analysis was carried out to determine the key factors from the universe of the influencing factors (factor reduction).

Development of future assumptions for each key factor (construction of projections)

Once the key factors were defined, hypotheses were derived for the ways they might evolve into the future.

These hypotheses were based on data from:

- the results of the horizon scanning;
- the megatrend analysis;
- the lifestyle analysis;
- the cash cycle stakeholder analysis.

In a two-stage Delphi survey involving experts from various specialist fields, the hypotheses were first validated and then condensed to form future projections (possible pathways) for the key factors.

Three projections were prepared for each key factor according to the "mutually exclusive and collectively exhaustive" (MECE) principle. As exploratory scenarios, the projections express possible, probable and plausible developments.

Construction of three scenarios

The three projections for each identified key factor were mapped to a two-dimensional decision matrix, a morphological box, and consistent projection bundles were identified. The guiding consideration in this exercise was which projections for the key factor at hand could fit together without creating excessive tensions in terms of content and without creating inconsistencies in the subsequent scenario. The respective projection bundles formed the basis for raw scenarios, which were then refined into comprehensive narratives.

The next section provides a brief description of the foresight methods used in the study and how they were specifically implemented in the research design.

4.2 Foresight methods used

Horizon scanning

Horizon scanning is often a first step in more extensive strategic foresight processes (Habegger 2009), as was the case in this particular project. The method is an early identifier of signs of future changes (Lang 1998; Glenn and Gordon 2009).

The aim of the horizon scanning in this study was to systematically identify weak signals[3] (Ansoff 1980), trends, developments and technologies within defined search fields (the "horizon") which could shape cash – the central topic of investigation – in the future. The method allows us to detect and outline fundamental interactions in order to obtain initial information units, data and analytical relationships for the projections to be developed (possible pathways of a key factor).

The following search fields were the starting point for the horizon scanning exercise:

- *Requirements for cash:* security, privacy, sustainability, convenience et al.
- *"Digital" cash:* cash in e-commerce, digital cash receipts et al.
- *Cash characteristics:* inclusion, avoidance of negative interest rates, corrective effect in payments system et al.

3 Weak signals are the first signs or indications of strategic discontinuities and thus of possible change in the future. They can be both warning signs and a source of information on new developments and opportunities (Holopainen and Toivonen 2012, 199).

- *Cash cycle:* services, organisation and processes, cash recycling, decarbonisation, security of supply et al.

- *Printing technologies:* intaglio printing, inkjet et al.

- *Printed electronics on paper:* printed sensors, displays and other electronic components

- *Logistics in general:* services, organisation, processes, technologies, decarbonisation

- *Materials:* smart materials, paper, plastics, recyclability, resource consumption

- *Cash security features:* machine-readable features et al.

- *Security and crime:* money laundering, ATM explosions, attacks on cash-in-transit companies and bank robberies et al.

- *Cashless means of payment:* including product features (such as data protection, security, convenience) of cards, the digital euro and stablecoins, underlying technologies such as near field communication (NFC), QR, biometric authentication, distributed ledger technology et al.

- *Store of value:* gold, shares, real estate et al.

The search strategy implemented was a combination of desk research (mainly grey literature,[4] but also technical texts and newspaper articles) and a hot topic analysis based on a combination of text mining approaches[5] and artificial intelligence (AI) methods for semantic text analysis.[6] The information obtained from the search strategy was supplemented by the perspectives from ten semi-structured interviews with experts (Table 4.2.1). In addition, a statement by the Serious and Organised Crime Division of the Federal Criminal Police Office (*Bundeskriminalamt – Abteilung Schwere und Organisierte Kriminalität (SO)*) entered into the horizon scanning. The statement was a response to questions from the interview guideline.

4 These are, for example, research reports or congress reports, which are usually published by institutions or organisations such as public authorities, research institutions, industry or business associations, etc.
5 Text mining is a process of converting unstructured text into a structured format to analyse patterns and derive new insights.
6 In a semantic analysis, an AI-based software program classifies text elements into a context of meaning.

Interview partners in the horizon scanning exercise Table 4.2.1

Name	Organisation
Binnebößel, Ulrich	German Retail Federation (*Handelsverband Deutschland e.V.* – HDE)
Kemmers, Fleur (Prof.)	Institute of Archaeological Sciences, Dept. II, Coins and Money in Greek-Roman Antiquity, Goethe University Frankfurt
Knoop, Björn	Federal Criminal Police Office (*Bundeskriminalamt*) Unit CC21-3 Payment cards/Logical attacks on payments (*CC21-3 Zahlungskarten/Logische Angriffe auf den Zahlungsverkehr*)
Lohweg, Volker (Prof.)	OWL University of Applied Sciences and Arts
Mewes, Michael; Paulick, Andreas; Wiegand, Kirsten	Association of German Cash Service Industry (*Bundesvereinigung Deutscher Geld- und Wertdienste e. V.* – BDGW)
Schmiese, Jörg	Association of German Banks (*Bundesverband deutscher Banken e. V.*)
Seidemann, Wolfram (Dr); Thum, Severin	Giesecke + Devrient Currency Technology GmbH
Weissenbäck, Markus	Fraunhofer Institute for Integrated Circuits IIS (*Fraunhofer-Institut für Integrierte Schaltungen IIS*)
Zeitz-Brandmeyer, Claudio	Federation of German Consumer Organisations (*Verbraucherzentrale Bundesverband e. V.* – vzbv)
Anonymous	

The following data sources were used for the hot topic analysis:

- Research content drawn from academic publications from all over the world contained in the Scopus® database (abstract and citations database for peer-reviewed literature)

- Research and development projects funded at the federal level (*Förderkatalog des Bundes* – Fökat) and the European level (Community Research and Development Information Service – CORDIS)

- Current media coverage and specialised news blogs in the form of rich-site summary (RSS) feeds

The software-based hot topic analysis provided an important basis for deriving and formulating weak signals, trends and developments. The results of the hot topic analysis of the funding projects at the Federal and European level, as well as of media reports and news blogs, were particularly fruitful.

The search query used enabled 144 sub-projects funded at the federal level (listed in Germany's Fökat database) and 584 sub-projects in the European Commission's CORDIS database, 58 of which were sub-projects with German involvement, as well as 7,157 media reports and news items – including 2,636 newspaper articles, 609 articles in popular science magazines, 55 blog posts, 20 articles in specialist journals and 2 contributions from parliamentary institutions for technology assessment – to be identified and text mined.

The ten interviews with experts as part of the horizon scanning were conducted between April and August 2022, with the interviews lasting between 30 minutes and one hour 45 minutes. The key results of the interviews were processed in the form of seven thematic fact sheets and supplemented with further "weak signals," some of which were detected in the hot topic analysis and some in further desk research. These results feed into the development of the influencing factors and the derivation of the pathways for the key factors.

Megatrend analysis

While horizon scanning focused on identifying trends within individual search fields, megatrend analysis looks primarily at megatrends – that is, long-term driving forces that are starting to emerge now and will most likely have significant influence on the future. These have the potential to lead to global transformations in countless areas of daily life, sectors, policy fields and society, and to shift and spe the rules of the game on a lasting basis.

The idea behind the megatrend analysis was to identify relevant megatrends as drivers of evolving requirements when it comes to means of payment as well as possible effects on future cash use, and to use these as a basis for deriving assumptions about the future.

A literature research and analysis drawing on future-oriented studies was conducted to obtain a systematic overview of the megatrends relevant to the "Cash of the future" topic of investigation, with 24 previously published accounts of megatrends being analysed overall.

The section below examines the anatomy of each megatrend in terms of its impact on the topic of investigation, its root causes and the pace of its development. The exploratory framework used for this purpose is based on the following categories.

- *Consumer requirements and payment behaviour:*
  Consumers' needs, wants and demands when it comes to means of payment, and possible consumer behaviour with regard to cash and cashless payment instruments in each use case

- *Cash and cashless means of payment:*
  Possible developments in cash as a means of payment and cashless means of payment in each use case

- *Cash and cashless means of payment as a store of value:*
  Possible developments in cash as a means of payment and cashless means of payment in each use case

- *Demand for banknotes and cash cycle*:
  Possible effects on banknote demand and the cash cycle in each use case

- *Security and crime:*
  Possible effects on security and crime in each use case

The possible effects of the megatrends, together with the results from the horizon scanning exercise and the lifestyle and cash cycle stakeholder analyses, were used to derive influencing factors that served as a basis for cross-impact analysis. In addition, future assumptions were developed as part of the megatrend analysis and fed into the projections for the individual key factors.

Lifestyle analysis

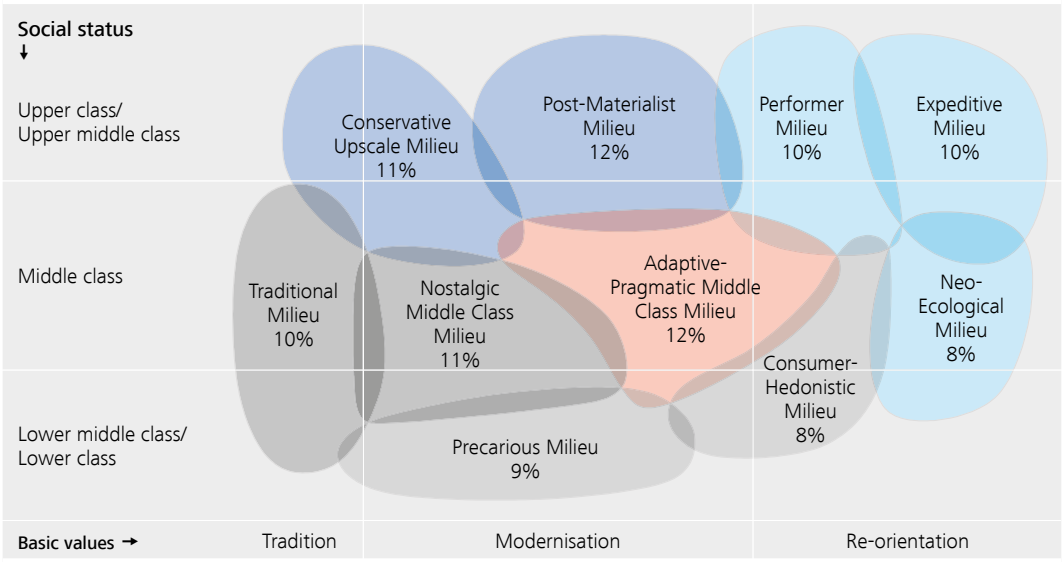
The idea behind the lifestyle analysis was to obtain a systematic and nuanced picture of the role that different lifestyles play, and to thereby gain a thorough understanding of their significance for the topic of investigation – in this case, cash of the future. Different consumer lifestyles have a bearing not only on how cash is used today, but also on what consumers expect from the means of payment of tomorrow. For this reason, the factors driving and hindering the use of cash and attitudes towards cash were examined by different lifestyles using SINUS milieus (SINUS-Milieus®) as a social and target group model. The study was designed to comprise both focus groups and a representative survey. By combining a qualitative and a quantitative research approach, it was possible to analyse causal relationships across phenomena (qualitative perspective) on the one hand and proportionalities (quantitative perspective) on the other.

SINUS milieus, which provided the analytical framework for the focus groups and representative survey, are a social and target group typology that arranges individuals into groups of like-minded people based on their values and lifestyles and visualises them as a "social map". Fundamental values are accounted for, as are everyday attitudes (e.g. on work, family, leisure, money, consumption, the media) and social status (e.g. education, occupational group, income).

The SINUS milieus were developed by the SINUS Institute more than 40 years ago and have been updated ever since, most recently at the end of 2021, to reflect societal change. They have served as an established method of psychographic target group segmentation for decades now, and are in continuous use for market and social research by enterprises and also by public authorities.

At present, German society consists of ten such SINUS milieus (Figure 4.2.1). The transitions between neighbouring milieus are fluid (a phenomenon that SINUS calls the "uncertainty principle" of everyday reality). The vertical axis in Figure 4.2.1 shows the social status (ranging from low to high) and the horizontal axis the value orientation (ranging from traditional to postmodern). The higher a milieu is located in this graph, the more upscale its education, income and occupational group; the further to the right it extends, the more modern in a sociocultural sense the basic values of the respective milieu.

Surveyed segments by SINUS-Milieu® Figure 4.2.1



Source: SINUS-Institut

For the study, multiple SINUS milieus were grouped into milieu segments which, in the context of the study topic, could represent alliances between the personal environments people inhabit. Milieus were grouped based on attitudes towards cash assumed upfront as a hypothesis.

Specifically, these are the following:

- the **established segment** (blue in Figure 4.2.1), consisting of the Conservative Upscale Milieu (the older structurally conservative elite) and the Post-Materialist Milieu (the sovereign educated elite with post-material roots);

- the **progressive segment** (light blue in Figure 4.2.1), consisting of the Performer Milieu (the efficiency and progress-oriented technocratic elite), the Expeditive Milieu (the ambitious creative bohemians) and the Neo-Ecological Milieu (the progressive realists);

- the **modern middle class** (red in Figure 4.2.1), consisting of the Adaptive-Pragmatic Middle Class Milieu (the modern mainstream);

- the **traditional segment** (dark grey in Figure 4.2.1), consisting of the Nostalgic Middle Class Milieu (the harmony-oriented middle and lower class) and the Traditional Milieu (the security and order-loving older generation);

- the **consumption and participation-oriented segment** (light grey in Figure 4.2.1), consisting of the Consumer-Hedonistic Milieu (the consumption and entertainment-focused lower middle class) and the Precarious Milieu (the lower class striving for orientation and participation).

Further information on the individual SINUS-Milieus® can be found on the SINUS Institute's website.[7]

As part of the study, two in-person and three online focus groups were held with typical representatives from each segment between 26 April and 5 May 2022. Group discussions lasted around two hours on average and were led by experienced SINUS moderators using a partially structured discussion guide. Participants were able to articulate their personal views, attitudes, needs and frustrations unfiltered using their own everyday language and reflect on them spontaneously directly within the group. The focus group approach revealed not only what respondents thought, but also why they thought what they did.

7 Sinus-Milieus® Germany | SINUS-Institut

Table 4.2.2 shows the demographic breakdown of the focus groups and how it was operationalised.

Breakdown of surveyed segments Table 4.2.2a

	Total sample	Established segment	Progressive segment
Number of participants	N = 37	n = 7	n = 8
Gender (as balanced as possible)	21 × F, 16 × M	4 × F, 3 × M	4 × F, 4 × M
Age (focus informed by milieus)	18 to 70 years	34 to 65 years	24 to 59 years
Education (focus informed by milieus)	Range: Low to high level of formal education	Focus: High level of formal education	High level of formal education
Urban vs. rural (residence) (as balanced as possible)	Range: Urban to rural	Range: Urban to rural	Range: Urban to rural
Migration background (Proportional to the overall population)	N = 8 × with migration background	n = 1 × with migration background	n = 2 × with migration background

Breakdown of surveyed segments Table 4.2.2b

	Modern middle class	Consumption and participation-oriented segment	Traditional segment
Number of participants	n = 6	n = 8	n = 8
Gender (as balanced as possible)	4 × F, 2 × M	5 × F, 3 × M	4 × F, 4 × M
Age (focus informed by milieus)	27 to 42 years	18 to 61 years	50 to 70 years
Education (focus informed by milieus)	High level of formal education	Low to medium level of formal education	Focus: Low to medium level of formal education
Urban vs. rural (residence) (as balanced as possible)	Range: Urban to rural	Range: Urban to rural	Urban + periphery
Migration background (Proportional to the overall population)	n = 1 x with migration background	n = 2 x with migration background	n = 2 x with migration background

The focus group exercise was supplemented by a quantitative public survey that took place in March 2023. The sample was in a hybrid format, with 1,600 online interviews and 400 telephone interviews, each lasting around 20 minutes on average.

The results are representative for the German-speaking resident population aged 18 and above. To achieve comparability between the results from the representative survey and those from the focus groups, participants were all assigned to a SINUS milieu and thus to one of the milieu segments described above. To this end, they were additionally asked a set of standardised questions to choose the right SINUS milieu. Also, the discussion guide for the focus groups and the questionnaire for the representative survey were compatible.

Thanks to the representative survey, it was possible to largely validate the findings from the focus group-based qualitative study and close the gaps in knowledge that had arisen in the focus groups.

The results from the lifestyle analysis mainly went into constructing projections for the key factor "consumer requirements" (Chapter 5.4).

Cash cycle stakeholder analysis

The cash cycle stakeholder analysis was carried out with a view to:

- getting an idea of what motives cash cycle stakeholders have to carry on maintaining the cash infrastructure;
- identifying possible levers and incentives that could play a role in maintaining the cash infrastructure;
- sounding out innovations in terms of services, organisation and processes that could reduce cash supply costs going forward;
- dentifying tipping points that could be a factor in stakeholders withdrawing from the cash supply stream.

Structured scenario design means not only systematically capturing key trends, developments and technologies, but also identifying key players, such as cash cycle stakeholders, as well as their objectives and creative scope.

Four semi-structured interviews with stakeholders from the cash cycle took place between June and July 2022 as part of the cash cycle stakeholder analysis (Table 4.2.3), with the interviews lasting between 60 and 90 minutes.

Cash cycle stakeholder analysis – interviewees Table 4.2.3

Name	Organisation
Roth, Gregor	DZ Bank AG
Sauter, Dieter (Dr)	Bundesdruckerei GmbH
White, Heath	Prosegur Cash Services Germany GmbH
Wolf, Robert	ALVARA Digital Solutions GmbH

The results from the interviews fed into the hypotheses on future developments that were put to the respondents in the Delphi survey and enriched with further insights. They are mainly reflected in the key factor "cash cycle" (Chapter 5.3).

Framework conditions analysis

In the framework conditions analysis, which was conducted as a STEEP+VL analysis, the influencing factors identified in the previous methodological steps (horizon scanning, megatrend analysis, lifestyle analysis, cash cycle stakeholder analysis) were mapped to the seven categories of the STEEP+VL analytical model. Redundancies were identified and eliminated at the same time.

The aim was to filter out those categories containing a relatively small number of influencing factors so that targeted follow-up research could be carried out on these. This would ensure that all the scenario-relevant developments in the framework conditions surrounding the topic of investigation had been taken into account.

In this particular study, it was only possible to identify a relatively small number of influencing factors for the Legal category, to begin with. The plan was therefore to begin with follow-up interviews that would include questions on what the status of cash as legal tender meant specifically for consumers and how that status squared with the concept of "freedom of contract". Another question would explore the extent to which cash cycle stakeholders could be required by law to keep the cash cycle running. Answering those questions turned out to be a highly complex legal endeavour, however, necessitating further research that goes beyond the scope of this study.

Therefore, the possible gaps in the Legal category were addressed by researching the legislative proposals in the EU context on the topics of cash acceptance, access to cash and the digital euro and feeding the results into the presentation of the key factors of the same name.

In addition, semi-structured interviews took place with international experts in Portugal and Spain (Table 4.2.4) to explore how cash acceptance and access to cash are dealt with in other countries (including from a legal perspective). Those interviews took place in April 2023. The Spanish association of financial users (ASUFIN) answered the questions in writing.

Framework conditions analysis – interviewees Table 4.2.4

Name	Organisation
	Asociación de usuarios financieros (ASUFIN) [Spanish association of financial users]
Pranjivan, Vinay	Associação Portuguesa para a Defesa do Consumidor (DECO) [Portuguese consumer protection association]
Sampaio Amaral, Mónica	Banco de Portugal [Portuguese central bank]

Cross-impact analysis

Cross-impact analysis is a classic foresight method that follows a systematic and interdisciplinary approach to analyse interactions between influencing factors within complex systems based on expert (stakeholder) assessments. In this study, cross-impact analysis was used to extract the main key factors from the influencing factors identified in an earlier step.

This analysis took place for the purposes of the "Cash of the future" study in the form of an expert workshop in Frankfurt am Main on 1 September 2022. Attendees at this workshop included stakeholders from the following (categories of) organisations, firms and interest groups:

- Deutsche Bundesbank
- Academic institutions concerned with banking and finance as well as cash
- Foresight service providers
- German Banking Industry Committee (*Deutsche Kreditwirtschaft* – DK)
- German Retail Federation (*Handelsverband Deutschland e. V.* – HDE)
- Federal Association for Information Technology, Telecommunications and New Media (*Bundesverband Informationswirtschaft, Telekommunikation und neue Medien* – Bitkom)

- Association of German Cash Service Industry (*Bundesvereinigung Deutscher Geld- und Wertdienste e. V.* – BDGW)

- Cash cycle and logistics software providers

Prior to the workshop, participants were asked in an online survey which of the 49 influencing factors they thought would have the greatest impact on the future of cash. Respondents were each able to select up to ten factors.

The idea here was to (initially) discard the influencing factors that the stakeholders all felt were generally less relevant. All the influencing factors selected by at least 25% of online survey participants were used in the cross-impact analysis as initial influencing factors, and these numbered 15. The experts were then split up into two separate groups to workshop the interactions among these 15 influencing factors and reach a consensus view on them.

