# How New Technologies are impacting in the European Banking Sector

## *Cómo están impactando las nuevas tecnologías en el sector bancario europeo*

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**ABSTRACT**

Since the Global Financial Crisis of 2007 to 2009, the profits of the European banking industry are eroding. It is due to low-interest rates, a change in customers behaviour, and steadily increasing regulatory requirements. The unsatisfying price-to-book ratio of incumbent banks testifies this process. Against this backdrop, not only disruptive but also revolutionary digital changes in its business models are mandatory.
The objective of this article is to provide positioning. Where are incumbent banks currently with their digital transformation? It is based methodologically on a qualitative content-analytical evaluation of external annual reports and business consultancies white papers. Finally, is sketched a new possible form of a banks' business model.

**Keywords**: Banking, open banking, API, blockchain, artificial intelligence, big data, cloud computing.

**JEL Classification**: G20, G21.

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**RESUMEN**

Desde la crisis financiera mundial de 2007 a 2009, los rendimientos del sector bancario europeo se están erosionando. Esto se debe a los bajos tipos de interés, a un cambio en el comportamiento de los clientes y al aumento constante de los requisitos reglamentarios. La insatisfactoria relación precio/valor contable de los bancos tradicionales da fe de este proceso. En este contexto, es obligatorio introducir cambios digitales no sólo disruptivos sino también revolucionarios en sus modelos de negocio.
El objetivo de este artículo es proporcionar un posicionamiento. ¿En qué punto de la transformación digital se encuentran los bancos tradicionales? Se basa metodológicamente en una evaluación cualitativa de contenido de informes anuales externos y libros blancos de consultorías de negocio. Por último, se esboza una nueva forma posible de modelo de negocio de los bancos.



**Palabras clave**: Banca, banca abierta, API, blockchain, inteligencia artificial, big data, computación en la nube.

**Clasificación JEL**: G20, G21.

## 1. INTRODUCTION

Banks are in the Bermuda Triangle. This spontaneous search query on Google generated 1,320,000 results on April 3rd, 2021, spread over the past decade. In the sources found, this allegory is related, among other things, to individual financial institutions as well as to the entire financial industry worldwide. The term financial industry is restricted in this paper to globally acting G-SIBs (Global Systemically Important Banks) [1]. But even D-SIBs (Domestic Systemically Important Banks) and LSIs (Less Significant Institutions) e.g., like savings banks or cooperative banks, cannot escape the influence of the forces. For this paper, the allegorical imaginary corners of the Bermuda Triangle or Devil's Triangle (Njau 1995) symbolize the trilemma facing the financial industry that has persisted since the GFC (Global Financial Crisis) ) (Morgenthal 2016). It is exposed to persistently low or negative interest rates, steadily growing regulatory requirements, and changed customer behaviour.

1st corner: persistent low or negative interest rates.
The interest margin income of incumbent banks' business models depends on interest rate differentials in favour of the assets side. The business model requires at the same time economic funding on the liabilities side. This inequality in interest rates, which the banks have taken advantage of since the banking system in the late period of the Egyptian high culture came to existence (Caselli 1980; Bogaert 1981), was permanently disrupted by the exogenous shock of the global financial crisis (Schenk 2021). Which started with Lehman brothers' filing for bankruptcy on the 15th of September 2008 (Williams 2010).



The data provider Reuters (Refinitiv Eikon) sees the likelihood of a rise of the key interest rates (main refinancing operations, deposit facility and marginal lending facility) due to decisions by the ECB's governing council at 0% per cent on a two years' horizon (Refinitv Eikon ECB Monetary Policy Poll => Long-term outlook). Nowadays, even a rapid rise in the key interest rate would be fatal for banks. A central bank's hasty decision would lead to massive impairment on the banks' assets as well as to the subsequent measurement of the banks' liabilities (BIS 2019). As far as can be foreseen, the current monetary policy of low or negative interest rates will in the nearer future not change. A look at the Japanese economy clarifies that a phase of low or negative interest rates can last up to three decades (since 1995 after a real estate bubble burst) (Knupfer 2019). Overall, individual economic agents are not able to influence macroeconomic decisions by the central banks (at least in countries of the so-called Western world (Walker 2021)).

2nd corner: steadily growing regulatory requirements.
It is challenging to precisely determine the number of banking regulatory legal norms at the European level alone to give the reader an impression of the enormous regulatory requirements. The homepage of the European Union (EUR-Lex website) suggests the first impression. The heading "Banking and financial services" contains a kind of content overview of banking regulatory priorities which concern the EEA (European Economic Area).

The bank-specific legal norms are divided into 7 main sections, which can be found in the following table in which each main point is supplemented by an associated and officially known regulatory highlight.

**Table 1: Overview of EU Banking and financial services' legal norms.**

| No | Title | Regulatory highlights | Content |
|---|---|---|---|
| **I.** | Capital Markets Union | Directive (EU) 2019/2162 | Covered Bonds and covered bond public supervision |
| **II.** | Financial supervision and risk management | EBA, ECB and SSM, BRRD, Banking Union | EBA European Banking Authority; Banking supervision of institutes under remit of ECB within the Single Supervisory Mechanism as well as the winding-up of credit institutions (Bank Recovery and Resolution Directive) |
| **III.** | Consumer finance and payments | DIRECTIVE (EU) 2019/2161, DIRECTIVE (EU) 2015/2366 | Consumer Protection Directive, PSD II Payment Services Directive II |
| **IV.** | Financial markets, financial instruments | DIRECTIVE (EU) 2014/65, Regulation (EU) 648/2012 | MiFID II (Markets in Financial Instruments Directive II), EMIR (European Markets Infrastructure Regulation) concerning financial instruments especially derivatives |
| **V.** | Capital movements | COUNCIL DIRECTIVE (EEC) 88/361 | The capital liberalisation directive |
| **VI.** | Insurance and pensions | DIRECTIVE (EC) 2009/138 | Solvency 2 (Risk management and supervision of insurance companies) |
| **VII.** | Company reporting and auditing | Regulation (EC) 1606/2002 | Adoption of IAS/IFRS |

Source: Own elaboration based on (European Union 2021).



