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RELEVANT ASPECTS OF EU LEGISLATION AND CJEU JURISPRUDENCE ON TRADING COMPANIES

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Abstract
The first part of the paper refers to the legal framework at the level of the European Union regarding commercial companies. The analyzed area is regulated largely by the member states of the Union, which, however, are obliged, by virtue of their statute, to permanently adapt their internal legal order on the matter to that of the Union, by appropriating the primary legislation, the regulations and by transposing the corresponding directives. This imperative is determined by the priority of EU law over national legislation. In this sense, we will comment on the main legal provisions of the Union, which aim at: companies' formation, their capital, the obligation to communicate information; the legal situation of the companies that carry out activities in several countries. The second part of the paper highlights some important cases from the jurisprudence of the CJEU, which determine relevant directions in the field.
The work is of great interest for specialists, but especially for the member states, which must comply with the Union framework legislation in the field. Equally, this information is important for the commercial companies, which are obliged to respect and apply exactly the commented regulations.
Keywords: trading companies, legislation, jurisprudence; European Union.
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1. PRELIMINARY CONSIDERATIONS ON TRADING COMPANIES

A company represents a legal person, with all its characteristics recognized by the law, made up of two or more people (with the exception of the limited liability company, which can have only one partner), who participate with sums of money, goods or specific knowledge in carrying out commercial activities, in order to obtain benefits and share them, depending on the contribution of each one.

In the legal literature it has been stated that, after the adoption of the Treaty establishing the European Economic Community, "EU company law harmonization was largely a top-down, technocratic project that was considered imperative to realize the common market [...] it was promoted mainly by the

European Commission and experts advising it without any particular business or investment interest group pushing for harmonization" (Gelter, 2019, p. 2).

As will be noted from the presentation of the legal framework at Union level regarding the setting up of a company, the capital and the disclosure requirements, in 1968, the Council adopted a directive (First Council Directive 68/151/EEC) on coordination of safeguards which, for the protection of the interests of members and others, are required by Member States of companies within the meaning of the second paragraph of Article 58 of the Treaty, with a view to making such safeguards equivalent throughout the Community.

The directive was repealed by another directive from 2009 (Directive 2009/101/EC), so that the latter was also repealed by Directive (EU) 2017/1132, which itself underwent several amendments.

Therefore, at the European Union level, especially since 2017, there has been a constant concern regarding the determination of appropriate regulations regarding companies, to create a beneficial business environment.

The legal regulation of companies was carried out within the broader framework of the internal market and freedom of establishment, expressly provided for by the Treaty on the European Economic Community of 1957 (EEC Treaty), which, with the appropriate amendments, is still in force today, being known under the new name of the Treaty on the Functioning of the European Union, an integral part of the Treaty of Lisbon.

In this paper, some of the most important legal acts adopted at Union level in the field of companies will be presented and commented on, which refer to companies' formation, their capital, the obligation to communicate information; the legal situation of the companies that carry out activities in several countries.

To provide a broader picture of how companies effectively function in practice and the problems that arise, some of the most relevant cases in the field, ruled by the Court of Justice in Luxembourg, are subject to our analysis.

2. THE LEGAL FRAMEWORK OF THE EUROPEAN UNION ON TRADING COMPANIES

A basic legislative framework which is the one established by the European Union offers a much more effective and equal protection to all investors in the member states of the Union and removes the competition regarding legislative regulation between them in the field of company law.

The purpose of European Union rules on companies is to give entrepreneurs the opportunity to create and carry out activities on the territory of the European Union member states; to ensure protection for all interested parties, in particular employees and creditors.

Company law concerns areas of social relations, in which the Union has a competence shared with the Member States. Therefore, according to art. 2 of the Treaty on the Functioning of the European Union (TFEU), "the Union and the

Member States may legislate and adopt legally binding acts in that area. The Member States shall exercise their competence to the extent that the Union has not exercised its competence. The Member States shall again exercise their competence to the extent that the Union has decided to cease exercising its competence".

The aforementioned provision must be corroborated with art. 4 paragraph 1, which lists the internal market among the areas in which shared competence intervenes. The latter "comprises an area without internal frontiers in which the free movement of goods, persons, services and capital is ensured in accordance with the provisions of the Treaties" (art. 26 TFEU).

We will present and comment on the main legal provisions of the Union in this area. In this sense, the primary legislation is of particular importance, which has an immediate, direct application and which has priority over the national legal provisions in the field. Thus, the article 49 paragraph 1 TFEU prohibits restrictions on the freedom of establishment for both natural and legal persons: "[…] restrictions on the freedom of establishment of nationals of a Member State in the territory of another Member State shall be prohibited. Such prohibition shall also apply to restrictions on the setting-up of agencies, branches or subsidiaries by nationals of any Member State established in the territory of any Member State". Then, art. 49 paragraph 2 defines the content of freedom of establishment: "freedom of establishment shall include the right to take up and pursue activities as self-employed persons and to set up and manage undertakings, in particular companies or firms within the meaning of the second paragraph of Article 54, under the conditions laid down for its own nationals by the law of the country where such establishment is effected, subject to the provisions of the Chapter relating to capital".