It was possible to re-insert factors that had initially been discarded in the online survey, merge influencing factors together, and to add factors not included in the original 49 influencing factors. The results of the two groups' discussions were amalgamated in the plenary session. The outcome of the cross-impact analysis workshop was the definition of 12 key factors. To eliminate substantive overlaps, these were then narrowed down to ten key factors which served as a basis for constructing scenarios.

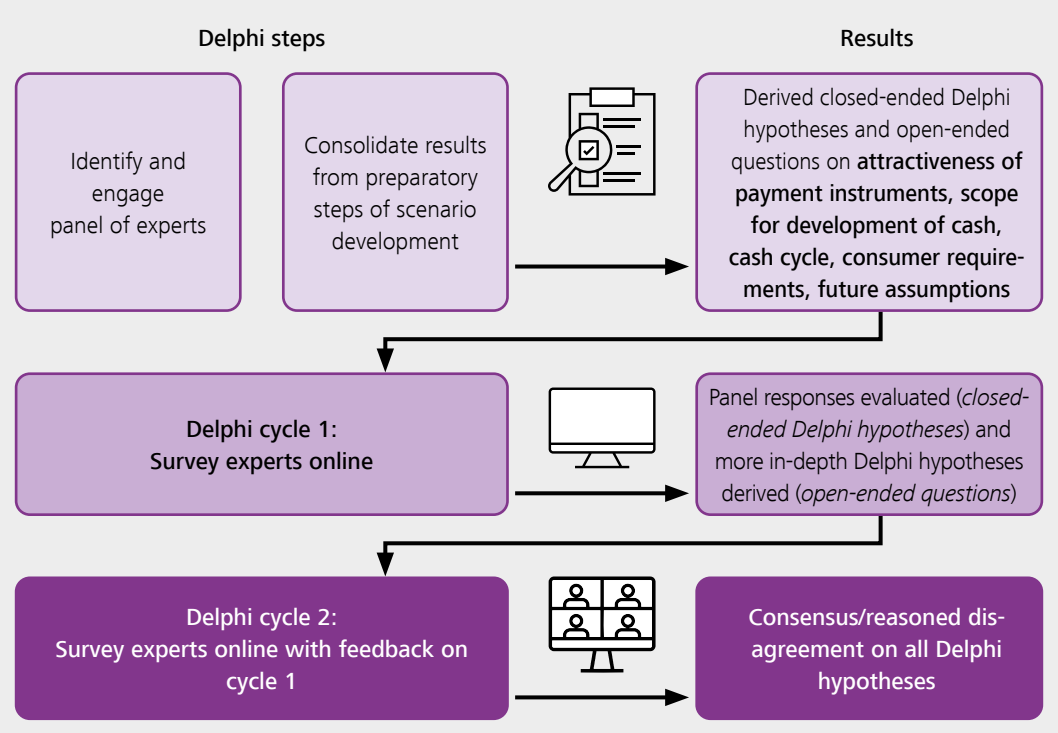
Delphi method

The Delphi method was developed by the California-based RAND Corporation in the 1950s and 1960s to elicit a valid, prioritised and thus probable "meta opinion" on future developments from a diverse group of handpicked experts. Originally used to address military problems, the Delphi method soon became standard practice in various other areas of application in future studies and foresight. The Delphi method can generally be regarded as a procedure by which an iterative process is used to gather expert opinions on a particular issue with the aim of soliciting and substantiating consensus and disagreement in those opinions (Niederberger and Renn 2018, 7).

A Delphi process consisting of two cycles was operationalised for the "Cash of the future" study. The experts surveyed came from a range of backgrounds, including the fields of academia and foresight, the cash cycle, central banks (including the Bundesbank) and social associations. Cycle 1 saw the experts answer closed and open-ended questions on the use of cash in Germany today and in the future, the pros and cons of cash, payment behaviour in the future, consumers' key requirements when choosing a means of payment in 15 to 20 years' time, and innovations for the cash cycle. The experts also assessed how likely it was that future assumptions developed in previous methodological steps for the individual key factors would materialise.

In cycle 2, one question asked whether the main cash use situations today, which the respondents had named in cycle 1, would still be the same in 15 to 20 years' time. Other questions took a deep dive into the concept of anonymity as a key feature of cash as well as the concepts of inclusion and universality, and explored topics surrounding innovations in the cash cycle in greater depth. Moreover, respondents in cycle 2 were challenged with the results on payment behaviour and the likelihood of the future assumptions for the key factors expressed in cycle 1 materialising, and were given the opportunity to make new assessments. Figure 4.2.2 provides a stylised overview of the Delphi survey.

Two-cycle Delphi process – stylised overview Figure 4.2.2



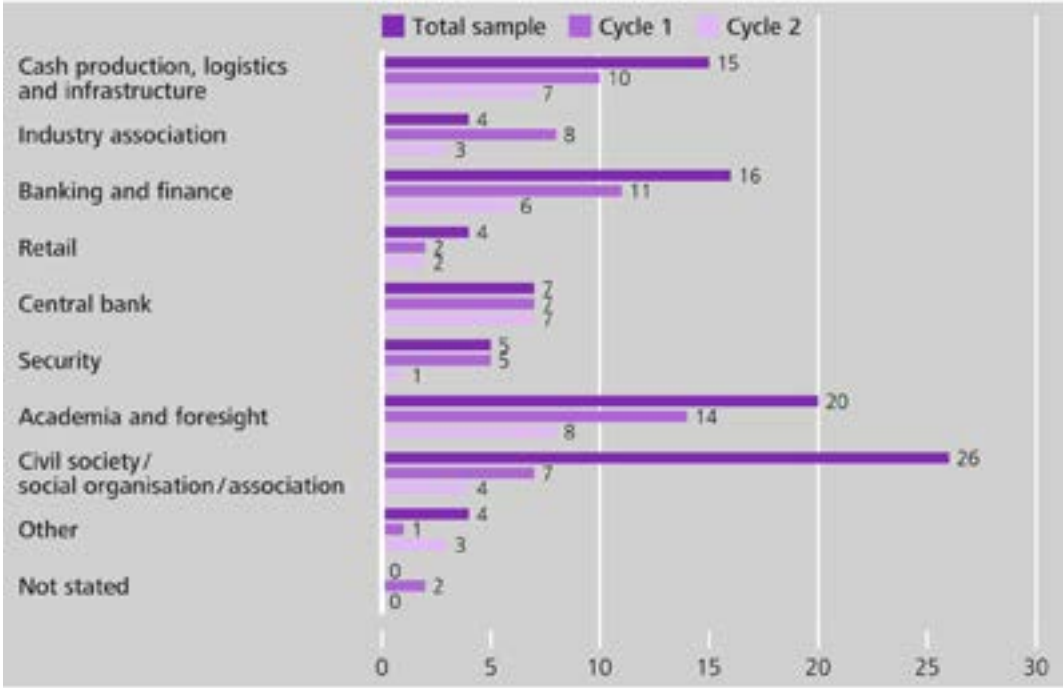
The questionnaire used in Delphi cycle 1 was sent to 101 people in December 2022, 67 of whom responded. In cycle 2 (March 2023), the questionnaire was sent to 55 people who had indicated at the end of the cycle 1 survey that they would be interested in filling it in. 41 experts completed the questionnaire. The response rate is within normal parameters.

Figure 4.2.3 shows which stakeholder categories the individuals and respondents contacted in cycles 1 and 2 belong to. Some people classified themselves as belonging to a different stakeholder category than originally envisaged by the study authors.

In cycles 1 and 2, questions on the cash cycle were asked only to Delphi participants with specific expertise in that area. In cycle 1, 38 experts were surveyed on the cash cycle, with 34 replying. In cycle 2, 30 experts were surveyed and 26 responded.

Where reference is made to the Delphi survey, this paper presents the results rounded to the nearest whole number.

Stakeholder categories of the total sample and the responding experts in cycles 1 and 2 Figure 4.2.3



Scenario construction

Scenario development builds primarily on earlier work and findings, incorporating these to produce inherently consistent narratives. Three scenarios were designed according to the MECE (mutually exclusive and collectively exhaustive) principle, covering a broad spectrum of plausible developments in the "cash of the future" space.

To begin with, three projections (i.e. different possible pathways) were drafted for each identified key factor based on the data from the methodological steps described above. These form the basis for scenarios with a high degree of differentiation. There are as many projections for each key factor as there are scenarios.

Scenario construction used a morphological box (two-dimensional decision matrix) following Fritz Zwicky (Kosow and Gaßner 2008, 49). The horizontal axis of the morphological

box shows the ten key factors, while the vertical axis depicts the different attributes or possible projections for the individual key factors. Excerpts from the morphological box can be found at the end of each chapter on the key factors.

The morphological box allows the possible futures to be analysed based on the different possible combinations of possible attributes for the key factors (Kosow and Gaßner 2008, 49).

Projections are grouped into projection bundles if combining them is plausible and they are not inherently contradictory, with one projection from each key factor being used in each case. These projection bundles provide the groundwork for the exploratory raw scenarios.

Raw scenarios are draft long-form descriptions that sketch out each scenario's contents, pathways (how did this situation come about?) and mutual dependences across developments. For validation purposes, the three raw scenarios were rigorously tested for plausibility in 90-minute video conferences in conjunction with Bundesbank experts and ultimately built out into integrated exploratory scenarios (Chapter 3).

5

KEY FACTORS

5.1 Cash acceptance

The concept of cash acceptance covers the nature, quantity and geographical distribution of cash acceptance points, which can be shops, public offices or market stalls, for example.

The trends and signals identified in horizon scanning regarding developments such as one large retailer in Germany refusing to accept cash, the proliferation of low-cost terminals for consumer-to-business (C2B) payments, and the case law of the Federal Administrative Court[8] (see the section on legal practice and the regulatory framework in this key factor) indicate for the most part that the opportunities to pay in cash could diminish in the future. It is unclear, though, how quickly and in what quality these developments will materialise. Regulatory initiatives such as the *European Commission proposal for a Regulation of the European Parliament and of the Council on the legal tender of euro banknotes and coins* (COM(2023) 364) of June 2023 (European Commission 2023) might have a stabilising effect. That depends, however, on the actual legal structure and implementation. Nascent resistance to the disappearance of cash from "cash strongholds" is another factor that could impact positively on cash acceptance.

The sections below present the evidence supporting the different possible future pathways (projections) for the key factor "cash acceptance", which are briefly summarised in Table 5.1.1.

Cash acceptance in retail outlets[9]

In Germany, customers are normally able to pay in cash in retail settings (European Central Bank 2022c, Chart 2 b; European Central Bank 2022b, Chart 35 Notes). Horizon scanning revealed that this has not been possible at one large retail chain for digital devices since the middle of January 2023 (Böhm 2023).

The expert from the German Retail Federation (HDE) interviewed as part of horizon scanning takes the view that if a large retailer refuses to accept cash, that can indeed send a signal throughout the industry – if the first retailer with a smartphone-savvy customer base stops accepting cash and that causes no problems for the retailer, this can lead to the acceptance of cash by retailers gradually being reduced further over time. One possible outcome of this is a decline in customer expectations that they are able to pay in cash almost everywhere. This may prompt retailers in turn to stop offering the option of paying in cash (*Binnebößel interview*).

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8 Reference number BVerwG 6 C 2.21.

9 This chapter confines itself to describing developments that influence the acceptance of cash in retail settings in the narrower sense. Developments in bricks-and-mortar retail and online commerce that can influence future cash use are discussed in Chapter 5.5 Retail.

The experts surveyed as part of the Delphi process backed this view in relation to retailers with a digitally savvy customer base.[10] In contrast to the preferences (digital affinity) of a retailer's own customer base, that retailer's size, on the other hand, seems to play less of a role in the acceptance of cash payments in the future.[11]

The assumed fall in cash acceptance points also shows up in the response to the Delphi question asking which means of payment would best meet the expectation of universality[12] over the next 15 to 20 years. A full 44% took the view that it would be the cashless means of payment.

Cash could therefore lose one of the key advantages it possesses over cashless means of payment in future – its communicative strength. While customers and retailers nowadays do not need to communicate about whether it is possible to pay in cash, that might become necessary in the future. It may be the case that customers will have to ask in shops more frequently whether cash payment is accepted (*Binnebößel interview*).

The "hyperdigital payment world" scenario assumes that cash payments are generally no longer the norm in retail. The "vanishing hybrid payment world" scenario is based on the assumption that only retailers with a digitally savvy customer base will no longer accept cash. The "cash renaissance payment world" scenario describes, in connection with possible developments in the legal environment, the reintroduction of cash acceptance at retailers that had stopped accepting cash for a time.

Cash strongholds

The results of the horizon scanning exercise show that cash strongholds are increasingly being challenged by cashless means of payment. This phenomenon was revealed by the hot topic analysis run on the Fökat database, viewed in combination with the results of the interviews with experts in the horizon scanning exercise. For the purposes of this study, "cash strongholds" are defined as socio-economic situations when cash is used exclusively or with a disproportionately high frequency and which serve as an "anchor" for cash use, such as tipping, gifting banknotes in birthday cards or purchasing items from street vendors.

The experts consulted in the Delphi survey assume that, in 15 to 20 years, cash will still be used by most of the population for certain purposes – for which most of the population use cash today. These include making purchases from street vendors, keeping an "emergency

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10 Delphi hypothesis: "In 15 to 20 years, it will mainly be retailers with a digitally savvy customer base that no longer accept cash payments." Result: 82% in cycle 1 and 83% in cycle 2 regard this as likely; 15% in cycle 1 and 17% in cycle 2 consider it unlikely; 3% in cycle 1 and 0% in cycle 2 chose "I don't know/no answer".
11 Delphi hypothesis: "In 15 to 20 years, it will mainly be smaller retailers that no longer accept cash payments because they will not be able to bear the high fixed costs associated with cash anymore." Result: 21% in cycle 1 and 17% in cycle 2 regard this as likely; 73% in cycle 1 and 78% in cycle 2 consider it unlikely; 6% in cycle 1 and 5% in cycle 2 chose "I don't know/no answer".
12 The ability to use a means of payment anywhere in Germany and abroad without having to agree with the counterparty on whether the latter accepts it.

stash", tipping, teaching children how to use money, gifts for friends and family and low-value payments. However, that assumption alone does not provide any indication of the extent and frequency of future cash use in these areas. By contrast, most of the experts believe it unlikely that the majority of the population will continue to use cash for public toilets (56%: unlikely) or for payments at vending machines (68%: unlikely) in the future. Only a small majority (54% of respondents) expect most of the population to use cash for donations in the future, while 41% of the experts surveyed believe this to be unlikely.

There are a number of reasons why cashless means of payment have started to penetrate cash strongholds.

For example, many apps and payment terminals already have a tipping function. The increasing prevalence of mobile and person-to-person (P2P) payment via cheap terminals or apps is providing a further boost to the penetration of cashless payment instruments in street sales (*Schmiese interview*). In addition, the SumUp card terminal serves as a kind of "terminal for all", which can also be used by homeless persons (*Knoop interview*). In fact, "Der Tagesspiegel" once reported the story of a homeless person on a Berlin subway who was able to take donations via a card reader, although this usage is not yet very widespread in Germany compared with Sweden (Soltau 2022).

In addition, people are increasingly gifting vouchers rather than banknotes in birthday cards (*Binnebößel interview*). In a survey for the HDE in 2022, when asked about Christmas gifts, 30% of respondents stated that they planned to give vouchers for retailers and shopping communities, while 19% intended to give cash (Handelsverband Deutschland 2022).

Resistance to the displacement of cash

As some cash strongholds are closely intertwined with aspects of inclusion, the targeted displacement of cash is now also meeting with resistance. As the following two examples from the horizon scanning exercise illustrate, a refusal to accept cash can also lead to backlash effects.

- In response to the pandemic situation, the Berlin Transport Company (*Berliner Verkehrsbetriebe*) withdrew the option of cash payment on buses in March 2020. In addition, passengers were no longer permitted to enter buses at the front in the interests of protecting bus drivers from infection with COVID-19. While the possibility of entering at the front of the vehicle was reinstated in 2021, there was (initially) no change to the obligation to pay in cashless form. This was criticised by some of Berlin's governing parties, as well as by the Berlin Passengers' Association (*Berliner Fahrgastverband*) and the Parity Welfare Association (*Paritätischer Wohlfahrtsverband*), who highlighted the importance of cash for the inclusion of financially disadvantaged and older people as well as people with impairments (Wurtscheid 2021; rbb24 2023). In September 2022,

the Berlin Senate Transport Department announced that it would reinstate the option to pay in cash on buses in consultation with the Berlin Transport Company. Since mid-January 2023, passengers have been able to pay for tickets in cash again. One of the reasons cited for reintroducing this option was that a refusal to accept cash could create barriers to the use of public transport, thereby hindering the implementation of the mobility transition. The reinstatement of the option of cash payment was criticised by both the Berlin Transport Company and the trade union Verdi. The latter pointed to the greater effort this entails for drivers and the risk of robbery associated with having cash registers on buses (rbb24 2023).

- Since August 2022, fees for the use of public toilet facilities in Berlin can only be paid cashless; 50 of the 280 city toilet facilities can be used free of charge. However, the latter are usually less clean. People with physical impairments can still access toilets for free using the Euro key.[13] This complete changeover to cashless payments for toilet facilities was a response to a huge wave of thefts on coin-operated machines in toilet blocks. The measure was criticised by both the State Senate Advisory Council for Elderly Persons and a number of political parties. They pointed to the needs of older and homeless persons and those without a bank account, who still rely on the option of cash payment and also, in some cases, on free use (Thewalt 2022; Der Tagesspiegel 2022).

  Following a six-month trial of cashless and cost-free access to toilet facilities, the Berlin Senate announced that the number of toilet facilities accessible without charge would double to 100 from March 2023 onwards, with the intention of making all public toilets free of charge in the future. During the trial period, the use of free toilet facilities increased and that of paid toilet facilities decreased (Latz 2023). The announcement that all public toilets will be made free of charge renders the issue of reintroducing cash payments at Berlin's public toilet facilities obsolete.

In the "hyperdigital payment world" scenario, it is assumed that cash no longer plays a role in its former strongholds and that this does not meet with any resistance. The "cash renaissance payment world" scenario explores the aspect of resistance to the displacement of cash from its strongholds. In the "vanishing hybrid payment world" scenario, cash persists in some of its strongholds, but disappears from others.

Legal practice and regulatory framework

The horizon scanning exercise revealed that the status of cash as legal tender does not automatically entail its mandatory acceptance and that the design of upcoming regulations could have a significant impact on the prevalence of cash acceptance points.

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13 The Euro key can be purchased by individuals who need to use toilet facilities for people with impairments. It provides access to many such toilet facilities throughout Europe.

In April 2022, the Federal Administrative Court (*Bundesverwaltungsgericht*) ruled on the matter of whether the state of Hesse's broadcasting body, Hessischer Rundfunk, was permitted to refuse cash payment of radio and television licence fees.

In its ruling,[14] the Federal Administrative Court referenced the interpretation of the Court of Justice of the European Union (CJEU) concerning the meaning of the concept of legal tender in EU law as well as the CJEU's assessment regarding the exclusive regulatory competence of the European Union in the area of monetary policy.[15,16] Consequently, the Federal Administrative Court ruled that Section 14(1) sentence 2 of the Bundesbank Act (*Gesetz über die Deutsche Bundesbank*) ("Banknotes denominated in euro shall be the sole unrestricted legal tender.") constitutes an infringement of the EU's regulatory powers in this area (Federal Administrative Court 2022), which means that the Bundesbank Act cannot be invoked in this context. In principle, moreover, it is permissible to refuse cash payments if doing so is in the public interest (cost savings). However, a blanket exclusion of cash payments goes against the principle of equal treatment,[17] and the Federal Administrative Court therefore ruled that Hessischer Rundfunk was obliged to accept cash payment of the radio and television licence fee for a transitional period until such a time as the fees statute was amended, albeit only from persons without access to a giro account (Federal Administrative Court 2022).

In its preliminary ruling, upon which the Federal Administrative Court's ruling is based, the CJEU stated that, although the status of euro banknotes and coins as legal tender implies, in principle, an obligation to accept them, that obligation may be restricted for reasons of public interest. Restrictions in the public interest can include cases where restricting cash payment enables public authorities to provide their services more cost-effectively and avoid unreasonable expense. However, any restriction must always be proportionate, which means that other means of payment must be accessible (Court of Justice of the European Union 2021, 2).

The European Commission's proposal for a *Regulation of the European Parliament and of the Council on the legal tender of euro banknotes and coins* (COM(2023) 364) of June 2023, which makes reference to the aforementioned judgment of the CJEU, aims to establish the principle of mandatory acceptance of cash throughout the euro area. Member States are to be required to monitor cash acceptance on the basis of common indicators. This explicitly includes monitoring the level of ex ante unilateral exclusions of payments in cash. According to the proposal, "ex ante unilateral exclusions of cash" are situations where, for example, a retailer or service provider displays a "no cash" sign. Under these circumstances, potential payers would not, in practice, have the option of agreeing an alternative means of payment with the payee.