The main titles mentioned in table 1 are containing a total of 76 sub-sections, representing individual regulations. Even internal, expert employees in regulatory departments of banks are only approximately able to quantify the correct number of national and international regulatory standards currently to be considered. The reasons for this are on the one hand to be found in the abundance of regulators, on the other hand in the fact that often cross-departmental knowledge databases have not yet been developed that go beyond a simple often difficult to manage internal policy directory. In addition, credit institutions currently are obliged to act against money laundering, terrorist financing, tax offences and, more recently, also to think about ESG (Environment, Social, Governance) criteria as well as a variety of recent digital market directives. In the past, the European

financial industry has hesitated to report regulatory costs externally. Approaches were sometimes limited to segment views and were often not pursued any further. A uniform movement of the European financial industry is not observable apart from quietly raised voices on financial forums or surveys among decision-makers initiated by consultants or associations (Bankenverband 2017).

Already in 2015, DekaBank (GiroCentre of the German Sparkassen-Finanzgruppe) stated during a specialist lecture at Frankfurt's Goethe University that 40% of the annual project budget was tied exclusively to regulatory issues.

Overall, individual economic agents are not able to influence neither the 1st nor the 2nd corner of the devil's triangle. What remains is an optimistic look at the last corner.
3rd corner: changed customer behaviour.

In contemporary customer research (a subdiscipline of marketing), the demand behaviour of present generations (generations X to Z) is sometimes referred to in a simplified manner by the following figure of speech: "I WANT IT ALL, I WANT IT NOW, I WANT IT MY WAY" (Porsche-Consulting 2020). Credit institutions must adapt to this change in customer behaviour from passive to active and mature customers. The transformation is favoured by the steadily advancing digitization, which not only has a lot more information available than in the past but also allows more freedom through electronic end devices than a few years ago. For instance, in 2006 only a small number of end customers were able to follow the soccer World Cup in Frankfurt on the Main directly on their mobile phones (Frankfurter Allgemeine Zeitung 2006). Nowadays 15 years later, the smartphone threatens the classic television, as well as the classic broadcasting offer (OECD Competition Division 2013).



What could the way out of the trilemma outlined in the introduction look like?
Commercial banks even groups are not able to influence the ECB's interest rate decisions. Very indirectly (if at all) they can at least anticipate upcoming regulatory arias. It is very difficult to imagine influencing final regulatory decisions (e.g. the emergence of Basel IV (Neisen and Roth 2018)).

In short, banks' only internal options are currently to change their business model, adapt sales channels and use new digital technology in an intelligent and networked manner to react to the given environmental conditions.

This paper aims to sound a way out of the Bermuda triangle based on advanced digital technologies. Their skilful use could generate a decrease in costs and an increase in profitability, considering the key points of the current economic situation already mentioned above.

A revolutionary willingness to invest on the part of decision-makers, however, is often prevented by the fact that returns only appear after several years (Scott Morton 1994). Nevertheless, from a bank's economic point of view, the main influencing factors are an improvement of the CIR (cost-income ratio) with the simultaneous generation of higher sustainable revenues.

A qualitative content analysis according to Philipp Mayring (Mayring 2015) is employed to research the frequency of new business digitalization technologies named eighter in the grey literature of relevant consulting companies or banks' current financial reports.

In contrary to an often hypothesis-driven quantitative approach, which is sometimes reduced to the analysis of statistical relationships of a few variables, a qualitative approach is suitable for this analyse due to the degree of the overarching questions' complexity.

In the third section, this analysis is processed step by step. For better structuring, the individual levels can be identified by the reader following the sub-headings.



## 2. TECHNOLOGICAL FOUNDATION

In this section, the prevailing technological developments are presented in an anticipatory manner to be able to better convey their potentials and thus the use cases later. The chosen order of technologies is not traceable to the insights gained in section 3 through the analysis of the supplier and demand side. This order is based on non-scientific argumentation like logic, intuition, and anecdotal evidence from randomly conducted unstructured expert interviews.

Incumbent banks are currently looking more or less intensively at the use of these technologies. The awareness of a necessary transformation towards the digitalisation of the business model is present. In the future, banks will play an important role in the economy in their role as liquidity intermediaries. However, the structure of the business model and the framework conditions are changing. The research focuses on the pursuit of a reduction in the cost-income ratio as well as the economic sustainability of the respective business model. This pursuit is limited by cyber risks and data protection, which can be extremely costly to combat and contain. Both concepts will be introduced later.

First, the order represents the weighting as it is currently lived in the financial industry. New technologies are often only able to unfold their full potential in combination. Sometimes the question arises as to why these technologies are only being used tentatively. One answer to the question could be that the expected time to return on

investment goes beyond the time horizon of an internal multi-year plan or the terms of management's contracts.

Open API: The financial industry will increasingly transform into carriers of technological platforms. This is the only way to enable the formation of cross-industry digital ecosystems. There will be companies that will drive the formation of these platforms, those that will participate and those that will perish. Similar to the standardised couplings for model railways that fit perfectly across manufacturers, providers of digital financial solutions (e.g. reading invoices) must be able to connect to such a platform. For this purpose, a well-developed Open API infrastructure must exist. This term (Open Application Programming Interfaces) refers to data access through third-party development. The creation of these interfaces was made possible in 2015 by the adoption of the revised Payment Services Directive (PSD II) by the European Parliament.

Big Data: From the company's point of view, there are two aspects behind this term. Companies sometimes already have customer databases that have been populated for several decades and are often highly unstructured. These contain master and transaction data, sometimes without considering changes in the life of a private or corporate customer. It can happen that a bank is not yet able to recognise whether a customer is simultaneously the managing director of his own company and a private person with a customer account. Much more complex is, for example, the up-to-date recording of group networks, which can also appear as customers. Therefore, the first aspect of Big Data is to first structure one's own data stocks in such a way that they generate comprehensive images within the company. Based on this, the second aspect of Big Data (Smart Big Data) consists of combining the abundance of existing data offers, e.g. in an ecosystem, so skilfully that complete customer journeys, for example, become recognisable.



Artificial Intelligence (AI): This sub-area of computer science deals with the automation of intelligent behaviour and machine learning. In general, the term refers to the attempt to simulate certain human decision-making structures. The aim is to enable a computer to process detected tasks relatively independently. Determining a comprehensive definition of AI is challenging due to the variety of human behaviour (Kaplan et al. 2020). Despite this aspect of complexity, AI is closely related to current social change. The development takes place from the information society to the smart digital society (Palomo Zurdo et al. 2019).

