



CBDCS & STABLECOINS

Competitor Leaderboard

Prepared for G+D



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1.1 Why Read This Report

This section details several vendors active in the CBDCs market. This report is not intended to provide comprehensive coverage of all the vendors operating in the CBDCs market, but introduces the reader to 15 CBDC vendors that Juniper Research considers leaders in the market.

Juniper Research is a European-based provider of business intelligence. We specialise in providing high-quality data and fully researched analysis to manufacturers, financiers, developers and service/content providers across the financial services industry. Juniper Research is fully independent and able to provide unbiased and reliable assessments of markets, technologies and industry players. Our team is drawn from experienced managers with proven track records in each of their specialist fields.

CBDCs Key Takeaways

CBDCs to Exceed Stablecoin Transaction Volume by 2027

While stablecoins are clearly more popular at the present time, we forecast that by 2027, in terms of transaction value, the inflection point will have been reached, with CBDCs overtaking stablecoins.

There are a number of reasons for this. Firstly, stablecoins are not being used that widely – they are a good fit for some cross-border transactions, but to date, a large proportion of stablecoins issued are owned by investors, rather than being actively used for payments. Secondly, stablecoins lack the acceptance networks to become a central part of how payments are handled. Thirdly, CBDCs will have much stronger central bank support, meaning that these payments can be mandated centrally, which will increase their speed of roll-out, compared to alternative payment networks which are predominantly fintech created and backed.

As such, we believe that CBDCs will become a central part of how many economies make payments – however, while growth is strong in the latter part of the 2020s, much of it will occur by the end of the decade and at the start of the 2030s, as the penetration of such systems becomes stronger.

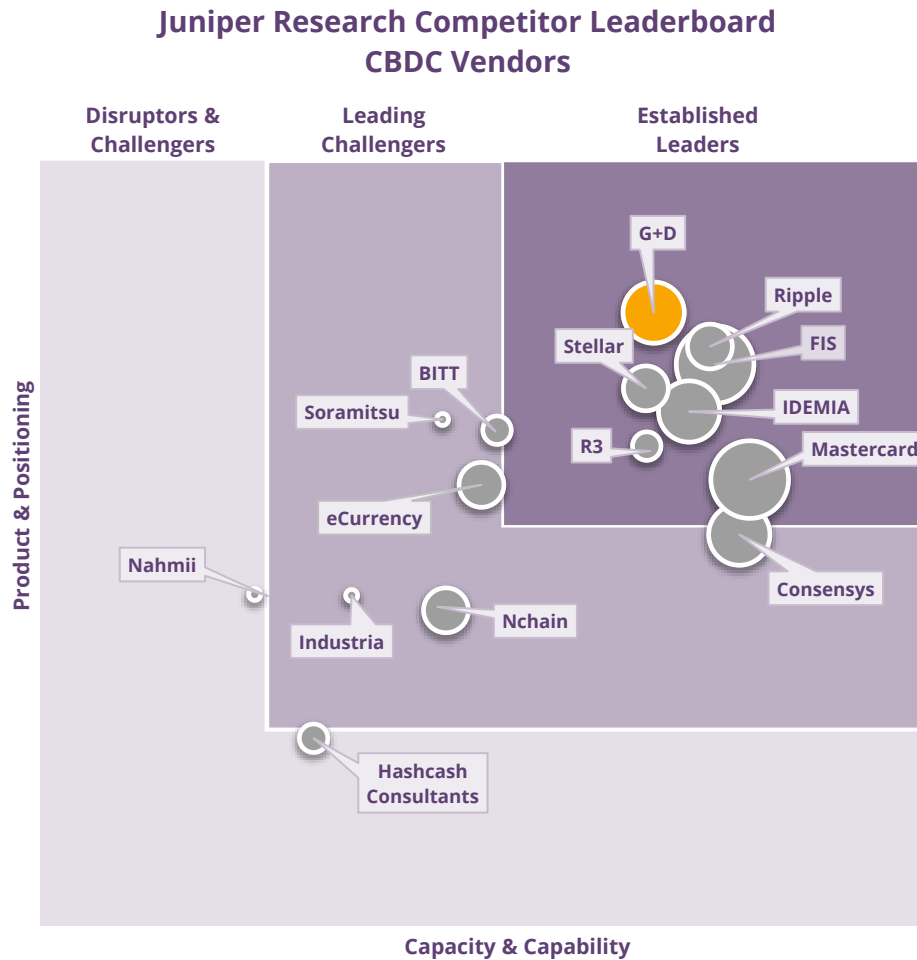
CBDCs Face Competition from Instant Payments and Other Payment Networks