However, only after the regulation has entered into force will the European Commission define the common indicators for monitoring cash acceptance via implementing acts of

14 Reference number BVerwG 6 C 2.21.
15 Cases C-422/19 and C-423/19.
16 Article 3(1)(c) of the Treaty on the Functioning of the European Union (TFEU).
17 Article 3(1) of the Basic Law (*Grundgesetz*).

general application. If a Member State concludes on the basis of these yet-to-be-determined common indicators that the general principle of mandatory acceptance of euro banknotes and coins in all or part of its territory is no longer guaranteed, the proposal for a regulation stipulates that the Member State must take remedial measures and report on them to the Commission. The Commission may also adopt delegated acts introducing exceptions to the mandatory acceptance of euro cash. This is without prejudice to the possibility for Member States, in areas of shared competence, to introduce their own exceptions in accordance with the conditions laid down by the aforementioned judgment of the CJEU (keyword: public interest) (European Commission 2023).

There are various conceivable paths regarding when and in what form the final regulation enters into force, what common indicators for monitoring cash acceptance will be used and what exceptions to the general principle of mandatory acceptance will apply, and these different paths are explored in the scenarios. In the "hyperdigital payment world" scenario, it is assumed that the legal requirements are fairly weak. In the "cash renaissance payment world" scenario, they are fairly strong and permit hardly any exceptions. In the "vanishing hybrid payment world" scenario, they are unfit to maintain the acceptance levels of the 2020s.

In Germany, the principle of freedom of contract precludes the mandatory acceptance of cash, as was introduced in Spain in May 2022 (*ASUFIN written interview*). As experts' opinions on this matter also varied widely in cycle 1 of the Delta survey,[18] none of the scenarios assumes a legal obligation to accept cash in the retail sector, but merely a recommendation.

Incidentally, the principle of freedom of contract exists in Spain, too, but according to a Spanish consumer association, it is interpreted differently. Freedom of contract must be taken into account by both parties. According to this interpretation, freedom of contract cannot exist if one of the parties has the option of imposing a basic condition such as the means of payment in a way that entails additional obligations for consumers (in this case, a credit card) (*ASUFIN written interview*).

18 Delphi hypothesis: "In 15 to 20 years, there will be a legal obligation to accept cash in the retail sector." Result: 38% in cycle 1 and 63% in cycle 2 regard this as likely; 33% in cycle 1 and 23% in cycle 2 consider it unlikely; 29% in cycle 1 and 15% in cycle 2 chose "I don't know/no answer". The strong shift towards mandatory acceptance being deemed likely in cycle 2 stems from the fact that those who had already voted "likely" in cycle 1 were more strongly represented in cycle 2. The results from cycle 1 inform the scenarios.

Acceptance of cash by public authorities

However, the experts consulted in the Delphi survey mostly[19] assume that public authorities and local government enterprises will be legally obliged to accept cash in the future. Only just under one-third believe it likely that the option of paying in cash at public authorities will be available only to those without access to a giro account.[20] Taking into account developments in European case law and regulation, an absolute mandatory acceptance of cash without exception is not assumed in any of these scenarios. However, the "cash renaissance payment world" scenario does assume that public authorities will have to clear far higher hurdles to justify why a refusal of cash payments is proportionate.

19 Delphi hypothesis: "In 15 to 20 years, there will be a legal obligation for public authorities, offices, agencies and local government enterprises to accept cash". Result: 49% in cycle 1 and 56% in cycle 2 regard this as likely; 37% in cycle 1 and 27% in cycle 2 consider it unlikely; 14% in cycle 1 and 17% in cycle 2 chose "I don't know/no answer".

20 Delphi hypothesis: "In 15 to 20 years, public authorities, offices, agencies and local government enterprises will only allow cash payments in exceptional cases for persons without access to giro accounts." Result: 33% in cycle 1 and 29% in cycle 2 regard this as likely; 49% in cycle 1 and 66% in cycle 2 consider it unlikely; 18% in cycle 1 and 5% in cycle 2 chose "I don't know/no answer".

Excerpt from the morphological box on the key factor "cash acceptance"

Table 5.1.1

Scenario	Projections for "cash acceptance"
The hyperdigital payment world	Cash payments have become unusual in retail settings and at public institutions. Since the successful digitalisation campaign in public administration launched at the beginning of the 2020s, the public are generally accustomed to accessing administrative services digitally. Cashless payment is integrated into the checkout process when ordering an administrative service. Cash no longer plays much of a role in its former strongholds, either. Mobile payment terminals are being used at weekly street markets, flea markets and in the food services sector. Statutory provisions stipulating cash acceptance fundamentally have little effect, as there are numerous exceptions to the principle of mandatory cash acceptance.
The cash renaissance payment world	In light of the EU regulation, the Federal Government recommends in the early 2030s that retailers should, as a basic principle, accept cash. Up to that point, a number of major retail chains with digitally savvy customers had already completely stopped taking cash payments. Some of them now start to accept cash again. At the beginning of the 2020s, clear resistance to the displacement of cash from its former strongholds (use of public toilets, public transport) emerges for the first time. Public authorities have to clear higher hurdles to prove that they cannot accept cash payments for efficiency reasons. Administrative services are therefore generally offered in online and analogue formats.
The vanishing hybrid payment world	Retailers with a digitally savvy customer base no longer accept cash. Whilst others offer a hybrid system for the most part, they encourage their customers to pay in cashless form. Although it is still possible to pay for administrative services in cash in at least one municipal administration office in every city, the authorities also prefer cashless means of payment. Cash persists in some of its strongholds and disappears from others. The common indicators for monitoring the mandatory acceptance of cash established on the basis of the EU Regulation on the legal tender of euro banknotes and coins, as well as the exceptions, are not fit to maintain the acceptance levels of the early 2020s.

5.2 Access to cash

In this study, the key factor "access to cash" describes the widespread and sufficient availability of cash for consumers through provision of cash access points (ATMs and bank branches, cashback and cash-in-shop in retail outlets).

If access to cash and cash services deteriorates, consumers will tend to use cashless payment solutions, owing to the greater effort involved in procuring cash.

Horizon scanning identified the number of commercial bank branches and ATMs, cash services offered in shops and the future impact of the European Commission's proposal for a *Regulation of the European Parliament and of the Council on the legal tender of euro banknotes and coins* (COM(2023) 364) of June 2023 (European Commission 2023), as mentioned in Chapter 5.1 above, as relevant determinants of cash availability.

Development of bank branches and ATMs as cash access points

The number of bank offices – legally independent credit institutions and branches – has been in marked decline since the end of the 1990s. In 1997, there were still 66,764 bank offices. In 2021, the figure was around 65% lower than in 1997, with only 23,231 remaining bank offices. A year earlier (2020), the figure was 25,779. This corresponds to a decline of 9.9% within one year (Deutsche Bundesbank 2022a).

The number of ATMs (in brackets below) has not evolved in parallel to the number of bank branches. In the period from 2001 (49,620) to 2016 (58,909), they actually increased in number by around 18.7% (Deutsche Bundesbank 2022b).

This increase may be related to the simultaneous closure of branches, as the banking industry may have been aiming to provide customers with alternative cash access points.

Between 2016 and 2021 (55,136), however, the number of ATMs fell by 6.4%. Current numbers are close to what they were in 2008 (Deutsche Bundesbank 2022b).

From the perspective of the commercial banks, cash has become a cost item (*Schmiese interview*).

Attacks on ATMs

Another reason given by experts for the decline in ATMs is that they are quite expensive to operate owing to their tendency to get attacked (*Knoop interview*).

Physical attacks on ATMs, especially those in which the ATM is blown up, have risen steadily since 2012, as can be seen from the written statement by the Federal Criminal Police Office's (*Bundeskriminalamt* – BKA) Serious and Organised Crime Division (SO) (*BKA SO statement, 2*). These usually consist of injecting a gas mixture into the ATM and

igniting it. According to the BKA, however, since 2020 perpetrators have increasingly been using actual explosives, adding a further level of danger. The methods criminals use to blow up ATMs entail considerable risks to life and limb for residents, passers-by and police and fire service personnel (*BKA SO statement*).

The Federal Ministry of the Interior and Community has now publicly called on ATM manufacturers and operators to invest in protective measures against physical attacks (for example, smart banknote neutralisation systems such as adhesive and ink systems, which trigger upon an explosion and render the banknotes unusable). Consideration is also being given to legally obligating ATM manufacturers and operators to take protective measures. However, the banking industry does not see itself as the only one responsible for preventing ATMs being attacked and points out that policymakers and law enforcement authorities also have a responsibility for protecting cash infrastructure (Tagesspiegel 2023).

It is quite conceivable that banks and savings banks could react to a statutory obligation to equip and upgrade their ATMs with banknote neutralisation systems by further thinning out the ATM network rather than dealing with the associated high costs. This aspect is tackled in the "vanishing hybrid payment world" scenario.

Although cash supply is a cost item from the banks' perspective, it is well understood that maintaining cash access points *in keeping with demand* will continue to be important for consumers in the future [emphasis added by the authors]. Various approaches are being discussed for this purpose, such as outsourcing ATM infrastructure to a separate company (*Schmiese interview*).

In any case, a clear majority of the experts surveyed as part of the Delphi exercise assumed that the number and distribution of ATMs will have declined sharply in 15 to 20 years.[21] An even larger majority believe that it is unlikely that the supply of cash services to consumers will remain at its current level.[22] This expected further dismantling of the branch and ATM network is tackled in the "hyperdigital payment world" scenario and the "vanishing hybrid payment world". The "cash renaissance payment world" scenario describes a pathway in which the branch and ATM network do become less dense, but the contraction rates are more moderate.

Provision of cash services by retailers

In the past, a simultaneous reduction in cash access points at banks and savings banks as well as in cash services (especially at bank counters) would normally result in a shift in the cash supply towards ATMs. More recently, greater use of the opportunity to withdraw

21 Delphi hypothesis: "In 15 to 20 years, the number and distribution of ATMs will have declined sharply." Result: 85% in cycles 1 and 2 regard this as likely; 15% in cycle 1 and 12% in cycle 2 consider it unlikely; 2% in cycle 2 chose "I don't know/no answer".
22 Delphi hypothesis: "In 15 to 20 years, banks will continue to provide consumers with cash services at around the current level." Result: 90% in cycle 1 and 95% in cycle 2 regard this as unlikely; 10% in cycle 1 and 5% in cycle 2 consider it likely.

cash at the point of sale has been observed (Deutsche Bundesbank 2022c, 10). A large majority of the experts surveyed as part of the Delphi exercise believe it likely that, in 15 to 20 years, cash services offered in retail outlets will largely cover consumers' demands.[23] However, the horizon scanning exercise identified factors that may present major obstacles in that path, as described in the following section.

In Germany, two systems are available for supplying cash through retailers: cash-in-shop and cashback.

Some banks offer cash-in-shop via Barzahlen/viacash. At certain retailers, customers can deposit cash into their own account (subject to a fee) and withdraw cash (free of charge). To do this, a barcode must be generated via a banking app (Böhl 2023). Cash-in-shop is a payment service requiring authorisation and subject to the requirements of the Payment Services Directive (PSD2). Participating retailers provide this payment service on behalf of a payment service provider (bank or payment institution) (Euro Retail Payments Board 2021, 41).

Cashiers at participating retailers must undergo training in accordance with Germany's Regulation on the auditing of cash (*Bargeldprüfverordnung*). The retailer earns a commission on each transaction (*anonymous interview*).

A better known method, however, is withdrawing cash from the point of sale via cashback. Cashback is not a payment service subject to authorisation. Cashback is also not subject to the Regulation on the auditing of cash (Euro Retail Payments Board 2021, 41, 42). The legal hurdles are thus considerably lesser than for cash-in-shop.

The cashback system has seen retailers themselves become cash providers in the cash cycle (*Schmiese interview*). In some cases, banks themselves flag up the option of accessing cash at retail outlets when the branch and ATM network is thin on the ground (*Zeitz-Brandmeyer interview*). In addition, there is a trend towards direct banks that do not have their own branch system and do not have ATMs (*Weissenbäck interview*).

However, retail itself has stressed that its cashback capacity is limited by incoming cash on the one hand and bank fees on the other. Ultimately, cashback is a girocard® transaction.[24] The customer purchases cash from the merchant as a form of excess change while making a card payment at the same time. If the customer withdraws €100 at the point of sale, the retailer would owe the card issuer (the customer's card-issuing bank) 20 cent.[25]

23 Delphi hypothesis: "In the next 15 to 20 years, cash services offered in retail outlets (cash-in-shop, cashback) will largely cover the supply of cash to consumers." Result: 61% in cycle 1 and 83% in cycle 2 regard this as likely; 30% in cycle 1 and 15% in cycle 2 consider it unlikely; 9% and 2% respectively chose "I don't know/no answer".
24 Authors' note: The majority of the cashback volume in German retail trade is settled via girocard®. In some cases, however, cashback transactions can be settled via debit and credit cards issued by international card providers (Rüter and Holtmann 2022).
25 Authors' note: 20 cent is the maximum amount owed for a cashback transaction with girocard®. The fees negotiated between the retailer and issuer concentrators (issuing banking group) in the girocard system apply.

If cash becomes less and less used for retail purchases, less cash will be available to withdraw at the checkout (*Binnebößel interview*). Germany already sees cases of cash withdrawal at the checkout being impossible because there is simply not enough money in the till (*Zeitz-Brandmeyer interview*). Another limiting factor is that, unlike many ATMs, the cashback system in the retail sector does not offer a 24/7 supply of cash (*Knoop interview*).[26]

Expert opinion holds that there could therefore be limits to the supply of cash to consumers via retailers. It only works as long as there is a significant proportion of payments being settled in cash in the retail sector. It should be noted that countries such as the United Kingdom have already entered a post-cashback phase (*Zeitz-Brandmeyer interview*). There, some supermarkets no longer offer cashback.

From the Bundesbank's point of view, cash withdrawals at the point of sale are a complement to, but not a substitute for, bank-supported cash infrastructure. This is due, amongst other things, to the fact that cash paid out at checkouts does not have to be audited for quality beforehand and that damaged or soiled banknotes may thus remain in circulation. From the Bundesbank's point of view, credit institutions and central banks need to remain heavily involved in order to ensure the quality and authenticity of banknotes in circulation (Deutsche Bundesbank 2023).

Expert opinion suggests that different circumstances might lead to different futures for retail cash services. The "hyperdigital payment world" scenario therefore describes a pathway in which the possibility of supplying consumers with cash via retailers comes to a standstill owing to very low acceptance and use of cash in retail. The "vanishing hybrid payment world" scenario tackles the idea of it not being possible to fulfil requests for cash withdrawals at the point of sale. In the "cash renaissance payment world" scenario, it is assumed retail is expanding its cash services offering.

Legal provisions

There are currently no legal requirements ensuring cash availability. The majority of the experts surveyed as part of the Delphi exercise assume that commercial banks could, however, be legally obligated in future to ensure the supply of cash to consumers and retailers.[27]

The European Commission's proposal for a *Regulation of the European Parliament and of the Council on the legal tender of euro banknotes and coins* might already move things in this direction. Its impact on the availability of cash – and the acceptance of cash, which the proposal also covers – will depend on the actual form of the Regulation and its practical implementation. In recital 7 of the proposed Regulation, the European Commission

26 Authors' note: Many ATMs are now closed at night for security reasons.
27 Delphi hypothesis: "In 15 to 20 years, commercial banks will have a legal obligation to ensure the supply of cash to consumers and retailers (as in Sweden)." Result: 57% in cycle 1 and 68% in cycle 2 regard this as likely; 22% in cycles 1 and 2 consider it unlikely; 21% in cycle 1 and 10% in cycle 2 chose "I don't know/no answer".

lists some possible indicators that could be used in the future to assess the level of cash availability, such as "[…] density of cash access points in relation to population, withdrawal and deposit conditions, including fees, the existence of different networks with different access modalities for customers, urban-rural and socio-economic variations, and access difficulties for certain population groups" (European Commission 2023, 11-12).

Furthermore, the consumer protection representative considers a map of the supply of cash by banking group, which also includes retail outlets as a cash access point, to be a useful tool for mapping the supply of cash to different consumer groups. After all, it does little to help individual bank customers if just any cash machine is nearby; it must be an ATM within the network to which the account-holding bank belongs (*Zeitz-Brandmeyer interview*).

As it is not yet possible to tell how the provisions of the EU legal framework as regards the availability of cash will turn out, nor how strictly those provisions will be interpreted, the scenarios assume three possible pathways. In the "hyperdigital payment world" scenario, the established indicators ultimately only lead to minimum standards for cash availability. In the "cash renaissance payment world" scenario, it is assumed that the EU regulation will lead to a rather high level of cash availability compared with the other two scenarios. This scenario also builds in the idea of a map of cash supply by cash dispenser associations. In the "vanishing hybrid payment world" scenario, a lax interpretation of the EU regulation is assumed.

Excerpt from the morphological box on the key factor "access to cash"

Table 5.2.1

Scenario	Projections for "access to cash"
The hyperdigital payment world	Banks and savings banks have massively thinned out their network of branches and ATMs. In the 2020s, the ATM network is also be scaled back due to frequent attacks on ATMs. In the 2030s, the key reason for the reduction of the branch and ATM network is the declining demand for cash from consumers and smaller retailers. As opportunities to pay cash in retail settings disappear, cashback and cash-in-shop services for withdrawing cash at the checkout vanish. On the basis of the EU regulation, minimum statutory standards to secure a basic level of cash provision for the general public are adopted.
The cash renaissance payment world	The trend towards branch closures among savings banks and banks continues and the ATM network also fails to maintain the reach it had in the early 2020s, although the decline in both areas slows back down from the mid-2020s onwards. Commercial banks take early notice of the potential impact of the EU regulation on access to cash and fear that if infrastructure is scaled back any further they may be forced to undertake the costly task of rebuilding. There are statistics on the supply of cash, broken down by banking group. Banks and savings banks increasingly come to regard the supply of cash services as an investment in customer loyalty. Retailers are able to expand their cash services, as they have sufficient cash takings coming into their tills through payments.
The vanishing hybrid payment world	Private banks – but also, to a lesser extent, cooperative banks and savings banks – continued to significantly reduce their number of branches by the turn of the decade. Explosive attacks on ATMs increase steadily up to the beginning of the 2030s, leading banks and savings banks to temporarily or permanently cease operating ATMs in particularly vulnerable areas. ATM manufacturers are now obligated to upgrade their machines with intelligent banknote neutralisation systems. As upgrading machines carries costs for ATM operators, these further reduce their supply structures. As the share of cash is shrinking, less and less cash is coming into shop tills, meaning that customers wanting cashback cannot always get the amount they want whenever they want it. The EU regulation, which entered into force in the mid-2020s, also has little stabilising effect owing to the rather lax interpretation of when access to cash is sufficiently guaranteed in the individual Member States.

5.3 Cash cycle

In this study, the key factor "cash cycle" covers innovations and possible adjustments in the cash cycle that could help to reduce the fixed costs of cash. Cash has high fixed costs and low variable costs (*Zeitz-Brandmeyer interview*). The fixed costs include maintaining the infrastructure required for cash supply and removal.

Generally speaking, the costs of supplying and disposing of a unit of cash thus increase as the volume of cash decreases. Where cash volumes continue to fall, retailers may be inclined to limit their acceptance of cash owing to the comparatively high cost of each single payment transaction (*Zeitz-Brandmeyer interview*); commercial banks could further cut their cash services for consumers. This would further reduce the volume of cash in circulation, leading to a downward spiral.

Against this background, it is important for the future of cash to determine whether and which fixed-cost-reducing innovations or adjustments could be introduced in the cash cycle and how strong their cost-reducing effects would be. The three scenarios describe different pathways for developments in this area.

The horizon scanning exercise and cash cycle stakeholder analysis revealed a number of approaches for reducing the costs associated with cash supply and removal. In order to be able to better assess these approaches, the following sections begin by describing the processes and players involved in the cash cycle and their respective roles. They also give an outline of where costs arise and what their causes are, as well as what could cause costs in the future.

Definition of the cash cycle and its processes

This section describes a slightly simplified presentation of the cash cycle and does not claim to reflect its complete complexity.

In this study, the term "cash cycle" refers to the process whereby cash, produced by banknote manufacturers and coin minting institutions, is transported via cash in transit (CIT) companies from Bundesbank branches to commercial banks. The cash is then issued to consumers, retailers and enterprises (cash supply). Furthermore, the cash cycle includes returning banknotes to and depositing banknotes at branches of the Bundesbank, as well as checking banknotes for fitness for circulation, including the destruction of damaged or unfit cash by the Bundesbank (cash removal) (Deutsche Bundesbank 2018a).