Blockchain DLT: In contemporary literature, technology-specific, as well as network-specific definitions, sometimes appear. The first definitions focused on the network (SWAN 2015). The term was originally defined as a decentralised, transparent database containing transaction records. This database is evenly distributed across all participating network nodes. It is updated by its users, does not belong to any individual user, and is not controlled by a central authority. Other definitions focus on technological aspects,

such as a database type in which the data entries are grouped into blocks (Walport 2016). A distinction is also made here between blockchain and DLT (distributed ledger technology). The blockchain is only a subordinate component of DLT.

Cloud computing: In this respect, the definition of the National Institute of Standards and Technology (NIST: US Department of Commerce) is leading. It has also been adopted by European authorities. "Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. To ensure the service offering to cloud clients, different service models are mentioned (IaaS, PaaS, SaaS), arranged as a layer in a stack. IaaS (Infrastructure as a Service) refers to the linking of underlying physical computing resources. PaaS (Platform as a Service) refers to the provision of a platform that the customer cannot control or manage. Nevertheless, he and only he can access his data exclusively at any time. SaaS (Software as a Service) stands, among other things, for the compatibility of the cloud to be able to use the customer's software for its access.



Quantum Computing: A quantum computer contains processors able to proceed with the information provided according to the laws of quantum mechanics. Classic computers, on the contrary process the information according to the laws of classical physics. The strength compared to classical processors is that memory contents can simultaneously overlap several values. An algorithm had to be developed specifically to identify the specific overlapping states of a bit (Qubits). A classical processor only allows the simultaneous allocation of one bit with one piece of information. This shortcoming should be overcome by making processors smaller and smaller. However, there seem to be limited to the reduction of components due to increasing error frequencies. A single quantum processor is thus able to act simultaneously like several conventional processors.

This sequence in terms of meaning/processing is currently crystallizing in the banking landscape.

Secondly, a brief description of secondary technologies, of which only robotics is outlined based on plausible use cases.

Robotics: RPA (Robotic Process Automation) is a software-based approach where robots mimic human beings in repetitive, rule-based processes. Located at the user interface features, the robot follows the same work instructions and access rights to the programs as human colleagues. This enables an RPA to combine the organisational and process structures of an incumbent organisation with the new digital world.

Finally, the term ecosystem must be mentioned. It is referred to as an association of companies in the economic sense. These are aligned by an orchestrator on shared value

creation (Moore 1993). The total power of the ecosystem exceeds the sum of the individual services contributed (Ceccagnoli et al. 2012). According to the consulting firm Gartner, ecosystems consist of 8 dimensions (Gartner 2017). The two bottom-line dimensions of strategy and technology provide the framework. Business ecosystems are often networks of dynamically interacting and mutually complementary units along the value chain. These can grow generically or in a planned structured manner. The trick is to make the right decision about a long-term focus on an ecosystem that is sometimes fragile. The second bottom line is the ideally proactive investment in future-oriented often disruptive technologies. These are indispensable door openers to a business ecosystem. The technologies should be chosen so robustly that they can easily follow any new formations of new ecosystems. The six dimensions within the framework already presented include Openness, Participants, Relationships, Value Exchange, Industries, Complexity.

Openness is characterised by common strategies, goals, and shared interests. Individual companies should contribute their willingness to share knowledge.
Participants stand for the wealth and value creation potential of an ecosystem. The more participants from different disciplines, the more comprehensive and unique the service that can be offered. Relationships aim at technological platform-based interconnectivity between the electronic devices of individual business entities worldwide. In 2020 alone, there were already around 30 billion electronic devices worldwide. Value exchange within ecosystems does not only have to consist of the exchange of a monetary counter value for goods. It can also consist of mutual enrichment of knowledge for the purpose of jointly marketing an overly complex product.



Like participants, but with a slightly different nuance, Industries stands for cross-sector connections along a value chain (e.g. service sector and manufacturing industry).
Complexity, as the term already expresses, stands for the increasing degree of complexity through mergers of different ecosystems.

This also increases the cyber risk, which represents a common "level playing field" for all participants. This term is presented below alongside data protection.

Cyber risk is often assigned from a banks' perspective to the cannon of operational risks (Aldasoro, Iñaki, et al. 2020). Due to the current lack of a uniform, the cross-sectoral definition of this term, an understanding in this context is appropriate. Roughly speaking, the risk can be defined as a potential loss arising from the fragmented protection of data used in cyberspace (Schatz et al. 2017).

As early as 2013, the reinsurer Munich Re predicted a sharp increase in losses due to cyber risks (Munich Re 2013). The forecast has come true, as demonstrated by the recent attack on the North American fuel supply (E. David et al. 2021).

According to the Munich-based reinsurer's definitional approach, cyber risk comprises four overlapping dimensions that can be external, internal, intentional, or unintentional. The IT and data security dimension refers to external data theft, blackmail, data vandalism or hacker attacks often initiated by so-called DDoS attacks (Distributed Denial of Device).

Compliance and privacy as another dimension stand for compliance/potential breaches of national/international data protection laws.

Corporate liability refers to the consequences that companies are confronted within the event of damage. They can arise, for example, because of business interruption, infringement of commercial usage rights or data protection violations.

The last dimension of cyber risk is reputation. Reputational damage arises from damage that has occurred, such as theft and/or the massive dissemination of false information on websites.



Data protection plays a central role in a modern information society. On the one hand, the legal norms behind it are intended to protect against the formation and encroachments of a totalitarian state or monopolistic operating companies. On the other hand, concerning individuals, this is understood to mean protection against abusive data processing, protection of the right to informational self-determination, protection of the right of personality in data processing and protection of the private sphere.

The European Union understands data protection as "in particular the protection of the privacy of natural persons about the processing of personal data" (Art. 1 para. 1 Directive 95/46/EC). The Council of Europe defines data protection as the protection of the "right to privacy for automatic processing of personal data" (Art. 1 European Convention on Data Protection). In the English-speaking world, one speaks of privacy (protection of privacy) and data privacy or information privacy (data protection in the narrower sense). In the European legal area, the term data protection is also used in legislation.