CBDCs solve an important challenge, as they can increase access to digital payments, at a low cost, particularly to merchants, compared to traditional card networks. However, they are not unique in solving this challenge. CBDCs solve many of the same issues as instant payments schemes, meaning that some may see CBDCs as an unnecessary step.

However, with the level of interest we are seeing in CBDCs, it is clear that there is a significant market here. Central banks must carefully consider how CBDCs will work alongside any existing instant payment rails, to ensure that roll-outs are smooth and do not face competition from existing, centrally controlled systems.



Figure 1: Juniper Research Competitor Leaderboard – CBDCs



Source: Juniper Research

Giesecke+Devrient

As a global market leader, G+D (Giesecke+Devrient) has a unique portfolio of solutions for public currencies as well as electronic and digital payments.

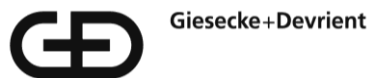
Within the CBDCs market, G+D has a distinct advantage, in terms of its development of G+D Filia® as a separate, marketable product. With Filia, G+D provides applications for central banks to issue, distribute and monitor a digital form of cash – a CBDC (Central Bank Digital Currency). Other companies have not yet developed their solutions in such comprehensive manner, making it stand out in the wider market as an all-in-one solution.

As experts in traditional currency, G+D’s bold move into the CBDC space is not surprising, and it means that it will be a trusted partner for many of the central banks in this space who are looking at CBDCs. This is an important advantage for it to harness.

At the same time, G+D is a partner for the banking and finance sector, with a comprehensive portfolio for smart cards, and facilitates secure electronic and digital payments. As such, when building a new payment system from scratch as CBDCs involve, G+D has a long list of capabilities to support its customers.



1.1.1 Giesecke+Devrient



Juniper Research interviewed Polly Bäumler, Business Development CBDC at G+D, Maud Prevert-Augustin, Strategy and Market Intelligence at G+D, and Sebastian Baierle, Manager of Strategic Partnerships CBDC at G+D in January 2023.

Table 2: Juniper Research Competitor Leaderboard Heatmap: G+D

	Corporate: Capability & Capacity					Product & Position					Market Presence
	Financial Performance & Size in Sector	Corporate Branding & Marketing Strength	Experience in Sector	Operations & Geographic Spread	Distribution/ Partnerships	Breadth of Offerings	Depth of Services	Customers & Deployments	Creativity & Innovation	Future Business Prospects	
G+D	High	High	High	High	High	High	High	High	High	High	High

High

Source: Juniper Research

i. Corporate

G+D (Giesecke+Devrient) is a global security technology group headquartered in Munich. As a trusted partner to customers with the highest demands, G+D secures the essential values of the world with its solutions. The company develops technology with passion and precision in four major playing fields: payment, connectivity, identities and digital infrastructures.

G+D was founded in 1852. In the fiscal year 2022, the company generated a turnover of 2.53 billion.

The company's current management team consists of Dr Ralf Wintergerst as Group CEO; Dr Peter Zattler as Group CFO; D. Wolfram Seidemann as CEO of G+D Currency Technology; Dr. Philipp Schulte as CEO of G+D Mobile Security; Gabrielle Bugat as a

Member of the Management Board G+D Mobile Security; Marc-Julian Siewert as CEO of Veridos; Axel Deininger as CEO of secunet.