Sub-cycles exist between consumers and retail. Cash flows to retailers through the payment process. Conversely, cash flows from retailers to consumers via change or, for example, cashback.

First, CIT companies transfer the "fresh" cash from the branches of the Bundesbank to their cash centres, where it is sorted and collected – sometimes by machine – in line with the specific customer wishes of retailers and commercial banks before being further transported. If the money has – per customers' wishes – already been portioned by the Bundesbank, it can be transported directly to the customer or an ATM. As large quantities of coins are usually stored in pools in the cash centres, not every order requires collection from the Bundesbank (Ehrenberg-Silies et al. 2022, 22).

Retailers and commercial banks return cash that is no longer needed to the Bundesbank via CIT companies (Deutsche Bundesbank 2018a). Retailers can also deposit cash that is no longer needed with commercial banks. The commercial banks themselves can check the authenticity and quality of banknotes and coins and, where necessary, disburse the cash again (Deutsche Bundesbank 2018a).

Situations in which retailers and commercial banks no longer need cash include times where cash is in unsuitable denominations for making up change, where it displays excessive wear and tear or where there is so much cash in a cash register or safe that the risk of loss in the case of theft is too high, the amount exceeds insurance limits or – in the case of positive interest rates – the interest rate loss from not putting the money in the bank would be too large.

When cash is returned to the Bundesbank, the route that it takes may vary depending on whether coins or banknotes are being paid in. Banknotes can be deposited directly with the Bundesbank. Nowadays, this is usually done as a multi-denomination lodgement, a procedure which means CIT companies no longer need to process the money in their own cash centres.

Coins instead make an additional stop in a CIT cash centre, where the coins are processed as required in accordance with Bundesbank standards, using standardised containers for lodgement and withdrawal of coins. Coins, in particular, are checked for authenticity and fitness for circulation in the cash centres, stored in the aforementioned coin pools as stock and then put back into circulation directly from there, without the Bundesbank having to intervene. The remaining cash is brought to the Bundesbank branches and then paid back into the customer accounts (Ehrenberg-Silies et al. 2022, 22). Once the Bundesbank has checked for authenticity and quality (fitness for circulation), the cash can be put back into circulation (Deutsche Bundesbank 2018a).

In addition, there are cash recycling machines which customers can pay into, which can then pay out the paid-in and checked money directly to the next customer.

Stakeholders in the cash cycle

The Bundesbank's role in the cash cycle is that of a "guardian" (*Mewes, Paulick, Wiegand interview*) and a "trusted institution" (*Binnebößel interview*). It fulfils its statutory mandate with regard to cash and, through its network of branches, operates the infrastructure for supplying cash to retailers and banks. In Germany, the exclusive right to issue banknotes lies

with the Bundesbank.[28] Credit institutions and other professional cash handlers may only reissue circulated banknotes if they have been checked and confirmed to be genuine and fit for circulation. Machine checks may only be carried out using banknote processing machines that have been successfully tested by the Bundesbank. Moreover, the Bundesbank is authorised to carry out on-site inspections at cash handlers' premises to monitor their banknote handling machines and to take samples of processed euro banknotes to check them at its own premises.[29]

The Bundesbank is the only stakeholder in the cash cycle permitted to destroy banknotes (*Mewes, Paulick, Wiegand interview*).

Commercial banks supply consumers with cash – mainly via the ATM infrastructure at present (*Mewes, Paulick, Wiegand interview*) – and provide small and medium-sized enterprises (SMEs) with cash services. However, as more and more bank branches close, for local business owners who would normally go to the bank in person it is more difficult to obtain and dispose of cash. In addition, existing branches have raised their prices for cash services – e.g. the price per coin roll (*Binneböße l interview*). It is conceivable that commercial banks might discontinue their cash services altogether for retail and corporate customers alike. In this case, corporate customers would have to switch to cash services provided by CIT companies (*Wolf interview*). However, many SMEs find CIT companies' prices for cash supply and removal too high (*Binneböße l interview*).

Retailers are also considered to be stakeholders in the cash cycle. They have started to gradually take over tasks from the banks (cash withdrawals and deposits) (*Wolf interview*). They act as cash providers for consumers (*Binneböße l interview*).

CIT companies are at the "centre of the web" (*Mewes, Paulick, Wiegand interview*). They transport cash to and from all the aforementioned parties[30] (*Wolf interview*) using CIT vehicles (Ehrenberg-Silies et al. 2022, 22).

Besides this, the cash cycle also includes a number of technical service providers that play a supporting role in this cycle, such as installers of smart safes,[31] first-level and second-level maintenance providers (*Mewes, Paulick, Wiegand interview*), logistics software developers and machine manufacturers (recycling machines and ATMs) (*Wolf interview*).

Costs in the cash cycle

In the cash cycle, costs generally arise from the transport, processing and storage of cash, the maintenance of infrastructure and cash withdrawals and deposits/collection via ATMs (*Mewes, Paulick, Wiegand interview*), inpayment machines/recyclers or at the bank counter

28 Section 14 of the Bundesbank Act – Banknote issue.
29 Decision ECB/2010/14, as amended by Decision ECB/2012/19 and Decision ECB/2019/39.
30 Authors' note: In this simplified presentation of the cash cycle, consumers are not considered to be independent stakeholders.
31 Smart safes allow users to deposit, count and secure cash.

– with the latter including, for example, staff costs for checking fitness for circulation and authenticity at the counter and material operating costs (*Schmiese interview*). Processing structures, which everyone involved in the cash cycle has to maintain, are a further cost factor (*Mewes, Paulick, Wiegand interview*). Added to this are security costs, e.g. for the use of technology to prevent criminal activities (*Schmiese interview*) and costs for insurance, internal audit, external audit and quality assurance (*Mewes, Paulick, Wiegand interview*).

In the retail sector, costs arise through cash withdrawals and deposits, obtaining change, transport, and disposing of takings. The retail sector also incurs internal handling costs, e.g. for cashiers' working hours, security devices such as safes, and cash registers (*Binnebößel interview*).

Cost drivers

Horizon scanning and the cash cycle stakeholder analysis identified a number of different cost drivers. On the one hand, experts reported that there are still too many manual interfaces and not enough automation or standardisation. Staff deployment for every simple transaction is very high (*Mewes, Paulick, Wiegand interview*). Ideally, the cash involved in a payment transaction would only be counted once and undergo one check for authenticity and fitness as it makes its journey through the whole cash cycle (*Seidemann, Thum interview*).[32] All in all, staff deployment needs to be reduced throughout the cash cycle (*Mewes, Paulick, Wiegand interview*).

In addition, the closure of Bundesbank branches means that CIT companies have to travel further to supply and dispose of cash. This pushes up wage and energy costs for the supply and removal of cash (*Binnebößel interview*). A clear majority of respondents in both cycles of the Delphi survey assumed that the Bundesbank would thin out its branch network further in the future.[33] An even larger majority of respondents disagreed when asked if they thought the Bundesbank would expand its branch network in future.[34] Against this background, it is to be expected that the closure of further Bundesbank branches will remain a direct cost driver in the cash cycle, or even become a more relevant one. Indirectly, however, the internal savings that would result from the Bundesbank's increase in profits would, in turn, benefit the taxpayer. Given the clear views of the experts surveyed in the Delphi exercise, none of the scenarios assumes that the Bundesbank's branch network will be expanded. The "hyperdigital payment world" scenario assumes that the branch network will be thinned out further and the "vanishing hybrid payment world" scenario assumes that more closures of individual branches are in the pipeline, at least, owing to the dwindling use of cash. The

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32 The Bundesbank already supports this through multi-denomination banknote lodgement. Before multi-denomination processing was introduced at the Bundesbank, CIT companies had to count, sort and group the money collected from retailers into bundles of 100 banknotes of a single denomination before paying it in to the Bundesbank. This is no longer necessary today.
33 Delphi hypothesis: "In 15 to 20 years, the Bundesbank will thin out its branch network further." Result: 64% in cycle 1 and 76% in cycle 2 regard this as likely; 16% in cycle 1 and 10% in cycle 2 consider it unlikely; 19% in cycle 1 and 15% in cycle 2 chose "I don't know/no answer".
34 Delphi hypothesis: "In 15 to 20 years, the Bundesbank will expand its branch network throughout Germany." Result: 5% in cycle 1 and 3% in cycle 2 regard this as likely; 80% in cycle 1 and 88% in cycle 2 consider it unlikely; 15% in cycle 1 and 10% in cycle 2 chose "I don't know/no answer".

branch network only remains at its current level in the "cash renaissance payment world" scenario.

Experts also believe that a potential future duopoly of CIT companies could be another cost driver (*Wolf interview*). The market for CIT companies is currently undergoing consolidation (*Binnebößel interview; Mewes, Paulick, Wiegand interview*). Together, the three largest market players in Germany – Prosegur, ZIEMANN and Loomis – already account for 80% of turnover today in the CIT market (Hans-Böckler-Stiftung 2022, 8). Prosegur and ZIEMANN recently acquired smaller companies in the sector (*Wolf interview*). However, in 2019, the Federal Cartel Office prohibited Loomis from taking over ZIEMANN (Hans-Böckler-Stiftung 2022, 8). Against this background, it is possible to speak in terms of oligopolistic market structures (Hans-Böckler-Stiftung 2022, 5). However, whether or not this oligopoly will make it possible to charge higher prices for CIT services in the future will depend on the extent to which CIT companies' clients need cash in the future. If prices for cash supply and disposal rise too sharply, retailers could stop accepting cash as a means of payment, for example. If retailers are not obliged to accept cash and commercial banks are not obliged to provide cash access points, and demand for cash continues to decline because the costs for supplying it are too high, CIT companies might not be able to charge any price they want in the long term, otherwise their own business model would no longer work. If they tried to do so for a time, based on the oligopoly in the CIT sector, demand for cash would probably decline further.

Overall, the pressure to innovate is rising and is being intensified by the emerging general shortage of skilled workers in Germany, which is also having an impact on the sector.

According to figures from 2019, however, the intensity of innovation in the sector "temporary employment activities and private security activities (WZ08 78/80)", which also includes CIT companies, stands at just 0.3% of the sector's turnover.[35] This means that it has the lowest intensity of innovation of all sectors of the German economy (Hans-Böckler-Stiftung 2022, 9).

It is therefore assumed that significant investment in innovation will only be made if statutory measures are taken to stabilise the use of cash and research aimed at optimising cash infrastructures is subsidised. These assumptions form part of the "cash renaissance payment world" scenario.

Suggested cash cycle innovations

Horizon scanning and the cash cycle stakeholder analysis identified a number of measures that could potentially reduce the fixed costs associated with cash supply and removal (for the purposes of this study, all costs incurred for transport and checking authenticity in the cash cycle, excluding the cost of producing cash). They can be roughly grouped under the headings "technology", "process/organisation", "service", "packaging types" and "other". The main objectives of the measures are to reduce the number of journeys by CIT companies

35 The share of CIT companies in the sector "temporary employment activities and private security activities" is unknown.

or make them more flexible, to better utilise the capacity of the existing structures, to make the process of cash supply and removal more flexible and to enable more automation through standardisation (wherever standardisation increases efficiency).

Technology

Smart safes with internet connectivity (*Mewes, Paulick, Wiegand interview; Wolf interview; White interview*) installed on retailers' premises allow cash to be deposited, checked, counted and secured on site. Once the deposit is made, the cash amount is credited to the retailer's account. Most smart safes have cassettes that are protected by ink staining technology (*Binneböße*l *interview*). Smart safes can help to reduce the time and money required to handle cash in shops and optimise cash removal. The frequency of trips by CIT companies can be reduced. The cash is only collected by a CIT company once the insured amount or other defined limits are reached (*Roth interview*).

Sharing systems (*Roth interview*) such as centrally managed vaults and locking systems can be used by several customers via single-use codes (multi-tenant vaults). In shopping centres, for example, multiple retailers can use them to dispose of their daily cash register takings and, if necessary, to stock up with cash again via CIT companies. This means that CIT companies do not need to go to individual shops at the shopping centre.

Cash recycling machines can be used to automate the process of depositing and withdrawing cash. They also check cash for authenticity and can be used directly at the point of sale (POS) or in the back office.

The advantage of customer-operated payment machines at the POS is that their content cannot be accessed as easily from the outside. They also help to avoid cash register discrepancies (*Binneböße*l *interview*). Larger cash management systems for the back office can be used in combination with appropriate software to provide detailed information on the inpayment records of various cashiers, for example (*Wolf interview*). Cash recyclers also facilitate cash handling and provide a better overview of the stock of cash so that change does not have to be obtained unnecessarily.

The ***technical monitoring of cash levels at ATMs*** allows cash to be supplied and collected as needed. This technology is already in use, but not nationwide (*Roth interview*). This approach could optimise the efficiency of CIT companies' journeys.

In a ***network of virtual ATMs***, any registered business or individual can act as a cash withdrawal point (*Sauter interview*). This information can then be accessed virtually, for example via an app. Thanks to its partnership with Sonect, Migros Bank (Sonect 2020) now operates the largest "ATM network" (emphasis added by the authors) in Switzerland – without any hardware (Sonect n.d.; *Sauter interview*).

Virtual ATMs could significantly expand retailers' existing cashback models, especially since

they could also be implemented for small shops (such as bakeries or pharmacies) that do not belong to chains or franchises. Cash can be stored more securely in shops because the fact that they also enable cash withdrawals means that the cash register balance is smaller (*Sauter interview*).

Artificial intelligence-powered route optimisation is also expected to lower costs. This allows trips to retailers to be made as and when needed (*Wolf interview*). At present, cash is usually supplied and collected according to scheduled route plans and rhythms.

Data analytics aimed at uncovering patterns in cash logistics could also help to make cash supply and removal more efficient.[36] Moreover, the use of a shared data platform for all cash cycle stakeholders could improve efficiency by making it possible to predict demand for cash (*Seidemann, Thum interview*).

Process/organisation

Cash supply and removal could also be made more efficient by ***separating banknote logistics (high security requirements) from coins/change logistics (low security requirements)***. In the retail sector, the need for change means a large number of trips have to be made – alternative sources could render these unnecessary (*Wolf interview*). Coins could also be transported in normal passenger cars (*Binnebößel interview*). In fact, the way that coins are supplied is already changing. For example, small volumes of coins of up to €500 can also be obtained via platforms such as muenzmarktplatz.de. They are sent as a package (*Binnebößel interview; Wolf interview*).

In addition, ***changing from three-person logistics to the one-person logistics commonly used in the Netherlands*** in the CIT sector could have a cost-reducing effect (*Wolf interview; Binnebößel interview*). However, this would require the use of intelligent banknote neutralisation systems (IBNS technology) (*Mewes, Paulick, Wiegand interview; Wolf interview; Binnebößel interview*). Employees in the sector are worried about the effect one-person logistics will have on their safety; they feel they are facing more psychological stress and deteriorating working conditions (Hans-Böckler-Stiftung 2022, 8).

The establishment of local/regional cash cycles with retailers acting as a hub is also cited as a way of reducing costs (*Wolf interview*).[37]

Service

Private, on-demand CIT – i.e. a kind of cash delivery service – was suggested as an idea to cover possible temporary peaks in demand in local cash cycles (*Wolf interview*).

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36 Special events and public holidays, for example, are factors that are known to influence demand for cash and are already taken into account in cash logistics today.
37 Authors' note: Cash recyclers at credit institutions may have the same effect, but were not explicitly mentioned by the experts interviewed.

Packaging types

Cost drivers in the cash cycle currently stem from the fact that there are too many manual interfaces and numerous media breaks (switching between different packaging units) (*Mewes, Paulick, Wiegand interview*). Media breaks still currently exist amongst all participants in the cycle (*Seidemann, Thum interview*). Standardising processes would also enable cash processing to be automated to a greater degree. Standardised and sustainable container systems for transporting banknotes and standardised packaging solutions could help improve efficiency in this area (*Seidemann, Thum interview*).

Another cost-driving factor mentioned by experts in the horizon scanning exercise and cash stakeholder analysis was the size of the standard containers in which the Bundesbank provides – for example – coins (*Binnebößel interview*). The Bundesbank's standard coin containers are 755 mm long, 575 mm wide and 570 mm high and, depending on the denomination, can reach a gross weight of between around 625 and 700 kg (Deutsche Bundesbank n.d.b). If all denominations are required, eight standard containers must be used. This is not practical for many stakeholders. The standard containers would not fit into the vault at many bank branches and retail businesses, meaning that the only viable option is supply and collection via CIT companies, priced accordingly.

In addition, coins are only accepted and disbursed by the Bundesbank in the form of several rolls in a coin roll pack in a standard container. Dealer banks also only take and distribute rolls because the Bundesbank has established this as the standard.[38] Obtaining loose coins is therefore relatively expensive because the coin rolls have to be opened by hand. In addition, the roll packaging costs at least ten cent. By contrast, a ***safe bag with loose coins*** would only cost two to three cent and is more in line with market practice. This is because market demand for loose coins is growing (*Wolf interview*).

Other

The ***abolition of 1 and 2 cent coins*** was mentioned as another idea aimed at cutting costs. Prices could then be rounded to the nearest five cent. This could help reduce effort, transport costs and cash handling costs (*Sauter interview*).

Drive-thru ATMs could also be a way of lowering costs. Drive-thru ATMs are cash machines operated by several financial institutions or independent providers that can be used conveniently without leaving the car and could be located, for example, in large car parks at shopping centres. These ATMs can be filled while cash is being supplied to or removed from the shopping centre, which could create synergy effects.

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38 Authors' note: This standard applies to delivery and disbursement by the Bundesbank. CIT companies and dealer banks are free to choose the form in which they supply coins.

Assessment of the suggested innovations in the Delphi survey

In cycle 1 of the Delphi procedure, a selection of experts were asked, in their opinion, which of these measures (excluding data analytics) would be most effective in helping to reduce the cost of cash supply and removal over the next 15 to 20 years. It was possible to select up to five measures out of 18 in total from the categories technology, process/organisation, service, packaging types and other. Participants were then asked which of the 18 measures they thought were very likely to be implemented in the next 15 to 20 years. It was also possible to select up to five measures for this question.[39]

Compared to the other measures, private on-demand CIT services,[40] drive-thru ATMs,[41] the separation of banknote and coin logistics,[42] more widespread use of ATMs operated by independent providers[43] and the spread of virtual ATMs[44] were picked least often in respect of efficiency and likelihood of implementation. A mid-level number of respondents indicated that potentially reducing the size of the Bundesbank's standard containers could be an efficient way of lowering costs. However, few Delphi survey respondents thought it likely that this measure would be implemented within the next 15 to 20 years.[45] None of the measures that only a few people assume will become a reality in 15 to 20 years' time are taken into account in the three scenarios.

The "cash renaissance payment world" scenario assumes it was possible to implement the measures that a comparatively high number of respondents in the Delphi survey consider effective and that, at the same time, a relatively high or mid-level number of respondents believe could become a reality in the future.

These are AI-supported trips to merchants to supply and collect cash when needed,[46] one-person logistics in the area of CIT,[47] the establishment of sharing systems such as multi-tenant vaults,[48] more widespread use of certified cash recyclers[49] and more widespread use of payment machines at the POS.[50] The last measure would fit more neatly into the "vanishing hybrid payment world" scenario, given the comparatively small impact it has on costs. However, owing to the technical similarities between cash recyclers and payment machines at the POS, they are built into the "cash renaissance payment world" scenario.

39 One of these measures was the "optimisation of ATMs through contactless cash withdrawals". Because the added value of this measure for reducing costs in the cash cycle is unclear to the authors of this study, it is not addressed in this chapter.
40 Private, on-demand CIT: "Most effective for reducing costs": 3%; "most likely to be implemented in the next 15 to 20 years": 6%.
41 Drive-thru ATMs: "Most effective for reducing costs": 9%; "most likely to be implemented in the next 15 to 20 years": 9%.
42 Separation of banknote and coin logistics: "Most effective for reducing costs": 9%; "most likely to be implemented in the next 15 to 20 years": 12%.
43 More widespread use of ATMs operated by independent providers: "Most effective for reducing costs": 18%; "most likely to be implemented in the next 15 to 20 years": 15%.
44 Virtual ATMs: "Most effective for reducing costs": 18%; "most likely to be implemented in the next 15 to 20 years": 15%.
45 Smaller Bundesbank standard containers: "Most effective for reducing costs": 24%; "most likely to be implemented in the next 15 to 20 years": 9%.
46 Trips to merchants as and when necessary to supply and collect cash with the support of AI: "Most effective for reducing costs": 56%; "most likely to be implemented in the next 15 to 20 years": 44%.
47 One-person logistics: "Most effective for reducing costs": 47%; "most likely to be implemented in the next 15 to 20 years": 29%.
48 Establishment of sharing systems: "Most effective for reducing costs": 41%; "most likely to be implemented in the next 15 to 20 years": 26%.
49 More widespread use of certified cash recyclers: "Most effective for reducing costs": 38%; "most likely to be implemented in the next 15 to 20 years": 38%.
50 More widespread use of payment machines at the POS: "Most effective for reducing costs": 21%; "most likely to be implemented in the next 15 to 20 years": 24%.