Dealing with data protection in a competent, respectful, and mutually satisfactory manner is a key to success in the application of new technologies (Schmidt et al. 2014).

## 3. LITERATURE REVIEW AND PROFESSIONAL SECTOR CONTEXT

Introductive, from a bank's perspective investments in digitization, was raised as a supposed starting point for cost reduction. The task of the third section, therefore, is to provide an overview of the current new technologies before finally in the last section a design proposal for the future banks' business model is sketched. The identification of

common technologies was done qualitatively by content analysis. For this purpose, the annual reports of 8 globally systemically relevant credit institutions (FSB G-SIB List 2020) were analysed (demand side of innovations). To contrast, grey literature (information brochures) of 9 management consultancies internationally recognized as leaders in digital transformation processes were evaluated (supply side of innovations). The analyse was carried out over a six-year observation period, from 2016 to 2021.

### 3.1 Determination of the overarching questions

So that the often-scarce resources of the credit institutions can be allocated profitably and sustainably, the following questions for a better understanding of modern developments are conceivable:

Q1: What digital technologies are currently on the focus of the banking community?

Q2: Which technologies turn out to be dominant?

Q3: What are the use cases for these technologies?

Q4: What does the future business model of banks look like?

This type of question is based on the headings of popular advertising brochures from relevant consulting companies.



### 3.2 Determination of the material sample

The material on which the qualitative analysis is focused is composed of two contrasting populations. Regarding the supply side, grey literature (advertising brochures) from well-known international consulting companies is used. Concerning the demand side, financial statements of American universal banks, and their peers are employed, which have proven to be particularly efficient in the recent past.

**Table 2: Feature matrix for determining the sample.**

| Feature | Feature value | Feature carrier |
|---|---|---|
| Geographical distribution | USA, Europe | all |
| Supply side, Innovation capacity | Potential of innovation | International consultancies |
| Demand side, Sustainability | G-SIB, Listed, RoE, Reinvestment rate, Peers | Credit institutions |

Source: Own elaboration based on (Mayring 2015).

The selection of the material sample is shown in Table 2 above. Regarding the contrastive selection of the analysis objects, three characteristics dominate. This includes the geographical distribution of supply and demand sides, the presumed striving for economic sustainability[2] of objects on the demand side and the presumed competence to be able to offer innovative digital offers in an advisory capacity. Concerning the supply side, grey literature accessible on the Internet from international consulting companies was selected as analysis objects. These companies were quarterly certified by an independent third

party (consulting company Forrester Q1 2019 to Q4 2020) to have a high level of competence in digital solutions. To ensure the best possible timeliness of the offer side's analysis, documents of the years 2016 to 2021 were researched. The 9 consulting firms analysed are shown in Table 3 (*printed in italic letters*). The consulting firms named for both random samples were selected for further analyse. The Boston Consulting Group (BCG) was added in Q4 2020, whose information was also intuitively included in the research due to its reputation.

**Table 3: The Forrester Wave™ Global Business Transformation Accelerators.**

| Category | Q1 2019 | Q4 2020 |
|---|---|---|
| **Leaders** | *McKinsey & Company*<br>*EY*<br>*Publicis Sapient*<br>*IBM*<br>*Accenture*<br>*Deloitte*<br>*PwC* | *Accenture*<br>*BCG*<br>*McKinsey & Company* |
| **Strong Performers** | *Capgemini*<br>*KPMG*<br>Cognizant<br>Wipro<br>Atos | *Deloitte*<br>*Capgemini*<br>*EY*<br>*KPMG*<br>*PwC* |
| **Contenders** | Tata Consultancy Services<br>Infosys<br>DXC Technology | *Publicis Sapient*<br>Globant |
| **Challengers** | n/a | n/a |

Source: Own elaboration based on (The Forrester Wave Q4 2020).

The selection of the analysis objects on the demand side (universal banks as carriers of characteristics) was carried out in line with their presumed pursuit of economic success. For this purpose, internationally active listed G-SIBs' were selected. The basic assumption here is the presumed innovative strength of American banks. The assumption is confirmed by the comparison of the two commonly used key figures RoE (Return of Equity) and RR (Reinvestment Rate). RoE reflects the return on equity invested as a percentage. The reinvestment rate expresses the percentage of how much a company invests to generate future growth (Ferson et al. 1997). The data is based on the one hand on the list of globally systemically important banks published annually (November) by

the FSB (Financial Stability Board with permanent seat in the (BIS) Bank for International Settlements, Basel). On the other hand, support from Reuters / Refinitiv was used to make the selection decision. Refinitv offers both the time series of the necessary financial data and peer reviews, which enable comparable companies to be selected quickly and easily. For this article, peers for Goldman Sachs (RIC[3] GS.N) were researched (see table 4 below).