Recently, the company's retail CBDC solution G+D Filia won the Best Technology Award in the Global Fast Track CBDC by the Hong Kong Monetary Authority. In 2021, the solution was named a winner in the Global CBDC Challenge hosted by the Monetary Authority of Singapore.

ii. Geographic Spread

The company has its headquarters in Munich, Germany. G+D currently has 103 subsidiaries and joint ventures, with over 12,600 employees across 33 countries worldwide.



iii. Key Clients & Strategic Partnerships

- G+D is the global market leader in payments. G+D's solutions are trusted by 145 central banks, all major payment schemes and more than 700 commercial banks worldwide.
- G+D recently participated in Banco do Brazil's CBDC initiative the LIFT Challenge. The CBDC, the Real Digital, is to be launched in Brazil as early as 2024. To do so, the Central Bank is working in partnership with the National Federation of Associations of Central Bank Servers (Fenasbac). The LIFT Challenge aims to identify the fundamental characteristics of an infrastructure of the Digital Real. As such, G+D's proposal for Filia was selected due to its capability of conducting dual-offline payments.ⁱ
- In October 2022, G+D announced its partnership with the Central Bank of Eswatini to research and explore the development of a CBDC. This collaborative project comes as a result of a long-standing relationship, between the Central Bank of Eswatini and G+D, going back more than 40 years into the early 1980s. As such, the partnership has been extended from providing physical currency solutions, to research and exploration of digital currency services. The aim of the project is to enable the Central Bank to make an informed decision on the implementation of a CBDC in Eswatini and the additional benefits it can provide.ⁱⁱ
- G+D also has an ongoing relationship with the Bank of Ghana. Together they piloted a general-purpose CBDC in various parts of the country, including off-grid areas without stable access to network connectivity. G+D provided the technology and adapted the solution to suit Ghana's requirements which was tested in a trial phase with commercial banks, payment service providers, such as mobile money operators, merchants, consumers and other relevant stakeholders.
- In 2021, G+D won a contract to develop and pilot a CBDC for the Bank of Thailand. The Bank of Thailand previously launched a wholesale CBDC project and proof of concept retail CBDC testing, which led to the bank deeming it necessary to extend the scope of retail CBDC development to a pilot phase. The bank will then assess the benefits of, and risk associated with, the pilot in order for it to create the relevant policies.ⁱⁱⁱ

iv. High-level View of Offerings

G+D's products and solutions cover four key areas: payments, connectivity, identities and digital infrastructure. The area that will be focused on will be payments, which includes CBDC solutions.

G+D created a CBDC solution called G+D Filia, which was designed to be a government-issued, public digital currency. The Filia CBDC ecosystem consists of multiple components tailored towards the needs of all stakeholders. At its core, G+D Filia is a token-based solution following the principles of security-by-design with no single point of failure and truly allowing for a balance of privacy versus transparency. It is designed to allow a seamless and highly secure transition of tokens between the online and offline world, capable of enabling secure, consecutive offline transactions.

Additionally, G+D offers guided support which ranges from the initial consultation to the design and development, implementation and operational support of a national digital currency. In order for central banks to gain comprehensive knowledge of CBDC and its technology, G+D offers a sandbox to test the solution in a secure, scalable and resilient environment encompassing an entire CBDC ecosystem. Additionally, G+D provides an array of hardware devices such as smart cards and wearables, as well as payment terminals and mobile apps to enable both online and offline CBDC payments. G+D supports central banks in certifying and auditing the Filia solution according to the necessary security standards.

G+D also offers a CBDC simulator that allows central banks to test multiple scenarios and develop optimum CBDC configurations. It enables central banks to better understand and measure potential risks across the entire financial system. For this, G+D partnered with FNA (Financial Network Analytics) to provide expertise in advanced analytics, modelling, and simulation technology.



1.1 Juniper Research Leaderboard Assessment Methodology

Juniper Research provides updates on a selected number of CBDC providers. To qualify for the Leaderboard, companies must be involved in the direct provision of CBDC platforms. The companies included here have developed specific expertise in the CBDC space, though some embarked on the route earlier than others and therefore have wider customer bases or geographical reach.

This research covers a significant number of vendors; however, we cannot guarantee that all players in the market are included. Our approach is to use a standard template to summarise the capability of players offering CBDC services. This template concludes with our view of the key strengths and strategic development opportunities for each vendor.