Measures that a mid-level number of respondents believed would be effective in reducing costs and which a medium to high number of surveyed experts expect to become a reality in the future are included in the "vanishing hybrid payment world" scenario. These are the technical monitoring of ATM fill levels across Germany to fit supply and removal of cash around demand,[51] the establishment of local cash cycles,[52] an increased proliferation of smart safes,[53] cutbacks to the frequent repackaging stages in the cash cycle,[54] and abolishing 1 and 2 cent coins.[55]

The "hyperdigital payment world" scenario assumes that the only measures taken to reduce the cost of cash supply and removal are those which comparatively few respondents believed to be effective and which a mid-level number of experts believe are likely to be implemented in the future. This applies to just one measure: the introduction of safe bags with loose coins instead of rolls.[56] Although the intense process of digitalisation in this scenario naturally also spills over to the cash cycle, innovations are introduced too late and are unable to influence the fixed costs of cash early enough to have a stabilising effect on cash use.

51 Technical monitoring of ATM fill levels across Germany: "Most effective for reducing costs": 35%; "most likely to be implemented in the next 15 to 20 years": 32%.
52 Establishment of local cash cycles: "Most effective for reducing costs": 35%; "most likely to be implemented in the next 15 to 20 years": 21%.
53 More widespread use of smart safes: "Most effective for reducing costs": 32%; "most likely to be implemented in the next 15 to 20 years": 35%.
54 Cutbacks to the frequent repackaging stages in the cash cycle: "Most effective for reducing costs": 32%; "most likely to be implemented in the next 15 to 20 years": 29%.
55 Abolishing 1 and 2 cent coins: "Most effective for reducing costs": 21%; "most likely to be implemented in the next 15 to 20 years": 41%.
56 Safe bags with loose coins instead of rolls: "Most effective for reducing costs": 15%; "most likely to be implemented in the next 15 to 20 years": 24%.

Excerpt from the morphological box on the key factor "cash cycle"

Table 5.3.1

Scenario	Projections for "cash cycle"
The hyperdigital payment world	Cost pressures on the cash cycle increase considerably up to the end of the decade. The situation is exacerbated by the Bundesbank thinning out its branch network further, resulting in longer travel times for cash-in-transit companies. This is, in part, a response to the decline in domestic demand for cash, and makes all the more impact due to the sharp contraction of cash volumes in the domestic cash cycle. The costs of cash supply and removal are driven up further. Only a small number of effective cost-cutting measures are implemented in the cash cycle, such as the introduction of safe bags for loose coins instead of coin rolls. Innovations in the area of digitalisation are introduced too late to have a stabilising effect on cash use.
The cash renaissance payment world	The size of the Bundesbank's branch network remains the same as in 2022. As cash use is no longer declining sharply, it makes sense to invest in cash cycle innovations. Digitalisation and artificial intelligence applications are increasingly deployed in the cash cycle. Cash-in-transit companies drive to ATMs and retailers to deliver and remove cash as and when needed. CIT company operatives are permitted to perform their duties alone ("one-person logistics") without having to obtain special authorisations; the transport is technically secured. Retailers use sharing systems with multi-tenant vaults. Certified cash recycling machines and payment machines are more prevalent at the point of sale. This means the fixed costs of cash can be reduced.
The vanishing hybrid payment world	As cash usage declines, thought is given to whether the Bundesbank's branch network might need to be reduced further. A number of innovations are introduced to the cash cycle: the technical monitoring of ATM fill levels is rolled out across Germany to fit supply and removal of cash around demand, local cash cycles are established, there is an increased proliferation of smart safes, cutbacks are made to the frequent repackaging stages in the cash cycle, and 1 and 2 cent coins are abolished. However, these measures have only a small impact on the cost structure, meaning that the fixed costs of cash hardly decrease.

5.4 Consumer requirements

The key factor "consumer requirements" comprises what consumers want from payment instruments in the future and specifics regarding their desire for freedom of choice when it comes to using them.

The megatrend analysis suggests that, in future, individualisation and pluralisation as well as social disparities within society will increase. Against this backdrop, consumer requirements will also diverge. The question of which means of payment will best meet the future expectations of consumers, societal segments or sub-groups in 15 to 20 years' time will have a major impact on the demand for cash. The question of how much consumers want to be able to choose which means of payment they use in which situation in future will also be a relevant influencing factor. Cash's degree of importance as a potential store of value in the future will play a role as well.

Use of cash today and in the future

The lifestyle analysis represents a key dataset in terms of assessing current consumer requirements and deriving future assumptions from these. The lifestyle analysis is based on two different survey methods: focus groups and a representative survey (Chapter 4.2).

The representative survey shows that the average day-to-day frequency of cash use is currently 5.9 on a scale of 0 (I never pay with cash) to 10 (I only pay with cash). A slight majority (54%) of respondents indicate that they often pay with coins and banknotes (scale values 6 to 10). At 32%, the share of predominantly non-cash payers (scale values 0 to 4) is much smaller. Hardly anyone lives completely cash-free (scale value 0: 1%).

The average frequency of use differs between lifestyle segments: according to the representative survey, cash is used most frequently in the traditional segment (mean value: 6.9 out of a maximum of 10). Following in descending order are the consumption and participation-oriented segment (6.4), the established segment (5.7) and the modern middle class (5.6). On average, cash payments are made the least frequently in the progressive segment (5.2). When looked at against the outcome of the focus group exercise, the order of segments in the representative survey presents a similar picture with regard to the frequency of cash use. That said, when the qualitative and quantitative investigations are placed alongside one another, the positions of the modern middle class and the progressive segment, both of which use cash relatively rarely, are reversed. In the focus groups, the modern middle class uses cash the least frequently; in the representative survey, the progressive segment takes this position. Furthermore, the range of mean cash use values between the segments is smaller in the representative survey – in other words, the minimum and maximum values are closer together.

In the representative survey, the majority of non-cash payers often belong to the progressive and established segments, sit within the age groups of 18 to 29 and 30 to 49, and have a high level of formal education. By contrast, consumers in the traditional segment as well as those over the age of 70 and persons with a low level of formal education often use cash almost exclusively.

When asked how frequently they would like to pay in cash in 15 years' time, a significant two-thirds majority of respondents (67%) stated that they would like to pay as frequently in cash as they do today. A further 28% would like to pay in cash less frequently than today, whereas 5% would like to pay in cash more frequently in cash in 15 years' time. This desire stands in clear opposition to the payment reality expected for Germany as a whole: seven out of ten respondents (70%) assume cash will be used less frequently in Germany in 15 years' time than it is today. 25% believe that in Germany cash will be used just as frequently as it is today in future, and 5% expect a higher share of cash payments in future than today.

In future, then, a much less cash-heavy payment reality is anticipated for society as a whole; however, consumers would personally like to continue paying with cash and clearly prefer a hybrid payment reality in which they are free to choose between cash and cashless payment methods.

An above-average reduction in cash payments in 15 years' time is likely to be seen in the progressive segment as well as amongst (already) rare cash users, in the age group of current 18 to 29 year olds and among those with a high level of formal education. Those most keen to stick with cash are respondents in the traditional segment, (current) frequent cash users, those who are currently over 70 years old and respondents with a low level of formal education.

The results imply growing differentiation between the payment habits of societal groups that remain highly cash loyal and those that keep living a largely cash-free lifestyle. This aspect is addressed in the "vanishing hybrid payment world" scenario.

Decision-making criteria governing the general public's choice of payment method today

The results of the focus groups and the representative survey largely concur that the various societal groups of today use different decision-making criteria when selecting a means of payment. Without distinguishing between different user groups, the decision-making criteria of convenience/comfort when paying and the range of available payment options (both 78%) are the most frequently selected out of ten given criteria among the 2,000 participants in the representative survey. This is followed by the payment amount (76%) and wanting an overview of available remaining funds/expenditure control (75%). Slightly behind, in fifth place, is the decision-making criterion of place of payment (71%).

With slightly lower agreement levels, the speed of the payment process as a whole comes next (62%), followed by habit and upbringing (53%). The least important criteria (albeit still important to the majority of respondents) are anonymity when making payments (50%) and collecting bonus points/receiving discounts (47%). In last place by a considerable margin is the payment behaviour of other persons (10%). 2% of respondents name other decision-making criteria.

Decision-making criteria vary between cash users and non-cash users

A number of segment-specific priorities can be observed with regard to decision-making criteria. Respondents in the progressive segment as well as 18 to 29 year olds are most interested in convenience when paying and the speed of the payment process as a whole. In the traditional segment and amongst older respondents, the opportunity to obtain an overview of available remaining funds, habit/upbringing and anonymity when paying are the decision-making criteria cited more often than average. With regard to these criteria, however, there are greater differences between predominantly cash-paying respondents and almost exclusively non-cash-paying respondents than there are between segments. For example, the convenience and speed of payment are particularly important for people who rarely pay with cash. Frequent users of cash place greater emphasis on the ability to keep track of their spending and anonymity, and more often use cash out of habit.

Requirements for means of payment in the future

The experts surveyed in the Delphi exercise assume[57] that for the majority of consumers, ease of use[58] will remain the most important requirement for a means of payment in future. Although the requirement "ease of use" in the Delphi survey is not completely comparable to "convenience/comfort" in the representative survey, both criteria refer to the user-friendliness of a payment instrument.

Ranked second, third and fourth are availability,[59] low user costs[60] and anonymity, privacy and data protection.[61] By contrast, the decision-making criterion of expenditure control,[62] which is deemed significant by three-quarters of representative public survey respondents, is only considered important for the future by a few of the Delphi exercise participants. The experts surveyed using the Delphi technique placed the future importance of speed[63] towards the lower end of the mid-range.

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57 In cycle 1 of the Delphi survey, the surveyed experts selected three of the requirements for future payment instruments that consumers deemed most relevant from a list of 18 criteria, and then ranked them by importance (most important, second most important, third most important). In a second step, the experts assessed whether the three requirements they had ranked as being most relevant were more fully met by cash or by cashless means of payment. The 18 requirements, in order of importance, were as follows (sum of highest, second and third highest importance [discrepancies in summands and sums due to rounding]): ease of use (64%), availability (48%), low user costs (36%), anonymity, privacy and data protection (31%), universality (18%), security against manipulation (16%), interconnectedness with digital applications (15%), resiliency (13%), speed (13%), independence (9%), low procurement outlay (9%), environmental sustainability (6%), expenditure control (6%), inclusion (4%), protection against loss of value (3%), analogue life (1%), transparency (1%), protection against robbery and associated risks to physical integrity (0%).
58 Ease of use: 34% (most important), 22% (second most important), 7% (third most important).
59 Availability: 15% (most important), 13% (second most important), 19% (third most important).
60 Low user costs: 3% (most important), 19% (second most important), 13% (third most important).
61 Anonymity, privacy and data protection: 6% (most important), 6% (second most important), 19% (third most important).
62 Expenditure control: 0% (most important), 1% (second most important), 4% (third most important).
63 Speed: 4% (most important), 1% (second most important), 7% (third most important).

With regard to expenditure control, which was deemed to be of above-average importance by cash payers in the representative survey, a slight majority of Delphi survey respondents assume that cash will fulfil this requirement the most fully in future (57% cash, 43% cashless means of payment). As for anonymity, which was also deemed to be of above-average importance by cash payers in the representative survey, cash is clearly seen as having a future advantage in the Delphi survey (95% cash, 5% cashless means of payment).

In the representative survey, convenience/comfort and speed are considered to be of above-average importance by non-cash payers. In the Delphi survey, a majority of respondents expect cash to meet the ease of use requirement in the future (58% cash, 42% cashless means of payment). The experts responding to the Delphi survey see a clear advantage for cashless means of payment in future in terms of the requirement for speed (11% cash, 89% cashless means of payment).

The results of the representative survey, the focus groups and the Delphi survey indicate that, for the vast majority of consumers, convenience/comfort – in other words, ease of use – will be the key criterion for choosing a means of payment in future. The trend toward a strong appreciation of user-friendliness in a payment instrument, which can already be seen today, is likely to become even more pronounced in future. One reason for this is that the share of the total population made up by the traditional segment and the current older generation will tend to decline in future. Only for these groups are criteria other than convenience and comfort the top priority. Another question that poses itself is which means of payment will best meet the requirement of convenience and comfort. The results of the representative survey, but also the horizon scanning exercise, suggest that nowadays, for part of the population, these tend to be cashless payment methods. From the Delphi survey, though, it looks like cash, too, could hold that position in future. It is likely that the respective consumers' perspective will determine which means of payment they deem most convenient to use in the future.

In all scenarios, the decision-making criterion of convenience/comfort plays an important role. In the "hyperdigital payment world" scenario, it is the cashless payment methods that fulfil this requirement; in the "cash renaissance payment world" scenario, cash payments are made easier by innovations and in the third scenario, the "vanishing hybrid payment world", the importance of comfort and the perception of which payment instrument is deemed convenient depend on which milieu or societal group individuals belong to.

The results of the focus groups, the representative survey and the Delphi exercise suggest that anonymity is of only medium relevance among the population as a whole when choosing a means of payment, and will remain so in the future. In the "hyperdigital payment world" scenario, it is therefore assumed that anonymity is by that point only

relevant for those in the traditional segment, those in a high age bracket and committed cash users. In the "vanishing hybrid payment world" scenario, the importance of anonymity is group-specific. Only in the "cash renaissance payment world" scenario is it assumed that this decision criterion will become more relevant again.

The importance of freedom of choice today and in the future

Irrespective of which means of payment individual respondents prefer, the results of the representative public survey, the focus groups and the Delphi exercise show that preserving freedom of choice will continue to be of vital importance in future. For three-quarters (73%) of respondents in the representative survey, the general possibility of paying with cash is very or somewhat important. Putting one's own preferences aside produces comparable results: 72% of respondents believe that it is also very or somewhat important for other people and/or society as a whole to be able to pay in cash, generally speaking.

However, although 44% of participants personally deem it very important to be able to pay in cash themselves, only 21% see this as a high priority for society as a whole. 29% consider having the option to pay in cash to be somewhat important in itself, while 51% believe that it is somewhat important for other people or society as a whole to have this option.

89%[64] of Delphi survey participants also want other groups of persons to have the option of paying in cash on a day-to-day basis, irrespective of their own preferences. 88%[65] of the experts surveyed as part of the Delphi exercise also want this for themselves.

In the representative survey, 93% of respondents completely or mostly agreed that they would, in future, like to continue having the choice of whether to use cash or a cashless payment method wherever they make a payment. Only 17% agreed that it would be good if there were no more cash at some point in the future. Agreement with this statement was above average in the progressive segment and in the Post-Materialist Milieu within the established segment. However, this finding is put into perspective by the results from the focus groups.

In the focus groups, members of the progressive and the established segments, in particular, showed awareness of the fact that not all parts of the population can keep up with new developments or respond equally positively to innovation. They therefore believe that cash should stay, as a purely cashless payment world would not be accessible to some groups of people. As the participants in the focus groups had more time to reflect on the importance of cash for other social groups than was possible in the representative survey, more weight is given to the focus groups' results here.

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64 Question in cycle 1 of the Delphi survey: "Irrespective of your own preferences, would you like other people to have the option of using cash on a day-to-day basis?" Result: 70% answered "Yes", 19% leaned towards yes, 10% leaned towards no, and 0% chose "No".
65 Question in cycle 1 of the Delta survey: "Would you personally like to continue using cash in 15 years and beyond?" Result: 66% answered "Yes", 22% leaned towards yes, 10% leaned towards no, and 1% chose "No".

In the "cash renaissance payment world" scenario, people belonging to the Expeditive Milieu and the Neo-Ecological Milieu advocate for the right to an analogue life on account of inclusion considerations and the desire to protect their privacy. The complexity of their attitudes towards the subject of cash, as shown in the focus groups and the representative survey (e.g. low levels of personal use, but predominant awareness of the importance of cash for society as a whole), is expressed by the fact that in this scenario, social and political motives are not the deciding factors in their preference for an analogue life, but rather the prioritisation of a self-determined life that is typical of these milieus.

In the other scenarios, there is no reflection on the importance of cash for certain societal groups and the benefits of freedom of choice.

Cash as a store of value

Having outlined the possible pathways for needs, wants and demands relating to cash as a means of payment, the study now turns to examine the pathways that cash as a store of value might take in the future.

The representative survey found that the store of value function of cash is very or somewhat important for a small majority (56%) of respondents personally, with 28% deeming it very important. The importance of this function is ranked even more highly for society as a whole, with 62% of respondents deeming it very or somewhat important and 17% of this group regarding it as very important.

While the store of value function of cash is of above-average importance for respondents belonging to the traditional segment and the Precarious Milieu (which forms part of the consumption and participation-oriented segment), frequent cash users and those with a low level of formal education, it is particularly unimportant for the Performer Milieu (part of the progressive segment), the Post-Materialist Milieu (part of the established segment) and those who seldom pay in cash.

The store of value function of cash plays a slightly more important role in the representative survey than in the focus groups. However, the focuses of the segments are identical in both the qualitative and the quantitative investigations.

In the "hyperdigital payment world" scenario, it is assumed that cash's store of value function becomes less important in future. One reason for this is that cash loses fungibility in this scenario, and the traditional segment, in which cash currently plays a major role, shrinks in demographic terms. Cash becomes one store of value among many others. In the "cash renaissance payment world" scenario, the importance of cash as a store of value remains at its current level or even increases due to enhanced awareness of crisis prevention measures in most milieus. Meanwhile, in the "vanishing hybrid payment world"

scenario, cash as a store of value is still relevant, above all for the traditional segment and the Precarious Milieu. Consumers in the Performer Milieu and the Post-Materialist Milieu turn to other means of storing value.

Excerpt from the morphological box on the key factor "consumer requirements"

Table 5.4.1

Scenario	Projections for "consumer requirements"
The hyperdigital payment world	Convenience and comfort are the core motives driving decisions on how to pay for almost all social groups, with the exception of the traditional segment, persons in a high age bracket and the few remaining cash users. Although members of the public continue to stress the importance of data protection and protecting their privacy when surveyed, this only rarely plays a role in specific everyday situations involving a choice about the means of payment. Within the population as a whole, the choice of payment instrument is determined by the question: what is the fastest, simplest and most convenient way to make this payment? Cashless means of payment are chosen the majority of the time. Cash is only one means of storing value among many others.
The cash renaissance payment world	People from the Expeditive Milieu and the Neo-Ecological Milieu advocate for the right to an analogue life and consciously begin to pay in cash more frequently. They do not want to supply providers of cashless payment instruments with data to feed into their business models. Alongside social and political factors, lifestyle aspects were also important: cash is associated with values such as sovereignty, independence, constructive rebellion and a way of casually setting oneself apart from the mainstream. Beginning with the individuals who hold these values, greater awareness of the benefits of cash gradually emanates to the other social milieus. With the exception of the traditional segment and the Precarious Milieu (situated within the consumption and participation-oriented segment), these consumers have tended to pay with cash rather infrequently up to this point. The majority of consumers use cash only if the underlying conditions make doing so simple and convenient. Nevertheless, cash is often used as a store of value for crisis prevention purposes, amongst other things.
The vanishing hybrid payment world	As milieus diverge from one another, milieu membership proves to be a main – though not the only – factor in determining which types of payment method and store of value consumers prefer. Economically restricted or disadvantaged individuals favour cash over cashless means of payment. People who are suspicious of the government or private and/or digital providers also prefer cash. The same goes for people looking for simplicity and a good overview of their own expenditure and who would like to or need to monitor their spending behaviour. Informed and sceptical consumers prefer means of payment that require little data or are anonymous. However, these groups are in the minority and are often encouraged to pay without cash. Consumers that are happy taking risks and those seeking convenience readily try out new cashless payment methods offered by private providers; those without strong feelings on data protection like trying them out anyway. Persons belonging to the progressive segment, in particular, enjoy trying out innovations in the field of cashless payments soon after they are introduced. Cash is used as a store of value mainly by people in the traditional segment and the Precarious Milieu. For other segments, cash plays barely any role as a store of value anymore.

5.5 Retail

In this study, the key factor "retail" covers trends and developments relevant to the potential futures of cash in both bricks-and-mortar and online retail. Horizon scanning and the megatrend analysis showed that retail as a whole is being strongly impacted by the digitalisation megatrend. This is reflected in the average growth in online commerce and in the progressive digitalisation of bricks-and-mortar retail alike.

The megatrend analysis revealed that consumer behaviour may continue to evolve towards products and services being as easily and readily available as possible. The reason behind this is an increasing interconnectedness, which allows easy access to globally active providers. New patterns of consumption are arising at the societal level, e.g. as a result of an aging clientele, technological innovations, the desire for individualisation and the emergence of an event culture (Trend ONE 2021).

For the key factor "retail", horizon scanning identified the evolution of online shopping, the proliferation of self-service checkout (SCO) systems, the spread of unstaffed micromarkets and supermarkets, as well as the persistence and expansion of the trend towards shopping locally as relevant factors for the future status of cash.