**Table 4: Refinitiv Peers of Goldman Sachs Group Inc.**

| Pretax RoE | 11.05.2021 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Identifier (RIC)** | **Company Name** | **SIB** | **Ø RoE** | **RoE 2020** | **RoE 2019** | **RoE 2018** | **RoE 2017** | **RoE 2016** |
| BAC.N | Bank of America Corp | G-SIB | 1,2% | 0,7% | 1,40% | 1,50% | 1,30% | 1,20% |
| BBVA.MC | *Banco Bilbao Vizcaya Argentaria SA* | *D-SIB* | 14,5% | 11,3% | 14,7% | 18,1% | 14,8% | 13,5% |
| C.N | Citigroup Inc | G-SIB | 1,1% | 0,6% | 1,2% | 1,2% | 1,3% | 1,2% |
| CBKG.DE | Commerzbank AG | D-SIB | 0,0% | (0,5%) | 0,2% | 0,3% | 0,1% | 0,1% |
| CSGN.S | *Credit Suisse Group AG* | *G-SIB* | 5,1% | 8,0% | 10,8% | 7,9% | 4,3% | (5,3%) |
| DBKGn.DE | *Deutsche Bank AG* | *G-SIB* | 0,1% | 1,7% | (4,1%) | 2,0% | 1,9% | (1,2%) |
| GS.N | *Goldman Sachs Group Inc* | *G-SIB* | 12,9% | 13,4% | 11,7% | 14,5% | 13,2% | 11,9% |
| JPM.N | *JPMorgan Chase & Co* | *G-SIB* | 14,8% | 13,1% | 17,2% | 15,9% | 14,1% | 13,8% |
| MS | *Morgan Stanley* | *G-SIB* | 13,9% | 15,7% | 14,0% | 14,3% | 13,6% | 11,7% |
| SAN.MC | Banco Santander SA | G-SIB | 0,7% | (0,1%) | 0,8% | 1,0% | 0,9% | 0,8% |
| WFC.N | Wells Fargo & Co | G-SIB | 1,2% | 0,0% | 1,3% | 1,5% | 1,4% | 1,7% |
| **Reinvestment Rate** | **11.05.2021** | | | | | | | |
| **Identifier (RIC)** | **Company Name** | **SIB** | **Ø RR** | **RR 2020** | **RR 2019** | **RR 2018** | **RR 2017** | **RR 2016** |
| BAC.N | *Bank of America Corp* | G-SIB | 6,6% | 4,2% | 8,2% | 8,7% | 6,0% | 5,7% |
| BBVA.MC | *Banco Bilbao Vizcaya Argentaria SA* | *D-SIB* | 7,1% | 6,5% | 7,5% | 10,1% | 5,6% | 5,7% |
| C.N | *Citigroup Inc* | *G-SIB* | 6,1% | 3,2% | 7,8% | 7,1% | 6,2% | 6,1% |
| CBKG.DE | Commerzbank AG | D-SIB | (1,1%) | (10,2%) | 1,4% | 2,2% | 0,1% | 1,0% |
| CSGN.S | *Credit Suisse Group AG* | *G-SIB* | 1,5% | 5,4% | 7,0% | 3,2% | 1,6% | (9,7%) |
| DBKGn.DE | *Deutsche Bank AG* | *G-SIB* | (2,8%) | 0,2% | (9,0%) | (0,4%) | (1,9%) | (3,1%) |
| GS.N | *Goldman Sachs Group Inc* | *G-SIB* | 9,0% | 8,7% | 8,0% | 10,9% | 9,5% | 7,9% |
| JPM.N | *JPMorgan Chase & Co* | *G-SIB* | 8,1% | 6,7% | 10,2% | 9,3% | 7,4% | 7,1% |
| MS | *Morgan Stanley* | *G-SIB* | 8,0% | 9,9% | 8,8% | 9,0% | 6,7% | 5,4% |
| SAN.MC | *Banco Santander SA* | *G-SIB* | 2,1% | (9,7%) | 4,9% | 7,1% | 4,0% | 4,3% |
| WFC.N | Wells Fargo & Co | G-SIB | 4,8% | -2,0% | 5,6% | 7,3% | 5,8% | 7,3% |

Source: Own elaboration based on Refinitiv (as of 11th of May 2021).

The banks Commerzbank, Santander and BBVA have been supplemented for comparison, although not originally determined by the peer review of Refinitiv (aof 02nd of May 2021).

For further analysis, the financial group statements of the banks highlighted in grey were identified based on the combination of the two key figures pretax RoE and reinvestment

rate (a negative rate means disinvestment in the respective year). Deutsche Bank was consciously included because of its commitment to the cloud (Osman et al. 2020).

### 3.3 Results of the supply side's analysis

The identification of the driving disruptive digital technologies, which already forced or will force a change of the business models of incumbent banks was elaborated by the following proceeding in four steps:

Step 1: Selection of vendors (consulting companies cf. table 3) nominated as "digital accelerators" by the Forrester Wave TM Report Q4 2020.

Step 2: Evaluation of the vendors' grey literature (e.g. marketing brochures) or their web sides directly.

Step 3: Evaluation of the technologies offered by the vendors including the use cases mentioned in the sources.

Step 4: Securing the insides gained challenging them against the Gartner Hype Cycle.

Based on the evaluation of the frequency of mention (some sort of trend analysis) in the in-house advertising of the vendors, the main drivers of digitization could be identified: Cloud computing (15%), Artificial Intelligence AI (14%), Big Data (10%), Blockchain (6%), Robotics (6%) and quantum computing with (2%). The remaining Others (47%) are comprising technologies that partially are already strongly application-specific or whose potential (e.g. 5G standard) has yet to be tapped. The main drivers identified could be verified with the corresponding Hype Cycle estimate by Gartner (Gartner 2021) as well as by prospective technological studies (Ortega und et al. 2019). In this way, the following terms have emerged for further research on the part of potentially technology-demanding banks. See the following tabular overview with brief comments on the terms, but initially with only one weighting in the two categories primary and secondary in mentioning.

**Table 5: Disruptive technologies.**

| Category | Technology | Comment |
|---|---|---|
| **primary** | *Block Chain* | *Distributed Ledger Technology* |
| | *(AI) Artificial Intelligence* | *Autonomous algorithmic learning* |
| | *Big Data* | *Data analytics* |
| | *Cloud Computing* | Concentration and storage of data |
| | *Quantum Computing* | Replacement of mainframes |
| | *IoT (Internet of Things)* | Worldwide sensor system transformable in financial data |
| | *Open API (publicly available application programming interface)* | Door to financial and non-financial ecosystems |
| | *ML (Machine Learning)* | Subset of AI customer focus |
| **secondary** | *Robotics* | *Link between the old and the new office world* |
| | *Biometrics* | *Security items* |
| | *Wearables* | *Smart watches (e.g. for payment)* |
| | *XR (augmented reality)* | *3-dimensional experience of a sales call* |

Source: Own elaboration based on the evaluation of the vendors' grey literature.

Disruption is understood here as a process by which an existing business model or an entire market is replaced, with the help of fast-growing innovation.

### 3.4 Results of the demand side's analysis

Analogous to the analysis of the vendors' documents, an examination of the annual reports (2016 and 2020) of the potential demanders of disruptive new technologies was carried out. The following tabular overview illustrates the picture of the comparison of the two reporting years, irrespective of external financial reporting under US GAAP (Generally Accepted Accounting Principles) or IAS/IFRS (International Financial Reporting Standards).