We also provide our view of vendor positioning using our Juniper Research Leaderboard technique. This technique, which applies quantitative scoring to qualitative information, enables us to assess each player's capability and capacity, as well as its product and position in the broader market for CBDC services. The resulting Leaderboard exhibits our view of relative vendor positioning.

1.1.1 Limitations & Interpretations

Our assessment is based on a combination of quantitative measures, where they are available (such as revenue and number of offices) that indicate relative strength, and also of qualitative judgement, based on available market and vendor information as published. In addition, we have added our in-house knowledge from meetings and interviews with a range of industry players. We have also used publicly available information to arrive at a broad, indicative positioning of vendors in this market, on a 'best efforts' basis.

However, we would also caution that our analysis is almost by nature based on incomplete information and therefore with some elements of this analysis we have had to be more judgemental than others. For example, with some vendors, less

detailed financial information is typically available if they are not publicly listed companies. This is particularly the case when assessing early-stage companies, where a degree of secrecy may be advantageous to avoid other companies replicating elements of the business model or strategy.

We also remind readers that the list of vendors considered is not exhaustive across the entire market but rather selective. Juniper Research endeavours to provide accurate information. While information or comment is believed to be correct at the time of publication, Juniper Research cannot accept any responsibility for its completeness or accuracy, the analysis is presented on a 'reasonable efforts' basis.

The Leaderboard compares the positioning of platform providers based on Juniper Research's scoring of each company against the above criteria that Juniper Research has defined. The Leaderboard is designed to compare how the vendors position themselves in the market based on these criteria. Relative placement in one particular unit of the Leaderboard does not imply that any one vendor is necessarily better placed than others. For example, one vendor's objectives will be different from the next and the vendor may be very successfully fulfilling them without being placed in the top right box of the Leaderboard, which is the traditional location for the leading players.

Therefore, for avoidance of doubt in interpreting the Leaderboard, we are not suggesting that any single cell in the Leaderboard implies in any way that a group of vendors is more advantageously positioned than another group, just differently positioned. We additionally would draw the reader's attention to the fact that vendors are listed alphabetically in a unit of the Leaderboard and not ranked in any way in the cell of the Leaderboard.

The Leaderboard is also valid at a specific point in time, February 2023. It does not indicate how we expect positioning to change in future, or indeed in which direction we believe that the vendors are moving. We caution against companies taking any decisions based on this analysis; it is merely intended as an analytical summary by Juniper Research as an independent third party.



Table 3: Juniper Research Competitor Leaderboard Scoring Criteria

Category	Scoring Criteria	Relevant Information
Capability & Capacity	Financial Performance & Size in Sector	Revenue derived from CBDC solutions over recent years, including year-on-year growth.
	Corporate Branding & Marketing Strength	This is a measure of the vendor's corporate branding and marketing strength.
	Experience in Sector	The date in which the company started operating in the CBDC market. Additionally, Juniper Research will consider the extent of activities during this time.
	Operations & Geographic Spread	The number of regional offices that the company has worldwide, in relation to CBDCs. It will also include the extent of service provision at a regional level.
	Distribution & Partnerships	Any corporate partnerships that support marketing, and/or delivering CBDC solutions.
Product & Position	Breadth of Offerings	This analyses the breadth of the vendor's offerings in the CBDC space, as determined by an extensive analysis of its product range. Information regarding new product releases and breadth of range is desirable.
	Depth of Services	This factor analyses the comparative depth in services between vendors, examining the extent to which each solution is featured.
	Customers & Deployments	The extent to which the vendor serves a large number of customers with its CBDC solutions, including whether its solutions are being used in a live system, in pilot stages, or in initial system development.
	Creativity & Innovation	Juniper Research assesses the vendor's perceived innovation through its flow of new CBDC products, developments and enhancements.
	Future Business Prospects in CBDCs	Juniper Research's assessment of the future prospects of the business in the CBDCs market.
Market Presence	Market Presence	The vendor's size of operations within the CBDC market.

Source: Juniper Research



1.2 An Interview with Giesecke+Devrient

Juniper Research interviewed Dr Raoul Herborg in April 2023



Dr. Raoul Herborg has a long history in creating digital solutions. After building and running his own companies he joined G+D in 2018 with a clear mission to empower central banks to provide a secure public digital currency (CBDC).