Digitalisation of retail

Retail trade is increasingly turning into a digital (*Binnebößel interview*) or hybrid space in which cash cannot be used as a means of payment, apart from payment options such as Barzahlen/viacash[66] (*Binnebößel interview; Knoop interview*). The assumption is that this will lead to a progressive crowding-out of cash used at the point of sale (POS) (*Binnebößel interview; Schmiese interview*). As digital and analogue sales channels merge, retail payments are becoming increasingly digital and completely fade into the background (*Binnebößel interview*).

If trends such as showrooming[67] continued or the "buy now, pay later" concept were to become established, the HDE expert believes that cash use at the POS could decline even more rapidly than to date (*Binnebößel interview*). This could also lead to a further deterioration in the retail sector's cost-benefit ratios with regard to the acceptance of cash payments (*Schmiese interview*). Cash has high fixed costs and low variable costs. This means that the lower the total cash turnover at the respective brick-and-mortar stores, the more expensive the individual cash payment becomes (*Zeitz-Brandmeyer interview*). Some stores (Chapter 5.1) have already stopped offering customers the option of cash payment (*Schmiese interview*).

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66 Barzahlen/viacash enables customers to pay for an online purchase in a retail store using a barcode.
67 Goods are viewed in bricks-and-mortar shops and purchased online.

Growth in online shopping

Between 2015 and 2022, sales in business-to-customer (B2C) e-commerce[68] in Germany increased from €39.9 billion to €84.5 billion. The increase from 2020 to 2021 during the COVID-19 pandemic, in particular, was immense, meaning that online retailers were able to generate sales as high as €86.7 billion in 2021 (Handelsverband Deutschland 2023). At the same time, sales in bricks-and-mortar retail decreased by around €5 billion on the year in 2021 to a gross €430 billion (EHI Retail Institute 2022). Key reasons for the growth surge in online commerce in the pandemic years are the temporary closure of shops (except for food retailers), the successful positioning of online shops by some retailers that are better known from the bricks-and-mortar sector and manufacturers embarking on digital direct distribution or distributing their goods on digital platforms (ZEIT Online 2022).

In 2022, the high level seen during the pandemic was almost maintained, although growth was declining. B2C e-commerce sales decreased by 2.5 percentage points on the year to €84.5 billion (Handelsverband Deutschland 2023). After a contraction in 2021, bricks-and-mortar retail was even able to record an increase, achieving gross sales of €465 billion (EHI Retail Institute 2023).

At present, it is unclear whether online commerce will continue to develop as rapidly in the coming years as it did during the COVID-19 pandemic, or whether 2022 will mark the beginning of temporary stagnation and reduced growth rates. The experts surveyed as part of the Delphi exercise do not see bricks-and-mortar retail being either crowded out[69] or resurging[70] on a large scale within the next 15 to 20 years.

The scenarios therefore assume different growth rates for online commerce, i.e. strong growth in the "hyperdigital payment world" scenario, low average growth rates in the "cash renaissance payment world" scenario and moderate growth in the "hybrid payment world" scenario.

Online commerce could experience strong growth in the future due to an expansion in retailing goods that have not really or hardly been included in online commerce to date. Groceries is generally seen as an area with large market potential in the e-commerce space.

Between 2014 and 2022, the food-based online commerce segment grew rapidly from €618 million to almost €4 billion, although market shares are still comparatively small. Similar to online commerce as a whole, this segment achieved the highest annual growth

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68 B2C e-commerce refers to the merchant selling directly to the customer.
69 Delphi hypothesis: "In 15 to 20 years, online retail will have largely displaced bricks-and-mortar retail." Result: 34% in cycle 1 and 24% in cycle 2 regard this as likely; 61% in cycle 1 and 68% in cycle 2 consider it unlikely; 4% in cycle 1 and 7% in cycle 2 chose "I don't know/no answer".
70 Delphi hypothesis: "In 15 to 20 years, bricks-and-mortar retail will experience a revival." Result: 15% in cycles 1 and 2 regard this as likely; 66% in cycle 1 and 73% in cycle 2 consider it unlikely; 19% in cycle 1 and 13% in cycle 2 chose "I don't know/no answer".

rates during the pandemic years of 2020 (up from around €1.6 billion in 2019 to around €2.7 billion in 2020) and 2021 (up to around €3.9 billion). In 2022, online food commerce grew only slightly (behv 2023). One of the obstacles to growth is that consumers are accustomed to being able to purchase day-to-day essentials spontaneously at bricks-and-mortar grocery stores; another is that the desire to check the freshness of food cannot be satisfied from a distance (Statista 2023). Whether food-based online commerce will continue to grow in the future will probably depend on the development of general lifestyle habits in the context of ongoing digitalisation, price developments compared with bricks-and-mortar retail (minimum order amounts and delivery costs may be obstacles) and the possibility of conveniently returning or exchanging goods which have defects.

The aspect of growing food-based online commerce as part of a fully digitalised society is addressed in the "hyperdigital payment world" scenario.

Shopping locally

The horizon scanning exercise showed that the trend of buying online during the COVID-19 pandemic was accompanied by the trend to shop locally. This is due, amongst other things, to working life becoming more flexible, which was also triggered by the COVID-19 pandemic. Nearly half of the people in Germany who mainly worked from home in the spring of 2021 reported in the 2021 Global Consumer Insights Pulse Survey that they were increasingly shopping locally (PwC 2021). The calls to show solidarity with local shops, which were widely shared on social media during the pandemic, can be regarded as a further stimulus to buying from local retailers.

In addition, awareness of sustainability and environmental issues increased, which led people to focus on buying local and regional products – in particular groceries (PwC 2021).

The "cash renaissance payment world" scenario sheds light on the impact of people shopping more locally.

Proliferation of shopping without a checkout process and of self-checkout systems in bricks-and-mortar retail

In bricks-and-mortar retail, customers are increasingly able to pay without interacting with sales staff. The changes in payments are facilitated by pick&go systems and by self-checkout (SCO) systems. Depending on the proliferation and acceptance of the novel payment systems and their specific design (SCOs with or without cash payment modules), these systems may impact the future use of cash in retail settings (*Knoop interview; Binnebößel interview; Schmiese interview*).

For pick&go systems, for example, customers check in to the supermarket by scanning a QR code. Cameras and sensors follow the customer's product selection. Once the customer leaves the store, the amount to be paid is displayed in an app and then

settled in cashless form using the selected cashless payment option. This means that customers can leave the shop without having to go to a cashier or physical checkout (*Binnebößel interview*).

Turning to SCOs, a distinction can be made between stationary self-checkout systems and mobile self-scanning systems.

In the case of stationary SCO systems, customers scan and pay for goods at the payment module. With mobile self-scanning, customers scan goods while shopping either with a hand-held scanner provided by the store, with a scanner on the shopping cart or with their own smartphone using the retailer's app (EHI Retail Institute n.d.b). The in-house manual scanners can be handed over to a staffed POS for payment or interact with a "Pay-tower" payment machine (transfer of goods data to the POS system), where payments can then be made (EHI Retail Institute n.d.b). Depending on the technical design, different payment options are conceivable when it comes to shopping carts with built-in scanners. The recently rolled out shopping cart system at one of the leading food retailers in Germany works by scanning a barcode at a serviced POS (t-online 2023). Using the retailer app usually allows goods to be scanned through the app and the payment to be made by means of a QR code, barcode or number code at a till or payment barrier. When customers pass a payment barrier, they can pay on their smartphone without interacting with the POS staff (Verbraucherzentrale 2023; Handelsunternehmen n.d.).

EHI Retail Institute's August 2021 market survey on SCOs showed a significant increase in their prevalence. In 2019, only 970 retail outlets had these systems; in 2021, the number had already more than doubled to 2,302 (EHI Retail Institute n.d.a).

Of 44 surveyed retailers with 36,800 branches in German-speaking countries (Austria, Germany, Switzerland), 43% offered self-checkouts, 25% offered self-scanning with retailer-provided hardware and 39% offered self-scanning via the customer's smartphone. In the future, 59% of retailers surveyed intend to enable customers to use self-checkout and self-scanning via smartphone; 34% want to offer self-scanning with hardware provided by the retailer (EHI Retail Institute 2022c).

In 2021, the majority of stores with stationary SCO systems offered cash payment modules (62% in 2021 compared with 85% in 2019). In terms of the number of stationary SCO units in the market as a whole, this figure came to 47% in 2021, compared with 53% in 2019. These data show that while many SCOs still have a cash payment module, their share has declined. As payment habits have changed in recent years, retailers could in future completely dispense with cash payment modules or provide only a few stationary SCOs with the option to pay in cash (EHI Retail Institute n.d.a).

The experts surveyed in cycle 1 of the Delphi procedure believe, by a narrow majority, that it is likely that it will be possible to pay in cash at self-checkouts in 15 to 20 years.[71] Accordingly, all scenarios assume that SCOs will continue to feature the option to pay in cash in the future; only the number of such checkout facilities and the number of stores offering them will vary. In the "hyperdigital payment world" scenario, shops offering SCO facilities where the customer can pay in cash are few and far between. In the "cash renaissance payment world" scenario, shops equipped with self-service checkouts have at least one and – depending on the shop's size – several featuring a cash payment module. In the "hybrid payment world" scenario, depending on size, there will be at least one SCO featuring a cash module in shops where part of the clientele like to pay in cash.

Moreover, the share of mobile self-scanning systems having increased tenfold between 2019 and 2021 (EHI Retail Institute n.d.a) may also contribute to cash being used less frequently in retail.

However, the provision and acceptance of these novel shopping systems are two different things. A recent EHI study shows that only 1 in every 150 customers makes use of the option to scan via app, though every 15th customer opted for self-scanning via a scanner that was hand-held or attached to a shopping cart. Possible explanations put forward for the low uptake of the scanning apps include, amongst other things, the complex registration processes, fears about damage to one's smartphone, the toll on the battery and not perceiving queuing times at staffed checkouts to be long. Nevertheless, retailers expect that between 3% and 5% of customers could use scanning apps in the medium term and 10% in the longer term (EHI Retail Institute 2022b).

A very clear majority of the experts surveyed in the Delphi exercise consider it likely that SCOs and self-scanning systems will be standard practice in 15 to 20 years.[72] Another clear majority believe that self-service and staffed checkouts will continue to be provided in parallel in the future.[73]

In the "hyperdigital payment world" scenario, it is assumed that pick&go systems and self-checkout systems are widespread and that staffed checkouts are hardly around anymore. In the "cash renaissance payment world" scenario, it is assumed that large supermarket chains provide SCO systems and staffed checkouts in parallel. In the "hybrid payment world" scenario, the cashier systems provided are strongly correlated with the product portfolio and customer base.

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71 Delphi hypothesis: "In 15 to 20 years, self-checkouts will also offer cash payment modalities." Result: 49% in cycle 1 and 73% in cycle 2 regard this as likely; 39% in cycle 1 and 24% in cycle 2 consider it unlikely; 12% in cycle 1 and 2% in cycle 2 chose "I don't know/no answer". The significant shift in the result in cycle 2 compared with cycle 1 is due to the fact that those who had already voted "likely" in cycle 1 were more strongly represented in cycle 2.
72 Delphi hypothesis: "In 15 to 20 years, self-checkouts and self-scanning systems will be standard practice." Result: 91% in cycle 1 and 90% in cycle 2 regard this as likely; 3% in cycle 1 and 7% in cycle 2 consider it unlikely; 6% in cycle 1 and 2% in cycle 2 chose "I don't know/no answer".
73 Delphi hypothesis: "In 15 to 20 years, self-checkouts and staffed checkouts will be offered in parallel." Result: 73% in cycle 1 and 85% in cycle 2 regard this as likely; 21% in cycle 1 and 7% in cycle 2 consider it unlikely; 6% in cycle 1 and 7% in cycle 2 chose "I don't know/no answer".

Unstaffed (micro) markets

The horizon scanning exercise also showed that some retailers are carrying out trials with unstaffed micro-markets using the pick&go technologies mentioned above. For example, the supermarket chain Tegut is planning to introduce 20 staff-free micro-markets stocking a range comprising 1,000 products in municipalities with 1,500 or more inhabitants around Frankfurt am Main (Kirchhoff 2022; Hessischer Rundfunk 2022; Melibokus Rundblick 2023).

56% of consumers can generally imagine shopping in a staff-free grocery store (Statista 2021).

However, the experts surveyed in the Delphi exercise disagree on the prevalence of unstaffed shops (not exclusively micro-markets) in the future. The number of participants that considered their proliferation to be likely was roughly the same as the number who believed it unlikely.[74]

For this reason, the aspect of a rapid spread of unstaffed and low-staff shops and micro-markets is only addressed in the "hyperdigital payment world" scenario. There, shopping markets are one of many areas of life to experience a strong digital transformation.

74 Delphi hypothesis: "In 15 to 20 years, unstaffed shops will be widespread." Result: 49% in cycle 1 and 44% in cycle 2 regard this as likely; 45% in cycle 1 and 44% in cycle 2 consider it unlikely; 6% in cycle 1 and 12% in cycle 2 chose "I don't know/no answer".

Excerpt from the morphological box on the key factor “retail”

Table 5.5.1

Scenario	Projections for “retail”
The hyperdigital payment world	Online commerce continues to grow strongly. Groceries, too, are increasingly being ordered online, especially in urban areas. The increasing technological maturity of pick&go systems and the expanded functional range of self-checkout systems lead to the rapid spread of unstaffed or low-staff shops. Staffed checkouts are hardly commonplace any more. In rural areas, too, unstaffed micro-markets become more common. Only very few shops accept cash payments at self-checkouts in isolated cases.
The cash renaissance payment world	Consumers deliberately choose to support small businesses and local and regional suppliers. Online commerce grows but cannot match the surges in growth seen in the past. All of the major supermarket chains offer both staffed checkouts and self-checkouts alongside one another. Depending on their size, all businesses that offer self-service checkouts also offer one or more SCOs with a cash payment module.
The hybrid payment world	Online commerce is growing. More and more branches of large retail chains are closing. Remaining bricks-and-mortar retailers vary hugely in terms of cashier system facilities. In addition to businesses that offer staffed checkouts and SCO systems in parallel, there are stores that only offer staffed checkouts and those that have no staff at all. This mainly depends on the business’s product portfolio and customer base. In shops where parts of the clientele like to pay in cash, there is at least one SCO with a cash payment module, depending on the size of the store.

5.6 Digital euro

The key factor "digital euro" concerns the development of a central bank digital currency for the euro area.

In all three scenarios, it is assumed that the digital euro will be introduced within the next 15 years. This assumption is based on the progress that has been made in the investigation phase for the introduction of the digital euro as well as the European Commission's proposal for a Regulation of the European Parliament and of the Council on the establishment of the digital euro, which was presented in June 2023 (European Commission 2023b). The proposed regulation is intended to set out the legal framework for the introduction of the digital euro.

The decision on the actual introduction of the digital euro and its launch date will be made by the ECB Governing Council together with policymakers (Deutsche Bundesbank n.d.a). The timing of the digital euro's introduction as well as its functionalities and technical design in practice will be pivotal in shaping its impact on cash usage.

Legal tender status and mandatory acceptance

The European Commission's regulation proposal provides that the digital euro, like cash, shall have the status of legal tender (European Commission 2023b, 42). As a result, this will also entail mandatory acceptance; exceptions can be made for microenterprises and non-profit legal entities provided these do not accept other forms of cashless payment instrument either. The European Commission may allow for additional exceptions by adopting delegated acts (European Commission 2023b, 42-43). Furthermore, in accordance with the case law of the Court of Justice of the European Union, Member States will also have the right to introduce exceptions to mandatory acceptance (see the cost saving aspect referred to in Chapter 5.1, section "Legal practice and regulatory framework").

Offline functionality

In its proposed regulation, the European Commission intends for the digital euro to be equipped with offline functionality immediately upon its introduction (European Commission 2023b, 51). This was also announced in July 2023 in the fourth progress report from the ECB and Eurosystem (European Central Bank 2023, 11). For offline payments made with the digital euro, "authorisation and settlement [will] take place in the local storage devices of both payer and payee" (European Commission 2023b, 39). This is possible in physical proximity and without an internet connection (European Commission 2023b, 51). However, the technical implementation of offline functionality has many prerequisites. As such, the ECB working group responsible for the digital euro initially expected that offline functionality might not be added until a later date (European Central Bank 2022a, 6).

The "hyperdigital payment world" scenario therefore assumes that the digital euro would be first introduced in purely online form. In the "cash renaissance payment world" and "vanishing hybrid payment world" scenarios, by contrast, it is assumed that, with regard to offline functionality, the European Commission's current regulation proposal passes through the legislative process entirely unchanged and that the digital euro has offline functionality immediately at launch.

In cycle 1 of the Delphi procedure, experts were asked whether consumers would use the digital euro more than cash for payments in 15 to 20 years' time. A majority of the respondents (46%) considered this unlikely, 37% considered it likely, and 16% responded "Don't know/no answer".

The question was repeated in cycle 2, but, this time, a distinction was made between variants of the digital euro with and without offline functionality. Respondents were asked to answer the question regarding the use of the digital euro under two different assumptions:

- In 15 to 20 years' time, the digital euro does not have any physical[75] offline component and is thus more similar to cashless means of payment – as in the "hyperdigital payment world" scenario.
- The digital euro has offline functionality and is thus more similar to cash – as in the other two scenarios.

When it was assumed that the digital euro would be equipped with offline functionality, the responses in cycle 2 followed a similar pattern to those in cycle 1. Expert assessment is divided: as in cycle 1, 46% consider it unlikely that the digital euro would be used more than cash in future, 41% consider it likely, and 12% responded "Don't know/no answer".

The scenarios reflect the two possible pathways, which are assumed to be around equally likely, with care taken to fit them into a form consistent with the attributes of the other key factors. In the "cash renaissance payment world" scenario, the digital euro is not used to a greater degree than cash. In the "vanishing hybrid payment world", the digital euro is used more than cash in future by the milieus that like to try out new innovations in payments in any case.

If the digital euro does not have any offline functionality in 15 to 20 years, the overwhelming majority of experts believe that it would not be used more than cash. Only 20% expect that the digital euro would be used more than cash, 71% consider this to be unlikely, and 10% responded "Don't know/no answer". The "hyperdigital payment world"

75 There are two options for the offline component: physical cards or an offline functionality for payments in physical proximity without an internet connection. The Delphi survey asked about a physical format in general. This is usually understood as referring to cards as a storage device. Offline functionality using local storage on a smartphone was not explicitly covered.

scenario, in which the digital euro is launched without any offline functionality, still assumes that cash comprises a comparatively small share of total transactions. As this variant of the digital euro – without offline functionality – spreads through the market only gradually, it has a negligible impact on cash use in this scenario.

Privacy and the digital euro

The European Commission's proposed regulation states that offline payments with the digital euro should ensure "a high level of privacy". The level of privacy should be comparable to withdrawals of banknotes at automatic teller machines and to the use of cash (European Commission 2023b, 3, 4). Online payment transactions with the digital euro would be subject to the same legal requirements as private cashless means of payment with regard to data protection, privacy, anti-money laundering, and countering the financing of terrorism (European Commission, 2023b, 4).

However, 63% of the experts surveyed in cycle 2 of the Delphi exercise consider it likely that, from a consumer perspective, a digital euro with offline functionality would not represent an alternative to cash, as it would not allow for full anonymity; 29% consider this to be unlikely and 7% responded "Don't know/no answer".[76] Without offline functionality, the digital euro would perform even more poorly: in this case, more than three-quarters of experts (78%) assume that, because it would not allow for full anonymity, it would not represent an alternative to cash; only 17% consider this to be unlikely and 5% responded "Don't know/no answer".

In light of the Delphi results concerning this aspect, only the "cash renaissance payment world" scenario assumes that a digital euro with offline functionality, as a low-data payment method in some cases, is used in addition to cash by members of the Expeditive and the Neo-Ecological Milieus. For members of milieus that currently already prefer cash for reasons of privacy, the digital euro does not represent an alternative to cash in any scenario.

Financial inclusion and accessibility of the digital euro

The European Commission's proposed regulation aims to ensure that the digital euro is not only accessible, but also contributes to financial inclusion.

Core payment services related to the digital euro must be provided by credit institutions free of charge. It is intended that anyone who does not wish to open an account with a credit institution will instead be able to use public entities such as local or regional authorities or postal offices (European Commission 2023b, 3). These should "provide basic digital payment services and provide digital inclusion support provided face-to-face in physical

76 For a digital euro with offline functionality, the results from cycle 2 resemble those from cycle 1, at which point a distinction had not yet been made between variants of the digital euro with and without offline functionality: in cycle 1, 58% of respondents considered it likely that the digital euro, due to its lack of complete anonymity, would not represent an alternative to cash in future; 31% considered this to be unlikely and 10% chose "Don't know/no answer".

proximity to persons with disabilities, functional limitations or limited digital skills, and elderly people" (European Commission, 2023b, 45). The issue of financial inclusion and accessibility with regard to the digital euro is addressed in the "hyperdigital payment world" scenario.