**Table 6: Technology mentioned in Annual Reports.**

| Group Financial Statement end-of-year 2016 | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Identifier (RIC) | Company Name | SIB | Digital | Eco-system | Fin-tech | Open API | Big Data | AI | DLT | Cloud | Quan-tum | Robo | Tech-nology |
| BAC.N | Bank of America Corp | G-SIB | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 16 |
| BBVA.MC | *Banco Bilbao Vizcaya Argentaria SA* | *D-SIB* | 46 | 1 | 3 | 1 | 2 | 1 | 1 | 1 | 0 | 1 | 67 |
| C.N | Citigroup Inc | G-SIB | 31 | 1 | 9 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 22 |
| CBKG.DE | Commerzbank AG | D-SIB | 116 | 0 | 3 | 0 | 2 | 0 | 0 | 1 | 0 | 3 | 0 |
| CSGN.S | *Credit Suisse Group AG* | *G-SIB* | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 53 |
| DBKGn.DE | *Deutsche Bank AG* | *G-SIB* | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 21 |
| GS.N | *Goldman Sachs Group Inc* | *G-SIB* | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 35 |
| JPM.N | *JPMorgan Chase & Co* | *G-SIB* | 27 | 3 | 16 | 4 | 6 | 0 | 0 | 14 | 0 | 7 | 97 |
| MS | *Morgan Stanley* | *G-SIB* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 |
| SAN.MC | Banco Santander SA | G-SIB | 184 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 79 |
| WFC.N | Wells Fargo & Co | G-SIB | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 29 |
| Σ | | | 464 | 5 | 32 | 7 | 10 | 1 | 2 | 19 | 1 | 11 | 443 |
| **Group Financial Statement end-of-year 2020** | | | | | | | | | | | | | |
| Identifier (RIC) | Company Name | SIB | Digital | Eco-system | Fin-tech | Open API | Big Data | AI | DLT | Cloud | Quan-tum | Robo | Tech-nology |
| BAC.N | *Bank of America Corp* | G-SIB | 54 | 1 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 35 |
| BBVA.MC | *Banco Bilbao Vizcaya Argentaria SA* | *D-SIB* | 104 | 3 | 1 | 0 | 2 | 7 | 0 | 10 | 0 | 1 | 93 |
| C.N | *Citigroup Inc* | *G-SIB* | 78 | 3 | 1 | 4 | 0 | 0 | 0 | 3 | 0 | 0 | 45 |
| CBKG.DE | Commerzbank AG | D-SIB | 106 | 0 | 5 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 12 |
| CSGN.S | *Credit Suisse Group AG* | *G-SIB* | 34 | 2 | 1 | 0 | 0 | 1 | 2 | 1 | 0 | 3 | 92 |
| DBKGn.DE | *Deutsche Bank AG* | *G-SIB* | 30 | 2 | 0 | 1 | 0 | 2 | 0 | 11 | 0 | 0 | 62 |
| GS.N | *Goldman Sachs Group Inc* | *G-SIB* | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 47 |
| JPM.N | *JPMorgan Chase & Co* | *G-SIB* | 55 | 1 | 20 | 1 | 1 | 4 | 1 | 13 | 2 | 0 | 61 |
| MS | *Morgan Stanley* | *G-SIB* | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 36 |
| SAN.MC | Banco Santander SA | G-SIB | 441 | 8 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 129 |
| WFC.N | Wells Fargo & Co | G-SIB | 18 | 0 | 0 | 0 | 0 | 3 | 0 | 7 | 0 | 0 | 39 |
| Σ | | | 931 | 20 | 29 | 7 | 10 | 23 | 4 | 47 | 2 | 5 | 651 |

Source: Own elaboration based on the named banks' annual reports 2016 and 2020.



In the left columns, in analogy to table 4 (Peers Group), the analysed companies can be seen. The headings of the subsequent columns to the right indicate the terms that were searched for in the annual reports. Interesting at first glance is the overall increase in the use of technical terms by a factor of 1.73 in 2020 compared with 2016. The institutions are beginning to acknowledge certain technologies more and more clearly compared with 2016. Among these, the terms Big Data, AI (Artificial Intelligence) and Cloud stand out. The clear leaders are American institutions, led by JPMorgan Chase & Co. The US GAAP Form 10-Ks officially filed with the SEC (Security Exchange Commission) contain very few statements on the use of disruptive technologies. The two companies Goldman Sachs and Morgan Stanley afford independent, multi-faceted reporting regarding technological use, which was not evaluated here. Spanish institutes are also noticeably clear about their willingness to engage with innovative technologies. Equally striking is the use of the term "ecosystem." This shows the growing awareness among companies that they will have to operate as part of an ecosystem of some kind in the future and will no longer be able to operate exclusively on their own, as they did in the past.

### 3.5 Offsetting

Table 7 below compares the matches of searched categories in the vendors' Grey Papers and the banks' annual reports.

**Table 7: Offsetting of the vendors' and banks' frequency in mentioning.**

| Disruptive Technology | Abbreviation | Vendors' supply side | Banks' demand side |
|---|---|---|---|
| Big Data | BD | 10% | 10% |
| Cloud Computing | CC | 15% | 48% |
| Artificial Intelligence | AI | 14% | 23% |
| Blockchain | BC | 6% | 4% |
| Quantum | QC | 2% | 2% |
| Robotics | RO | 6% | 5% |
| Others | | 47% | 7% |
| Σ | | 100% | 100% |

Source: Own elaboration.

The viewpoints of suppliers and demanders match up quite well. Banks seem to see significantly higher potential in the cloud than the providers have done. The Others category contains considerably more features from the point of view of the vendors than from the point of view of the banks. In the evaluation, the Open API category was described as "Others" at the banks' side.



### 3.6 Results.

The potential of Big Data is apparently assessed identically from both perspectives. The potential complementary lever in the form of artificial intelligence (AI) is valued more highly by the users. This may be since users with knowledge of their own system landscapes are able to identify internal and external use cases specific to their company. From the bank's point of view, the value of the cloud is clearly more important. This gives institutions effective leverage to improve the cost-income ratio, taking data protection and cybersecurity into account. If a bank's valuable data storage (on which its reputation also depends) is outsourced, its own often redundant data centres can be reduced. Banks see the Open API as much more important than vendors. This may be because the idea of being or becoming part of an ecosystem is starting to catch on. Finally, it is worth mentioning the observation that companies have created positions such as "Head of Digital ..." over the years to do justice to the topic.