Since January 2022, Raoul Herborg is the managing director CBDC at G+D; collaborating closely with central banks around the world on their journey towards a CBDC and is already running a number of pilot projects for the G+D CBDC solution Filia, e.g. in Ghana.

1.2.1 What potential does G+D see for CBDCs?

Payment is a critical service. The only public means of payment today without commercial interests attached is cash. But cash doesn't work digitally. As life becomes increasingly digitalized, the number and popularity of digital forms of payment is steadily growing. As of today, however, you cannot pay digitally if you haven't already subscribed to a payment service provider. A CBDC would extend the reach of cash into an ever-more digital world.

G+D firmly believes there is a need for a government-backed digital currency that is safe, secure, trusted, and available to everybody. With a CBDC, people can benefit from the stability that comes from being guaranteed by a central bank, and the transparent policy decisions that go with it.

Furthermore, CBDCs can simplify the payments system, as its current complexity is due in part to the fragmentation of the payment landscape. A CBDC could become a common standard – a platform provided by a central bank – upon which all industry players can build their products and services. A well-designed CBDC can serve as the bedrock of innovation that can improve the way we pay and do business. It has the potential to shape tomorrow's digital economy.

1.2.2 How can CBDCs enable improvements to financial inclusion and other societal benefits?

To be truly inclusive, a CBDC needs to be well designed. It cannot expect users to have bank accounts or smartphones, or be tech-savvy or financially literate. Merchants can't be expected to have access to high-end point-of-sale devices or Internet connectivity either. An inclusive CBDC needs to come with a very simple and intuitive user interface. It should have zero, or ultra-low, transaction fees. It needs to be available through multiple low-cost formats such as wristbands and smart cards, and it has to be accessible offline.

The unbanked and underbanked population will benefit the most from CBDCs. Currently, their exclusion from financial services limits their opportunity to pay digitally, protect their money, save securely, and receive and send funds.

A CBDC can also ease cross-border payments. The number of migrant workers globally is growing, as are their remittances back to their home countries. But sending money to friends and relatives in emerging countries can be very expensive and challenging, since many of them are under- or unbanked.

Many on government support programs will benefit from payments that are made more efficiently thanks to CBDCs. Gig workers can also expect quicker payment of their fees, while real-time payments in emergency situations are also possible. At a functional level, people can utilize new service categories like pay-per-use, instead of having to sign up for long-term subscriptions.

Ultimately, all parts of society will benefit from CBDCs. Citizens will get a universal, free means of payment that protects their privacy.

1.2.3 What makes G+D well positioned to support initiatives in this emerging area?

G+D is in a unique position to provide holistic CBDC solutions. As a trusted partner of central banks and financial institutions worldwide, G+D combines a deep understanding of public currencies with know-how in smart cards, digital, and wearable payments. In addition, we offer expertise in secure connectivity, and in building digital infrastructures with defense-grade security. G+D has been conducting



research and development into CBDCs for many years and collaborates with central banks across the globe.

With our production-ready solution G+D Filia, we can operate national retail CBDC solutions that support all players in the payment industry – central banks, commercial banks, fintechs, merchants, and others. G+D Filia meets the highest requirements of security and resilience, with no single point of failure. It provides privacy to honest users while fulfilling all regulatory requirements. At the same time, it offers a pioneering programmability approach enabling commercial players to offer innovative applications.

We support our clients no matter where they currently stand on their CBDC journey. They will be guided by G+D experts, from initial consultations to the design, development, implementation, and operational support of their national CBDC.

1.2.4 What challenges do you foresee in the rollout of CBDCs, and how is G+D addressing these?

The successful implementation and adoption of a CBDC relies upon finding the proper balance between pain points, motivations, and opportunities for all stakeholders in that particular ecosystem.

It is crucial to analyze the impact of a CBDC on any given nation's financial system. We offer pilot experimentation consisting of an extensive training program, interactive workshop sessions, and access to our CBDC sandbox. This ensures our clients can test the solution in a secure, scalable, and resilient environment. Together with the fintech start-up FNA, we developed a CBDC simulator to analyze possible impacts of CBDC issuance on the economy, commercial banks and the payment ecosystem and to parametrize a possible CBDC implementation, for example.