Holding limits and transaction limits

The regulation proposal assumes that there will be a general limit on total digital euro holdings held both online and offline (European Commission 2023b, 13).

In order to prevent money laundering and to counter the financing of terrorism, it is envisaged that the European Commission will be able to adopt implementing acts setting specific offline digital euro payment transaction limits and holding limits (European Commission 2023b, 58-59).

If the digital euro is also available offline, this could help to ensure that payment systems remain operational during temporary power outages or in the event of cyberattacks on cashless means of payment – depending on the size of the holding and transaction limits and the actual usage of the digital euro's offline functionality. However, this would not be equivalent to cash, as cash and only cash is largely independent of electronic infrastructure.

Against this backdrop, none of the scenarios that feature a digital euro with offline functionality assume that it represents an equal fallback solution for cash in the event of disruption. In the "hyperdigital payment world" scenario, in which the digital euro starts out without offline functionality, the digital euro is equally as vulnerable to cyberattacks and power outages as other cashless means of payment and is thus not an adequate substitute for cash in crisis situations.

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Excerpt from the morphological box on the key factor "digital euro"

Table 5.6.1

Scenario	Projections for "digital euro"
The hyperdigital payment world	The digital euro, which was introduced by the Eurosystem as the 2020s gave way to the 2030s and later expanded to include an offline function, penetrates the market fairly gradually but steadily and has little effect on cash usage, which has, in any case, already fallen sharply in the hyperdigital world. Individuals who do not have a digital euro account with a credit institution can access central bank digital currency via public entities and postal offices. The digital euro is geared not only towards a high degree of inclusion, but is also designed to be as accessible as possible. The digital euro is just as vulnerable to cyberattacks and power outages as other private cashless payment instruments and is therefore an inadequate substitute for cash in crisis situations.
The cash renaissance payment world	The digital euro is introduced at the turn of the decade and includes offline functionality. It is not used to a greater degree than cash. In some cases, it is used by members of the Expeditive Milieu and the Neo-Ecological Milieu as a low-data payment method alongside cash. For members of milieus that currently prefer cash for reasons of privacy, it is still not perceived as an alternative to cash. Due to its dependence on electronic infrastructure, the digital euro is not equivalent to cash in a crisis situation: even if the offline function is used, regular online exchange of data is required and the smartphone needs power. However, it can serve as a supplement to cash in helping to maintain payment systems in the event of temporary power outages or cyberattacks.
The vanishing hybrid payment world	The digital euro is introduced at the turn of the decade and includes offline functionality. Milieus that are already keen on trying out innovations in the area of payments are the only groups to use the digital euro more than cash. Due to its dependence on electronic infrastructure, it is not equivalent to cash in the event of a crisis. However, it can serve as a supplement to cash in helping to maintain payment systems in the event of temporary power outages or cyberattacks.

5.7 Prevalence of cashless means of payment

The key factor "prevalence of cashless means of payment" refers to how the share of payments settled using private cashless means of payment could develop and which factors could promote or inhibit these developments.

Development of payment behaviour in favour of cashless means of payment

Horizon scanning showed that, in recent years, payment behaviour in Germany has continued to change in favour of cashless means of payment. Between 2008 and 2017, the share of cash payments declined in terms of turnover and number of transactions by around one percentage point per year; in 2017, it stood at 74.3% of transactions (47.6% of turnover) (Deutsche Bundesbank 2018b, 24-25). In the first year of the COVID-19 pandemic, the share of cash transactions was only 60.1% (31.9% in value terms), which corresponds to an average decline of around five percentage points per year since 2017 (Deutsche Bundesbank 2022c, 26). From 2020 to 2021, the decline in cash usage slowed again slightly (2021: cash share at around 57.8% of all payment transactions, 29.9% of turnover) (Deutsche Bundesbank 2022c, 26). However, the decrease in cash's share of transactions and turnover of two percentage points was still significantly higher than the average annual decline of one percentage point during the previous decade.

In 2021, the largest share among cashless payment instruments was accounted for by card payments, at 29.8% (40.6% in value terms). The COVID-19 pandemic led to considerable increases mainly in contactless NFC payments (*Knoop interview*): in 2021, 15.1% of all transactions (16.3% in value terms) were made contactlessly via debit card. Five years prior, only 0.5% of transactions (0.9% in value terms) were made using this method. The acceptance of mobile payment methods has also increased (*Knoop interview*): in 2017, only 0.1% of transactions were made using mobile payment methods; by 2021, this share had already risen to 2.1% (1.6% in value terms). In addition, the share of e-payment methods more than doubled from 2017 to 2021, when it reached 5% of transactions (7.7% in value terms) (Deutsche Bundesbank 2022c, 26).

Factors promoting the prevalence of cashless means of payment

The horizon scanning exercise identified a number of factors that were subsequently assessed with regard to their impact on the prevalence of cashless means of payment by the experts surveyed in cycle 1 of the Delphi procedure.[77] In the experts' view, the strongest driver was growing online commerce (see also the key factor "retail" in Chapter 5.5). Out of the experts, 96% considered this to have a "positive" or "strong positive" effect (in the following, the figures in brackets refer to the rounded total percentage points for

77 In cycle 1 of the Delphi procedure, respondents were asked to do the following: "Please assess the impact of the factors listed below on the use of cashless means of payment." The possible response options were "No effect", "Weak positive effect", "Positive effect", "Strong positive effect", and "No answer".

"positive effect" and "strong positive effect"). This was followed, by a margin, by far-reaching digitalisation in all areas of life (85%) and the payment solutions offered by the GAFA companies (Google, Apple, Facebook, Amazon) (76%). The national debit card scheme (Girocard®) (69%) and the proliferation of self-checkouts and mobile self-scanning systems (66%) (see also Chapter 5.5) were considered by two-thirds of respondents to be important drivers. The provision of a multi-channel European payment solution (48%) and the introduction of the digital euro (46%) were assessed as less relevant by comparison. The prevalence of crypto-assets with a payment function, such as Bitcoin and Ethereum, was considered negligible (9%).

In addition to the drivers assessed in the Delphi survey, horizon scanning identified the ease and speed of cashless payment options (*Seidemann, Thum interview*) as well as the increasing popularity of finance apps as key driving factors fostering the prevalence of cashless means of payment. These apps let users analyse and optimise their own individual spending behaviour, similar to financial accounting in corporate settings (*Weissenbäck interview*). The "vanishing hybrid payment world" scenario looks at the linking of payment data with analytical tools in conjunction with the prevalence of payment solutions offered by the GAFA companies.

Factors inhibiting the prevalence of cashless means of payment

Experts cited digital infrastructure and its dependence on energy as the Achilles' heel of cashless payment systems.

If cyberattacks were to target payment infrastructures, such as major clearing systems, and this resulted in large-scale outages of cashless payment systems, the experts believe that the loss of confidence in cashless instruments would be immense (*Schmiese interview*). Natural disasters and the subsequent failures of infrastructure for cashless means of payment could also constitute temporary turning points leading people to use more cash again (*Seidemann, Thum interview*). In general, disruptions – such as the outage of Verifone card terminals in May 2022 – can fundamentally shake or destroy confidence in technical systems (*Weissenbäck interview*). They take hold in the public's collective consciousness. However, it would take a substantial shock – such as a protracted, nationwide failure of IT systems – for cash usage to rise again on a lasting basis (*Zeitz-Brandmeyer interview*).

Temporary outages of IT systems are a feature of the "hyperdigital payment world" and "vanishing hybrid payment world" scenarios.

In future, the prevalence of cashless means of payment may also be inhibited by a growing awareness of data protection aspects among consumers if they notice that, in addition to facilitating payments, these systems are increasingly about taking advantage of their personal data (*Seidemann, Thum interview*). This potential development forms part of the "cash renaissance payment world" scenario. Thus far, however, data protection concerns have not stood in the way of the prevalence of cashless payment instruments:

most customers accept the terms and conditions for cashless means of payment without actually having read them (*Schmiese interview*). In any case, for the majority of consumers, anonymity when paying is not the main criterion when choosing a means of payment, neither now nor as a requirement for a means of payment in the future. This was demonstrated in the lifestyle analysis and representative survey as well as the Delphi survey (see also Chapter 5.4). The other two scenarios therefore do not assume that there will be growth in or a resurgence of awareness around data protection aspects.

In principle, anything that limits the convenience of using cashless means of payment could be an additional factor hindering their prevalence. Requirements surrounding the use of cashless means of payment stemming from the second Payment Services Directive (PSD 2), such as two-factor authentication, could certainly be considered "tiresome" from the consumer perspective, even though they are beneficial from a security standpoint (*Knoop interview*). However, this does not appear to have had an effect on the prevalence of cashless payment instruments so far. In the "vanishing hybrid payment world" scenario, it is assumed that authentication will become easier in future, for example through greater use of biometrics.

Estimated shares of cash in total transactions in the Delphi survey

In order to determine the ranges within which experts anticipate the shares of cash and cashless means of payment in total transactions will fluctuate in future, cycle 1 of the Delphi survey saw respondents asked to estimate the shares of cash in total transactions and in turnover over the next few years. In cycle 2, they had the opportunity to confirm or change their estimates for this question based on their impressions of the overall results from cycle 1. The estimated values for 2027 and 2037, as validated in cycle 2, are shown below.

Estimated shares of cash in total transactions and turnover in 2027 and 2037 Table 5.7.1

As a percentage

Year	2027		2037	
	Transactions	Turnover	Transactions	Turnover
Minimum share	25	15	15	7
Average share	45	25	31	16
Maximum share	57	29	55	28

Decreases in share of cash compared with 2021 based on estimated values Table 5.7.2

In percentage points

Year	2027		2037	
With regard to	Transactions	Turnover	Transactions	Turnover
Minimum share	5.5	2.5	2.7	1.4
Average share	2.1	0.82	1.7	0.87
Maximum share	0.13	0.15	0.18	0.12

For 2027, the respondents assume, on average, that 45% of transactions will still be settled in cash (25% in value terms). This would correspond to average annual declines of 2.1 percentage points in terms of transactions and 0.82 percentage point in value terms from 2021 to 2027.

The maximum share of cash in total transactions for 2027 was estimated at 57% (29% in value terms). This would be tantamount to the share of cash stabilising at around the level recorded in 2021. The minimum share of cash in total transactions for 2027 was estimated at 25% (15% in value terms). This would represent an enormous average decline of 5.5 percentage points per year in terms of transactions and 2.5 percentage points in value terms from 2021.

For 2037, the experts surveyed in the Delphi exercise predicted an average share of cash in total transactions of 31% (16% in value terms). This corresponds to an average annual decline of 1.7 percentage point in terms of transactions and 0.87 percentage point in value terms since 2021.

For 2037, the minimum share of cash in total transactions was estimated at 15% (7% in value terms). This represents a large average annual decline of 2.7 percentage points in terms of transactions and 1.4 percentage point in value terms since 2021. The maximum shares of cash for 2037 were estimated at 55% of transactions and 28% in value terms. This would mean that, from 2021 onwards, the share of cash in total transactions would decline by a minimal 0.18 percentage point per year on average overall (0.12 percentage point in value terms); cash usage would thus stabilise at around its 2021 level.

Given the fluctuation ranges described above, the "hyperdigital payment world" scenario assumes the estimated minimum cash share of 15% in 2037 and the "vanishing hybrid payment world" scenario assumes the estimated average cash share of 31% in 2037. The estimated maximum cash share of 55% in 2037 appears somewhat too optimistic, even if things developed very favourably for cash; in light of this, the "cash

renaissance payment world" scenario does not specify any particular figure for the share of cash, but instead assumes that the prevalence of cashless means of payment will grow more slowly.

Excerpt from the morphological box on the key factor "prevalence of cashless means of payment" Table 5.7.3

Scenario	Projections for "prevalence of cashless means of payment"
The hyperdigital payment world	Advancing digitalisation in all areas of life fuels huge growth in the share of cashless payments. In 2037, cash payments make up a mere 15% of total transactions (7% in value terms). Cyberattacks on cashless means of payment occur every now and then.
The cash renaissance payment world	The proportion of cashless means of payment grows much more slowly than at the beginning of the 2020s. There is a renewed increase in consumer awareness around data protection issues.
The vanishing hybrid payment world	In 2037, cash makes up 31% of all transactions (16% in value terms). A particularly salient feature of cashless payment options is the now easier and more convenient authentication of payment transactions; they also link payment data with various analytical tools. The payment solutions provided by the GAFA companies are becoming increasingly popular. While cyberattacks and other disruptions to cashless payment systems continue to occur, they are only temporary and do not have a lasting impact on the public's payment behaviour.

5.8 Trust

In this study, the key factor "trust" encompasses various facets of trust. First, trust in government and its institutions with regard to the provision of basic public services and trust in government integrity. This also includes the counterfeit-proof production of cash and guaranteeing of its value. Furthermore, the key factor "trust" also includes trust in the providers of private payment instruments to provide these payment instruments in a secure manner.

Defined in this way, trust can influence cash use in various different ways. The experts involved in the cross-impact analysis workshop argued that the degree of trust in a government shapes the latter's potential and its capacity to deal with crises and uncertainties and to guarantee stability. Conversely, a government that is stable will also be trusted to a greater extent. Trust and stability are interdependent.

The megatrend analysis had suggested that, in the future, there might well be political upheaval at the national level, which could erode trust in governments and their stability. The causes of this could be the increasing influence of non-state actors (Z_punkt n.d.; European Union 2018) as well as increasing political dissatisfaction and democracy fatigue (Roland Berger Institute 2020; National Intelligence Council 2021). Studies have already identified a "latent" crisis of trust in Germany today between the public and policymakers, which also manifests itself in the form of criticism of the elite and the media. This crisis is due, amongst other things, to dissatisfaction with policy outcomes (Robert Bosch Stiftung and More in Common 2021, 10).

According to the experts involved in the cross-impact analysis workshop, the importance of anonymous payments could increase if trust in the government were to decline. The importance of such payments would also increase if trust in the providers of private payment instruments declined. Conversely, given a high level of trust in private providers and a preference for cashless means of payment, there is no need to switch to cash. By contrast, if the public trusts the government and its ability to cope with crises and uncertainties, they also place their trust in a functioning cash cycle. A hoarding of cash above the existing level is therefore likely to be only temporary in times of crisis.

The experts surveyed in the Delphi exercise believe that the stability of the EU, individual countries and their institutions and trust in these institutions will remain intact in future. This is likely to be the case, albeit to a lesser extent, for trust in the providers of private payment instruments.

In Delphi cycle 2, 83% of respondents consider it unlikely that political unrest in European Union countries will erode trust in the individual national government, the EU and the

Eurosystem (ECB and central banks of the euro area) (64% in cycle 1). 10% think this is likely (23% in cycle 1) and 7% chose "I don't know/no answer" (14% in cycle 1).

In cycle 2, 85% (67% in cycle 1) consider it unlikely that the European Union will be ailing economically and politically in 15 to 20 years' time, will be reduced to playing only a minor role on the world stage and, as a result, foreign demand for the euro will decline significantly. Only 12% (19% in cycle 1) regard this as likely and 2% (13% in cycle 1) chose "I don't know/ no answer".

Conversely, 83% of respondents in cycle 2 (66% in cycle 1) expect that the European Union will be a stable economic and political anchor in world affairs in 15 to 20 years' time, as a result of which the euro will continue to be one of the most popular currencies in non-European countries and be used there as a parallel currency or as a store of value. 15% (18% in cycle 1) regard this as unlikely and 2% (15% in cycle 1) chose "I don't know/no answer".

According to almost two-thirds of the experts surveyed, trust in private providers of cashless means of payment will also remain intact in 15 to 20 years' time.In cycle 2, 63% consider it unlikely (59% in cycle 1) that trust in many private providers of cashless payment solutions will erode due to numerous security incidents. 32% regard this as likely (27% in cycle 1) and 5% (14% in cycle 1) chose "I don't know/no answer".

Against the backdrop of the results of the Delphi survey, it is assumed in the "hyperdigital payment world" and "cash renaissance payment world" scenarios that a major part of the population trusts the government and its institutions. The "vanishing hybrid payment world" scenario addresses the aspect of the looming crisis of trust. However, pulling in results from the lifestyle analysis, it is assumed that there is a crisis of trust and a desire for an anonymous means of payment only in a few milieus – those within the traditional segment and the consumption and participation-oriented segment (see also Chapter 5.4).

In the "hyperdigital payment world" scenario, the level of trust is high not only in the government and its institutions. It is also assumed, based on the results of the Delphi survey, that there is trust in private providers of cashless means of payment as well. Since almost one-third of the experts still estimate that trust in the providers of cashless payment instruments could erode due to security aspects, this potential development is addressed in two scenarios. In the "vanishing hybrid payment world" scenario, trust in cashless means of payment falls among those belonging to the traditional segment and, in the "cash renaissance payment world" scenario, also among the members of the Expeditive and Neo-Ecological Milieus, which are actually technologically and digitally savvy milieus.

Excerpt from the morphological box on the key factor “trust”

Table 5.8.1

Scenario	Projections for “trust”
The hyperdigital payment world	The public has trust in the government and its institutions. In addition, trust in private providers of cashless payment instruments is quite high among the vast majority of consumers and any concerns are pushed into the background.
The cash renaissance payment world	There is a high level of trust in the government and its subordinate authorities. Past crises have proven the government’s ability to act. In the Expeditive Milieu and Neo-Ecological Millieu, trust in the providers of cashless payment instruments is diminishing. This is also true of the traditional segment. People belonging to this segment have comparatively less confidence in the providers of cashless payment instruments anyway.
The vanishing hybrid payment world	In milieus that reject social change or suffer from economic change, the crisis of trust between the public and policymakers that was already apparent in the 2020s intensifies. In general, members of the consumption and participation-oriented segment have little faith in state actors. In the better-off milieus, confidence in the state is comparatively stronger. Members of the traditional segment are sometimes suspicious of both government and private actors when they feel that they are intervening too much in people’s private lives.

5.9 Crises and uncertainty

The key factor "crises and uncertainty" encompasses the core challenges that could affect the stability and security of societies in the future and which are relevant for the future use of cash. Cybercrime and various geopolitical and national dynamics were identified as relevant determinants in the megatrend analysis.

Cybercrime

In the megatrend analysis, many sources indicated that technologies such as artificial intelligence (AI), robotics or the internet of things (IoT) could probably be commercialised in almost all areas of application by 2050, and that machines could be increasingly able to take on complex tasks for people (Roland Berger Institute 2020; EY Global 2020; UN Economist Network 2020; Z_punkt n.d.; Trend ONE 2021; Zukunftsstark 2022; Oxfam 2020; DPGC Flanders 2019; DASA 2017). With the digital transformation, interconnectedness will give way to hyperconnectivity (National Intelligence Council 2021; zukunftsInstitut 2022; Trend One 2021; Oxfam 2020; DPGC Flanders 2019). It is expected that this will already be the case in 2040 (European Union 2018). Hyperconnectivity refers to the increasing human-to-human, human-to-machine and machine-to-machine interconnectedness (Federal Ministry of Education and Research n.d.).

Cybercrime is growing as digitalisation and interconnectedness increase. Cybercrime encompasses offences "directed against the internet and information technology systems" (Federal Criminal Police Office 2023a, 1). According to the Federal Criminal Police Office's National Situation Report, the number of cases of cybercrime recorded by police in Germany tended to rise from 2007 (34,180 cases) to 2021 (146,363 cases). Year-on-year declines were only recorded in 2014, 2015 and 2022. The most recent decline, in 2022, amounted to 6.5%, with 136,865 cases being recorded by the police (Federal Criminal Police Office 2023b; Federal Criminal Police Office 2023a, 5). Owing to undetected cases, which are assumed to amount to 91.5% in the field of cybercrime, the data can only be used to show trends. Their informative value with regard to the actual number of crimes in this area is low (Federal Criminal Police Office 2023a, 4).

While the number of cases of cybercrime logged in the domestic Police Crime Statistics (PCS) is declining, the number of cases abroad (where the criminals are located abroad or where their whereabouts is unknown) is rising (Federal Criminal Police Office 2023a, 6-7).

Moreover, military conflicts, such as Russia's war of aggression against Ukraine, reverberate in cyberspace, where both state actors and private hacktivists[78] engage in cyberattacks. It is assumed that critical infrastructures in Germany could become the target of a Russian

78 "Hacktivist" is a portmanteau word made up of hacking and activist. These are actors who engage in hacking for political and ideological reasons (Federal Criminal Police Office 2023a, 2).

cyberattack. Their risk is deemed to be elevated (Federal Criminal Police Office 2023a, 2). In theory, this can also apply to payment infrastructures.

Owing to its great dependence on information and communication technologies, the cashless payments space is more at risk than cash payments – irrespective of who is attacking.