## 4. INCUMBENT BANKS USE CASES AND INTERFACES

The presentation of potential use cases, which is certainly not conclusive, is made from two perspectives. First, the view from the outside to the customer or other ecosystems is presented, with special consideration of the potential of smart big data. This is followed by an examination of the internal possibilities for using the new technologies to optimize and reduce costs.

### 4.1 External use cases

This presentation along the disruptive technologies is by no means a complete representation. It is an attempt to provide initial insights based on the review of Section 2.

Open API: This is what makes standardised access to ecosystems possible or from ecosystems to a bank as a technology platform. This makes it relatively easy for banks to embed solutions developed by fintech into their environment. Through these interfaces, non-financial and financial ecosystems can also be linked with each other (partnership ecosystems) (Glickenhouse et al. 2016).

Big Data: Big data initially refers to companies' efforts to maintain and better structure their sometimes highly unstructured databases. Only on this basis is it possible to create added value in the mutual sense of the customer-bank relationship over the duration of a customer's stay with a company within the framework of Smart Big Data. Based on the data obtained in this way, new customers can be acquired in a targeted manner and existing customers can be better looked after (McKinsey et al. 2021). Artificial Intelligence (AI): Hailed as an enabler of Big Data (McKinsey 2021).



Blockchain (DLT): On the one hand, this enables central bank-guaranteed tokenisation on the assets side for customers. On the other hand, this technology gives banks different access to the capital market (e.g. issuing bonds). If a corporate draws a liquidity line within seconds, the bank will be able to refinance itself just as quickly in this way (Sandner et al. 2020).

Cloud computing: Cloud computing is another enabler of decentralised handling of big data. On the one hand, it enables companies to reduce costs, on the other hand, it supports the formation of ecosystems (Osman et al. 2020).

Quantum Computing: These computers will one day be able to read out the complete cryptography of an existing blockchain if they are economically viable, robust and data secure. Due to the high costs and the developments that are still necessary, this hardware is not yet mentioned in the annual reports. However, American banks are already investing in this technology (see JP Morgan Case & Co.).

Robotics: With the help of this technology, a transition between the old and new world can be created. For example, customer letter printing can be controlled from a digital data processing system, right through to franking and dispatch. Conversely, physically delivered documents can be scanned and processed across systems. With this technology, even system language barriers (old versus new applications) can be overcome.

### 4.2 Internal use cases

For the structured recording of internal use cases, it is useful to divide the bank into the three floors of a house: roof, work area and basement.

Compliance, internal auditing, external auditing in the sense of auditing, and banking supervision should be located on the top floor.

Their requirements can be supported by Big Data, Artificial Intelligence (AI), Machine Learning (ML) and, in the long term, the BlockChain (BC) for the purpose of data exchange and, for example, the immediate preparation of corporate tax returns.

In the work area, customer-specific continuous credit checks are to be thought of internally in the credit business. In this way, customers can be better assessed, and potentials can possibly even be identified in a predictive manner. The identification of fraud patterns can also be supported. Furthermore, internal optimization of the scarce resource of risk-weighted equity is conceivable, considering commercial law requirements.



The use cases of customer-specific interaction have already been presented in the section above on the external view.

In the basement/machine space, Big Data, AI and the Cloud can conceivably support a multi-GAAP capable general ledger. A cross-system and cross-IT-language linking of old (often still based on physical documents) with the new digital world is conceivable using Robotic.

## 5. CONCLUSIONS

To round off this article, the overarching research questions are reflected here.

Q1: What digital technologies are currently on the focus of the banking community?
This question was answered in sections 2 and 3. In the second section, a qualitative content-analytical review of contemporary literature from the supplier side and of business reports from the buyer side was carried out. The drawing of the sample was also described. In Section 3, the most important technologies identified were presented in an explanatory and additive manner alongside common technical terms.

Q2: Which technologies turn out to be dominant?
Independently of the insights gained in section 2, section 3 attempts to weigh the influence of new disruptive technologies on the business model of long-established banks. A

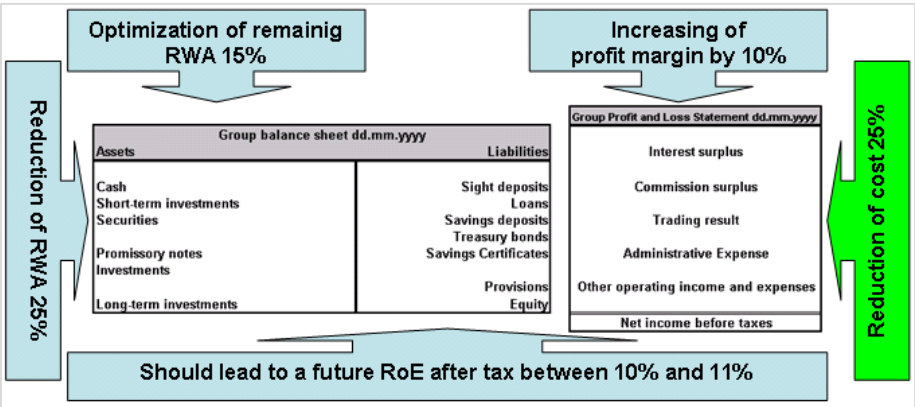
challenge for future research could be to evaluate these sometimes intuitively gained insights scientifically.

Q3: What are the use cases for these technologies?
The answer to this question, which is in no way conclusive, is given in the fourth section. Here a subdivision is made into the internal and external view of the company. One reason for future research could be to sketch a more complete picture of possible realistic use cases.

Q4: What does the future business model of banks look like?
To answer this question, it is now attempted to outline the transformation of the business models of incumbent banks towards technology platforms, based on the insights gained previously. In addition, there is a contrasting presentation of the traditional approach, often pushed by consulting companies, and the transformational approach, as it could be realised step by step.