Security is another major challenge CBDCs face. A solution would have to provide a level of security that is far beyond typical standards found in the payment sphere. Indeed, it should be at a level demanded of critical infrastructure. At the same time, a CBDC needs to be interoperable to ensure the seamless flow of funds. Pilot projects with real users, in collaboration with key stakeholders including financial service providers, are also essential for a successful rollout.

1.2.5 What CBDC use cases are you most excited about and why?

Filia has some outstanding features. From the very beginning, we considered how to handle secure, consecutive offline payments in areas without Internet connectivity. For micro entrepreneurs, with rural merchants, for instance – it is important for any CBDC solution to be available in an offline scenario. This was part of G+D's design criteria from day one, and was piloted very successfully, for example in a rural village in Ghana.

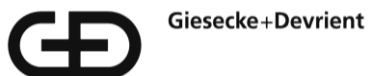
G+D's approach to programmability is unique as well. We are convinced that programmability should remain at the payments level to maintain public trust. Filia's Smart Wallets approach would enable specific rules and policies to be set at different levels to meet the needs of institutions, businesses, and individuals. Parents could create wallets designed specifically for their children, with set boundaries on spending, for example. Or, CBDC smart wallets could be used to promote national policies that help meet sustainability objectives, e.g., by issuing a "green" wallet. This would act as an incentive for consumers to buy environmentally friendly products and services. Furthermore, Filia tokens can be utilized in smart-contract ecosystems to enable new, innovative use cases, such as delivery versus payment or machine-to-machine payments.

At this stage, use cases for CBDCs are limited only by our imagination.

Filia® is a registered trademark of G+D



About Giesecke+Devrient



Giesecke+Devrient (G+D) is a global security technology provider headquartered in Munich, Germany. Founded in 1852, the company has a workforce of 12,600 employees and generated sales of EUR 2.53 billion in the 2022 fiscal year. A total of 103 subsidiaries and joint ventures across 33 countries ensure customer proximity worldwide.

Engineering trust through technology is G+D's core area of expertise. As a trusted partner to customers with the highest demands, G+D secures the essential values of the world. We develop customized technology in four major playing fields: payment, connectivity, identities and digital infrastructures.

As a global market leader, G+D has a unique portfolio of solutions for public currencies as well as electronic and digital payment. G+D provides solutions for end-to-end cash management. We produce and distribute banknote paper, banknotes, and technologically advanced security features. Our cash management solutions include banknote processing machines as well as complete cash center solutions. Complementary to this portfolio for physical currencies we also offer solutions for building and running a Central Bank Digital Currency (CBDC).

At the same time we are partner for the banking and finance sector with a comprehensive portfolio for smartcards and facilitate secure electronic and digital payment. In addition, we provide solutions for access and identity management in the health sector, for smart mobility and enterprises.

For more information, please visit <https://www.gi-de.com/en/>.

About Juniper Research



Juniper Research was founded in 2001 by the industry consultant Tony Crabtree, in the midst of the telecoms and dot-com crash. The business was fully incorporated in February 2002 and has since grown to become one of the leading analyst firms in the mobile and digital tech sector.

Juniper Research specialises in identifying and appraising new high-growth market sectors within the digital ecosystem. Market sizing and forecasting are the cornerstones of our offering, together with competitive analysis, strategic assessment and business modelling.

We endeavour to provide independent and impartial analysis of both current and emerging opportunities via a team of dedicated specialists - all knowledgeable, experienced and experts in their field.

Our clients range from mobile operators through to content providers, vendors and financial institutions. Juniper Research's client base spans the globe, with the majority of our clients based in North America, Western Europe and the Far East.



Endnotes

ⁱ <https://www.gi-de.com/en/group/press/press-releases/g-d-participates-in-brazilian-central-banks-digital-currency-initiative>

ⁱⁱ <https://www.centralbank.org.sz/central-bank-of-eswatini-partners-with-gieseckedevrient/>

ⁱⁱⁱ <https://www.bot.or.th/English/PressandSpeeches/Press/2022/Pages/n3965.aspx>