In the Delphi survey, 83% of respondents in cycle 2 (66% in cycle 1) assume that, in 15 to 20 years' time, cyberattacks on the cashless payments space time will repeatedly lead to consumers having to resort to using cash, 12% think this is unlikely (27% in cycle 1), and 5% chose "I don't know/no answer" (7% in cycle 1). By contrast, 61% of respondents in cycle 2 consider it unlikely that cyberattacks on cash logistics could negatively affect the cash supply in 15 to 20 years' time (66% in cycle 1), 29% consider it likely (24% in cycle 1) and 10% chose "I don't know/no answer" in both cycles.

The risks that cybercriminals will pose in the future will depend in large part on the measures that can be taken in the field of cybersecurity.

Germany's ability to deal with cyber threats is currently assessed as comparatively good. In the Global Cybersecurity Index 2020 of the International Telecommunication Union, Germany ranks 13 out of 194 countries, with 97.41 out of a possible 100 points (International Telecommunication Union 2021, vi, 25). The Global Cybersecurity Index measures 20 indicators in the areas of legal, technical and organisational measures, capacity building (e.g. cybersecurity research programmes, cybersecurity industry) and cooperation with other countries, as well as public-private partnerships to deal with cyber threats (International Telecommunication Union 2021, vi, vii).

There are signs that work will continue to be undertaken by various parties to strengthen cybersecurity in the coming years. According to forecasts, expenditure on IT security in Germany is expected to reach €10.3 billion in 2025, roughly three times the figure in 2017. At that time, expenditure on IT security amounted to €3.7 billion (Bitkom 2022a).

Furthermore, the Cyber Resilience Act is currently going through the European legislative process and aims to define "mandatory cybersecurity requirements for the design, development, production and making available on the market of hardware and software products". The law is aimed at increasing the security of products such as those intended for the internet of things (Council of the European Union 2023).

Whether or not consumers use cash to a greater extent as a result of an increasing risk of cyberattacks is affected by how sensitive they are to threats.

72% of people in Germany are afraid of a cyberwar, while 23% are not (Bitkom 2022b). In 2022, 75% of the population in Germany aged 16 and above reported that they had personal experience of criminal incidents on the internet in the last 12 months, compared with 61% in 2020 (Bitkom 2023). So far, it does not appear that fears and personal experience lead to curbed use of cashless means of payment, the infrastructure for which is potentially open to the threat of cybercrime. There is no telling how cybersecurity and consumers' sensitivity to cyber threats will develop.

In the "hyperdigital payment world" scenario, it is assumed that the ability to ward off attacks is rather high and that the sensitivity of consumers is low. In the "cash renaissance payment world" scenario, the ability to ward off attacks is rather limited, but sensitivity is high and in the "vanishing hybrid payment world" scenario, the ability to ward off attacks is also limited, whereas sensitivity is low.

Geopolitics and national dynamics

The megatrend analysis suggests that the rise of emerging market economies over the next 30 years is likely to shift the political balance of power, potentially leading to a geopolitical reorientation of the world order (Z_punkt n.d.; Organisation for Economic Co-operation and Development 2016; Zukunftsstark 2022; GIM 2017; UK Ministry of Defence 2018). This is creating an uncertain political situation which could manifest itself in new geopolitical alliances and international conflicts or crises (National Intelligence Council 2021; Roland Berger Institute 2020).

In addition to the aforementioned political upheavals, in future, emerging market economies – particularly African ones – will most likely also be able to position themselves more strongly in economic terms, with the result that global power structures will change here, too (EY Global 2020; National Intelligence Council 2021; Organisation for Economic Co-operation and Development 2016; Zukunftsstark 2022; PMI 2021; Oxfam 2020).

Furthermore, drivers such as trade barriers, uncertainties arising from crises or sanctions mean that a reorganisation or fragmentation of global supply chains is to be expected (Roland Berger Institute 2020; National Intelligence Council 2021; zukunftsInstitut 2022; CSIRO 2020). The weakness of an international dependence on goods and product components was highlighted most recently amid the COVID-19 pandemic, which led to supply bottlenecks and long delays (Bertelsmann Stiftung 2020).

The global debt situation, too, will not disappear in the future, but will rather increase in magnitude if governments are not in a position to bring the matter under control at an early stage. Developing countries are not the only ones to have seen their debt rise sharply in recent years. If developments continue, debt is projected to rise enormously to a global debt level of 98% of gross domestic product (GDP) by 2035, for example at 133% of national GDP in the euro area, 213% of national GDP in the United States, or as much as 386% of national GDP in Japan (KPMG International 2014). This results in increased

market risk at the global level and reduced capacity to respond appropriately to future economic or financial crises. Global demographic developments are having an additional catalysing effect on a future rise in debt (Roland Berger Institute 2020; Z_punkt n.d.; KPMG International 2014).

Overall, this results in global political and economic uncertainty, in which the probability of crises and armed conflicts or wars increases significantly. This aspect is addressed in the "cash renaissance payment world" and "vanishing hybrid payment world" scenarios.

At the national level, too, the megatrend analysis identified political upheavals owing to the increasing influence of non-state actors (Z_punkt n.d.; European Union 2018) as well as increasing political dissatisfaction and democracy fatigue (Roland Berger Institute 2020; National Intelligence Council 2021). Furthermore, it is assumed that terrorist or populistically motivated movements will increase (ESPAS 2019; Bertelsmann Stiftung 2020).

This aspect is featured in the "hyperdigital payment world" scenario.

Excerpt from the morphological box on the key factor "crises and uncertainty"

Table 5.9.1

Scenario	Projections for "crises and uncertainty"
The hyperdigital payment world	Increasing digitalisation means society's vulnerability also grows. In response, the government and enterprises are further expanding their cybersecurity measures and capabilities for fending off cyberattacks, allowing many, but not all, attacks to be prevented. Attackers are both private and state actors who seek financial gain (ransomware attacks) or wish to wreak havoc and massively disrupt everyday activities. Extremist groups seeking to bring about regime change across Europe are also, in some cases, able to carry out cyberattacks. Providers of cashless payment solutions and their systems are a tempting target for all these attackers. However, the population responds with equanimity when cashless payment systems become temporarily unavailable, as there are numerous cashless alternatives and any losses are compensated for. To date, there has been no prolonged period in which multiple cashless instruments have been down – including as a result of cyberattacks on the power supply. The majority of people keep some cash at home for temporary emergency situations.
The cash renaissance payment world	Cyberattacks on cashless payments and power grids are on the rise. In addition, the emergence of conflicts within and outside Europe leads consumers to keep higher amounts of cash as a store of value at home, as the government and the Federal Office of Civil Protection and Disaster Assistance (BBK) also recommend that cash be held in a crisis. Overall, recent experience has raised public awareness of the need to prepare for disasters and crisis situations.
The vanishing hybrid payment world	While cyberattacks and other disruptions to payment systems continue to occur, they are only temporary and are not perceived as concerning by the majority of people. This is also true when conflicts flare on the fringes of Europe.

5.10 Societal good

The key factor "societal good" describes the special status of cash as central bank money in contrast to private book money. It also addresses the societal significance of cash for the inclusion of various groups in society and also as a contingency solution during times of crisis. The question of whether cash can preserve its societal significance in the future will be largely influenced by its use and the extent to which the maintenance of cash infrastructures is supported by the government and policymakers.

Cash as a contingency solution in crisis situations

Cash is a material object and therefore physically tangible. The Eurosystem, i.e. the European Central Bank (ECB) and the national central banks of the euro area, guarantee its value (European Central Bank 2015). Cash is risk-free in terms of issuer risk. Cash is thus an anchor underpinning trust in the entire monetary system.

This is why it is of particular significance in times of crisis and is hoarded during these times (*Schmiese interview*).

People associate cash with protection in specific emergency situations. It is part of their personal emergency supplies. It also acts as an emergency fund when travelling if other means of payment fail or are stolen (*Weissenbäck interview*).

Cash also helps to support consumer trust in private forms of money, as they can "convert these at any time into analogue notes" (Kalscheur 2022).

Owing to its non-digital nature, cash is largely independent of technical infrastructure (*Schmiese interview*). When, for example, disruptions occurred to card payments at H5000 terminals of the manufacturer Verifone in May 2022 (Jahberg 2022), 70% of the 800 retailers surveyed by the German Retail Federation (*Handelsverband Deutschland* – HDE) reported sales losses. They were unable to use the terminals for more than seven days (Spiegel Online 2022). The sales losses would probably have been even more severe if cash had not been available as an alternative payment method.

The Federal Office of Civil Protection and Disaster Assistance (BBK) recommends in its Guide for Emergency Preparedness and Correct Action in Emergency Situations "having sufficient cash reserves in the house, as cash machines also no longer work during an electric power breakdown" (Federal Office of Civil Protection and Disaster Assistance 2019, 17). At least in the event of temporary power outages, cash can be used as a fallback solution.

However, it can only fulfil this function in crisis situations if it also still plays a role in the payments mix in normal situations (Sveriges Riksbank n.d., 32).

In all scenarios, cash's non-dependence on technical infrastructures is highlighted as a special feature of cash compared with private cashless means of payment.

Inclusion

Cash was also identified in the horizon scanning exercise as the only means of payment that enables financial inclusion and participation for all social groups. The experts interviewed highlighted that cash is accessible to everyone, regardless of income or social status (*Seidemann, Thum interview*). It can be used as a means of payment by economically disadvantaged and older people as well as people without access to bank accounts and cashless payment systems (*Mewes, Paulick, Wiegand interview*). Furthermore, it has an integrating effect with regard to new members of the population such as refugees, as understanding banknotes and coins does not require any language skills (*Seidemann, Thum interview*). When designing banknotes and coins, efforts are also made to cater for the needs of people with visual impairments (*Seidemann, Thum interview*). Moreover, given its physical and haptic nature, cash has an important function as "money for learning". It makes it easier for children to learn how to handle money (for example, saving or keeping track of spending). Cash is therefore very important for children's education in financial matters (financial literacy) (*Schmiese interview*) and is an important social component (*Mewes, Paulick, Wiegand interview*).

According to the experts surveyed in the Delphi exercise, cash will still be the means of payment that can address most aspects of inclusion in 15 to 20 years' time.[79] Only for people with motor and mobility impairments is it assumed that their requirements for a means of payment are most likely to be met in future by cashless payment solutions. This is probably already the case today for people with mobility impairments given the distances that have to be covered to procure cash, and for people with limited hand function, for instance.

For people with low digital skills, without internet and smartphone access, and for older people, a significant majority of the respondents consider the use of cash beneficial compared with cashless means of payment. This assessment is hardly surprising for the first two aspects of inclusion given that the trend is moving towards mobile payments. Digital end devices and digital skills are required to be able to make mobile payments.

Using cash is easier for people who are unable to fulfil these requirements.

However, the assessment that the inclusion of older people is still most likely to be best achieved via cash in 15 to 20 years' time raises questions. People who were born in 1960

79 Cycle 2 of the Delphi procedure put the following question to participants: Which means of payment is most likely to best fulfil each aspect of inclusion over the next 15 to 20 years? The possible responses were "Cash" and "Cashless means of payment". The percentage of respondents opting for the answer "Cash" is given in brackets after each of the various facets listed. a) People with low digital skills (95%), b) People without internet or a smartphone (93%), c) Inclusion of older people (90%), d) People with low reading and writing skills (85%), e) Inclusion of people with cognitive impairments (83%), f) Inclusion of economically disadvantaged people (78%), g) People with a migration background in the early stages of their life in Germany (71%), h) Inclusion of people with impaired vision (59%), i) Inclusion of people with motor impairments (e.g. limited hand function) (34%), j) Inclusion of people with mobility impairments (e.g. limited walking capacity) (12%).

will be 70 in 2030 and 77 in 2037. They will have been young adults when they were confronted with the proliferation of card payments und were in their mid-30s when the internet was introduced and use became widespread. Today they are on the verge of entering retirement – and many of them will probably have shopped online or have used online payment systems at the latest during the COVID-19 pandemic. The authors of this study consider it unlikely that this group of persons – also referred to as digital immigrants – will lose their digital skills as they age. A possible reason for the experts' response behaviour could be the attitudes towards age that are widespread in our society and that often associate age with cognitive and physical limitations.

Given that euro banknotes and coins are designed in close cooperation with the European Blind Union (EBU) (European Central Bank n.d.), it is striking that only just over half of the experts surveyed expect cash to be the means of payment that will most fully meet the requirements of people with visual impairments in 15 to 20 years' time. That said, 41% of respondents believe that cashless means of payment will be most capable of fulfilling these requirements, which could be due to the developments already under way today in the areas of speech recognition and synthesis (converting text into natural-sounding language). They form the basis for voice control technologies, such as those used for voice-activated banking by means of apps or digital assistants. In the case of voice-activated banking, account queries or transactions can be triggered by voice commands, for instance.

Commercial banks are promoting voice-activated banking as a potential "solution" for people "with a broken arm, dyslexia or impaired vision" (Sparkasse.de n.d.). It is quite possible that a similarly high level of inclusion to that of cash could be achieved with voice control technologies in combination with cashless means of payment. This will probably also depend on how the technological maturity of voice recognition technologies develops. At present, technologies sometimes still have difficulties dealing with, for example, different accents, dialects, speeds of speech, meanings of words and background noise (Clickworker 2022).

Even the seemingly undisputed position of cash as money for learning could change in future. Cashless innovations such as Bling Card aim to transport into the digital sphere the tasks of giving pocket money and imparting financial literacy skills (Buntrock 2022). For the corresponding app, however, children and young people require a digital end device and the skills to operate such a device. This is therefore probably rather unsuitable for learning to manage money, particularly for young children.

As outlined above, there is much to suggest that cash will be the most inclusive means of payment in future, too. Nevertheless, there are also strong signs that cashless means of payment could make up ground in the area of inclusion. The scenarios therefore describe different pathways. In the "hyperdigital payment world" scenario, cashless means of

payment become more accessible through developments such as voice-activated command capabilities. In the "cash renaissance payment world" scenario, cash is able to defend its position as the most inclusive means of payment, and in the "vanishing hybrid payment world" scenario, cashless means of payment catch up in at least some areas of inclusion.

Excerpt from the morphological box on the key factor "societal good" Table 5.10.1

Scenario	Projections for "societal good"
The hyperdigital payment world	Cash is valued above all for its general non-dependence on technical infrastructure and it is able to keep hold of its unique position in this respect. Meanwhile, voice-activated banking solutions and other assistance systems help to ensure that cashless means of payment become highly inclusive for people with various impairments. The digital euro also achieves a high level of inclusion.
The cash renaissance payment world	Cash is the only means of payment that can fulfil important societal functions (anonymity, non-dependence on technical infrastructure). Due to its importance for civil society, the government promotes the use of cash and research into optimising cash infrastructures.
The vanishing hybrid payment world	Some societal functions which were once largely fulfilled by cash are now also fulfilled by cashless means of payment. However, cash remains the only means of payment that ensures education in financial literacy for children and independence from technical infrastructure.

ABOUT THE AUTHORS

VDI/VDE Innovation + Technik GmbH

VDI/VDE Innovation + Technik GmbH (VDI/VDE-IT) is a leading service provider when it comes to questions relating to innovation and technology. It draws up strategy roadmaps, supports and advises customers in conducting analysis of complex procedures or market situations and with respect to funding from federal, local government and EU-level research programmes, and organises places of business or contact points for representatives in the spheres of research and economics.

Around 1,000 employees work together in multinational and interdisciplinary teams. VDI/VDE-IT has a total of ten specialist sectors and nine cross-sectional departments, meaning it covers a broad spectrum of topics and has highly qualified experts from the fields of science, engineering, social sciences and economics.

The company has been carrying out strategic foresight processes for many years now: for the Federal Chancellery, the Federal Ministry of Labour and Social Affairs, the Federal Environment Agency, Office of Technology Assessment at the German Bundestag and for a service subsidiary of a global leader in the field of technology, to name just a few examples.

It has a nationwide presence in Germany, with seven offices located in Berlin, Munich, Dresden, Bonn, Hanover, Erfurt and Stuttgart.

Dr Simone Ehrenberg-Silies has been active in the field of strategic foresight for more than 15 years. Her work focuses on topics such as Work 4.0, digital transformation and the future of payments as well as the automotive industry. For the Office of Technology Assessment at the German Bundestag, she published a study entitled "World without cash – changes in conventional banking and payment systems" (2022) and more recently a study with the title "E-voting – alternative forms of voting and how to make them secure" (2023). Amongst other responsibilities, she is deputy lead project manager of strategic foresight for the Federal Ministry of Labour and Social Affairs as well as the VDI/VDE-IT team for the Office of Technology Assessment at the German Bundestag.

Dr Marc Bovenschulte heads the department Demography, Clusters and Foresight at VDI/VDE-IT. His work centres around the effects of transformative processes on value creation and employment, focusing on both sectoral and regional perspectives. In addition to holding other positions, he is lead project manager of strategic foresight for the Federal Ministry of Labour and Social Affairs as well as of strategic foresight in the work flanking the Federal Chancellery's Alliance for Transformation.

SINUS Markt- und Sozialforschung GmbH

SINUS Markt- und Sozialforschung GmbH, which has offices located in Heidelberg and Berlin, has been a specialist in psychological and social research and consulting as well as an expert on strategic target groups for over 40 years. SINUS develops strategies for firms and institutions that use sociocultural change as a success factor.

A key tool for this is the SINUS-Milieu® system – a social and target group model that arranges individuals into groups of like-minded people according to their lifestyles. The SINUS milieus have been among the best-known and most influential segmentation approaches for decades and are available for more than 50 countries. In addition, SINUS develops attitude and usage typologies for different markets and publics, for example in the areas of media or mobility.

The interdisciplinary team currently consists of 28 employees and possesses a wealth of experience in conducting broad-based qualitative and quantitative research projects, both for corporate clients and for public institutions (ministries, associations and foundations). In particular, SINUS acts as a partner in larger research networks and consortia (for example in the context of EU projects).

Dr Silke Borgstedt is Managing Director at the SINUS Institute and an expert in sociocultural trend and milieu research. She has over 15 years of experience leading empirical studies for businesses and public institutions, in particular for Federal ministries and foundations. Her work sees her employ a resource-oriented approach that recognises individuals' experiences and needs as potential and social change as an opportunity. Areas of work and key topics: social change and transformation, everyday aesthetics, family sociology, and cultural and media industries.

Tim Gensheimer is a political scientist and, in his Senior Research & Consulting role, he is responsible for quantitative and qualitative research and consulting projects utilising target group strategies that are based on customer or market-specific typologies in addition to the societal and target group typology of the SINUS milieus. He is an expert in the fields of politics (particularly political attitudes), media, tourism and mobility. He works on behalf of several Federal ministries and, since 2019, his responsibilities have included the Cycling Monitor (*Fahrrad-Monitor*) study series, which is funded by the Federal Ministry for Digital and Transport.

ANNEX

List of figures and tables

Interviews

Name	Organisation
Anonymous	
Binnebößel, Ulrich	German Retail Federation (*Handelsverband Deutschland e.V.* – HDE)
Kemmers, Fleur (Prof.)	Institute of Archaeological Sciences, Dept. II, Coins and Money in Greek-Roman Antiquity, Goethe University Frankfurt
Knoop, Björn	Federal Criminal Police Office (*Bundeskriminalamt*) Unit CC21-3 Payment cards/Logical attacks on payments (*CC21-3 Zahlungskarten/Logische Angriffe auf den Zahlungsverkehr*)
Lohweg, Volker (Prof.)	OWL University of Applied Sciences and Arts
Mewes, Michael; Paulick, Andreas; Wiegand, Kirsten	Association of German Cash Service Industry (*Bundesvereinigung Deutscher Geld- und Wertdienste e. V.* – BDGW)
Pranjivan, Vinay	Associação Portuguesa para a Defesa do Consumidor (DECO) [Portuguese consumer protection association]
Roth, Gregor	DZ Bank AG
Sampaio Amaral, Mónica	Banco de Portugal [Portuguese central bank]
Sauter, Dieter (Dr)	Bundesdruckerei GmbH
Schmiese, Jörg	Association of German Banks (*Bundesverband deutscher Banken e. V.*)
Seidemann, Wolfram (Dr); Thum, Severin	Giesecke + Devrient Currency Technology GmbH
Weissenbäck, Markus	Fraunhofer Institute for Integrated Circuits IIS (*Fraunhofer-Institut für Integrierte Schaltungen IIS*)
White, Heath	Prosegur Cash Services Germany GmbH
Wolf, Robert	ALVARA Digital Solutions GmbH
Zeitz-Brandmeyer, Claudio	Federation of German Consumer Organisations (*Verbraucherzentrale Bundesverband e. V.* – vzbv)

Written interview and statement

Name	Organisation
	Asociación de usuarios financieros (ASUFIN) [Spanish association of financial users]
	Serious and Organised Crime Division of the Federal Criminal Police Office (*Bundeskriminalamt – Abteilung Schwere und Organisierte Kriminalität (SO)*)

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