**Fig. 1: Common solutions often recommended by consulting companies.**





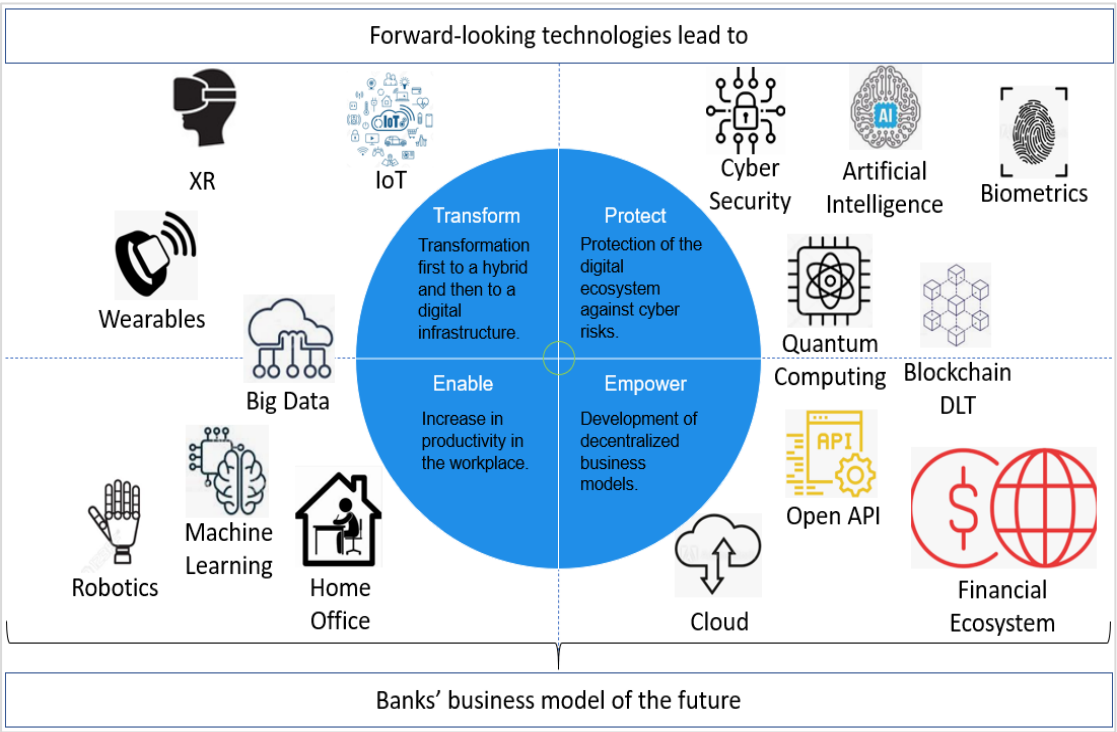

Source: Own elaboration based on a presentation of Deka Bank in 2015.

In the middle of the last decade, shortly before the global financial crisis (GFC), incumbent banks were still proclaiming that they wanted to achieve a return on equity of over 20%. These are performance figures that can no longer be achieved in the present.
As mentioned at the beginning of this article, the reasons for this are the ongoing negative interest rate phase, steadily increasing regulatory requirements and technology-based changes in customer behaviour.

Banks tried and are still trying today to first modify their business model, which is well known to them, to be able to achieve higher returns while complying with the regulatory requirements. The first step was to reduce the assets side of the balance sheet without cutting staff. The aim was to lower risk and complexity by systematically selling out risky assets, while at the same time freeing up regulatory capital for less risky new business in the retail and corporate sectors. As a rule, the segments were merged in such a way that

often only Retail, Corporate and Other (Non-core assets) remained. Investment banking, which used to be highly profitable but also high risky, no longer exists in European banks as it did before the global financial crisis. Under the Trump administration, American banks were able to cultivate this segment again. Today, the focus is still on a step-by-step change, if any, in the familiar business model and operational procedures. This time as a second step, the attempt is being made to present proclaimed earnings targets by massively reducing full-time positions, while at the same time focusing on profitable and technically supportable lending business as well as reducing massively costs. As before, the technical options mentioned in this article are used additively. The following graphic representation represents an attempt to shape the transformation to a digital platform as the basis of one or more ecosystems.

**Fig. 2: Banks' business model of the future**




Source: Own elaboration based on (Handelsblatt-Journal 2016).

*Transform:* The transformation to an initially hybrid infrastructure relies on a digital unification of both the supply side (incumbent universal bank) and the demand side (customers). The first step is to have a hybrid infrastructure that also enables classic access to a bank, as not all customers are digital natives.

*Protect:* The new business models will have to be flanked by protection concepts that are constantly being revised to minimize cyber risks. Furthermore, largely automated compliance (aaS as a service) is at the centre of the considerations.

*Empower:* New operating models for IT are necessary. The services must be fundamentally realigned to enable flexible new business models across platforms (keyword aaS ... as a Service). The aim should be to integrate the company in question into a financial ecosystem that might initially be regionally limited.

*Enable:* Efficient cooperation of all stakeholders seven days a week and around the clock should be made possible by exploiting all digital potential.

In a nutshell, the path through the digital jungle might be from a bank's perspective:

Step 1: Open API (one standardized system of plugs is mandatory).
Step 2: AI and BD (First, the databases must be restructured).
Step 3: Cloud and BlockChain (Central bank guaranteed tokenization).
Step 4: Quantum computing might pave the way to the future.

BUT => Cyber risk as one level playing field as well as data protection is shaping up.
The above sequence of the interaction of digital innovations might be considered as this article's main contribution. Often, only insiders currently have an overview of these interrelationships.



Times remain challenging and incumbent banks are forced to embrace change. In terms of character, these will be disruptive or even revolutionary, rather than evolutionary as before. However, banks must no longer cling to the business models of the 20th century. According to a 2018 statement by Gartner, up to the year, 2030 5% of banks worldwide will provide the technological platforms for ecosystems, 15% will co-use these platforms, and 80% will exit the market (Gartner 2018).

Based on the findings in this paper, the above statement should be regarded as a hypothesis for further analysis. To this end, the accelerating effect of the current pandemic (COVID 19) will be considered in more detail in another article.

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## NOTES



[1] The classification of the G-SIBs is based on the list published once a year in November by the FSB (Financial Stability Board). The more detailed subdivision of the D-SIBs is the responsibility of the ECB and / or other National Competent Authorities in cooperation with the ECB.

[2] In this paper is not meant in the sense of ecological sustainability, e.g., the compliance with ESG criteria.

[3] RIC: Reuters Instrument Code.