The legal regulation of the freedom of establishment for the pursuit of a specific activity (art. 49-55 TFEU) is achieved through the adoption of directives, according to art. 50 para. 1 TFEU: "in order to attain freedom of establishment as regards a particular activity, *the European Parliament and the Council*, acting in accordance with the ordinary legislative procedure and after consulting the Economic and Social Committee, *shall act by means of directives*". In this regard, according to art. 50 paragraph 2, the European Parliament, the Council and the Commission exercise several functions, of which the following are of particular importance for the subject under consideration: giving priority to activities which contribute to the development of production and trade; ensuring close cooperation between the competent national authorities, in order to know the special aspects of the various activities within the Union; eliminating those administrative procedures and practices, which arise either from national law or from agreements previously concluded between the Member States, the maintenance of which would constitute an obstacle to freedom of establishment; the progressive abolition of restrictions on

freedom of establishment in each branch of activity in question, as regards, on the one hand, the conditions for setting up agencies, branches or subsidiaries in the territory of a Member State and, on the other hand, the conditions for access of personnel employed at the head office to management or supervisory posts in such agencies, branches or subsidiaries; the coordination, to the extent necessary and with a view to making them equivalent, of the safeguards required by Member States of companies, in order to protect both the interests of members and of third parties.

Article 54 paragraph 2 of TFEU defines companies as follows: 'companies or firms' means companies or firms constituted under civil or commercial law, including cooperative societies, and other legal persons governed by public or private law, save for those which are non-profitmaking.

In addition to the articles commented above, we also mention Article 16 of the Charter of Fundamental Rights of the European Union (the freedom to conduct a business): the freedom to conduct a business in accordance with Union law and national laws and practices is recognized. This legal regulation has several limitations imposed by Article 17 of the Charter (right to property). At the EU level exists a secondary legislation that establish the criteria for founding a company, its capital, the obligation to communicate information.

Important legal regulations in the field were first included in the *Council Directive (68/151/EEC) of 1968* on co-ordination of safeguards which, for the protection of the interests of members and others, are required by Member States of companies within the meaning of the second paragraph of Article 58 of the Treaty, with a view to making such safeguards equivalent throughout the Community. In this sense, it was expressly provided that the coordination measures prescribed by this Directive apply to the laws, regulations and administrative provisions of the Member States relating to the types of company, which exist in the six founding member states of the Treaty establishing the European Economic Community concluded in 1957 in Rome. The first section of the directive under analysis contained regulations on mandatory publicity regarding companies. The second section referred to the validity of the obligations assumed by a commercial company. The next section considered the nullity of companies, which occurred under precisely determined conditions.

The above-mentioned directive has been replaced by Directive 2009/101/EC of the European Parliament and of the Council of 16 September 2009 on coordination of safeguards which, for the protection of the interests of members and third parties, are required by Member States of companies within the meaning of the second paragraph of Article 48 of the Treaty, with a view to making such safeguards equivalent. This 2009 directive was, in turn, repealed by Directive (EU) 2017/1132 of the European Parliament and of the Council of 14 June 2017 relating to certain aspects of company law, the content of which was consolidated in 2022, and which is in force. This normative act is divided into

three titles. The first of these contains general provisions and the establishment and functioning of limited liability companies. The second title refers to conversions, mergers and divisions of limited liability companies, and the last title contains final provisions. This directive contains provisions on disclosure of company information in business registers in Member States to enhance legal certainty in the internal market, and on a system of interconnection of registers

The Directive 2012/17/EU as regards the interconnection of central, commercial and companies' registers was also repealed by the Directive (EU) 2017/1132.

Directive (EU) 2017/1132 has been amended and supplemented by four other separate legal acts: Directive (EU) 2019/1023, Directive 2019/1151, the Directive (EU) 2019/2121 and Directive (EU) 2025/25. These last ones are presented below.

1. Directive (EU) 2019/1023 of the European Parliament and of the Council of 20 June 2019 on preventive restructuring frameworks, on discharge of debt and disqualifications, and on measures to increase the efficiency of procedures concerning restructuring, insolvency and discharge of debt, and amending Directive (EU) 2017/1132 (Directive on restructuring and insolvency)

The purpose of this Directive is to ensure the proper functioning of the internal market and to remove obstacles to the exercise of the free movement of capital and freedom of establishment. These obstacles arise from the different laws of the Member States and from national procedures concerning preventive restructuring, insolvency, discharge of debt, and disqualifications. The mentioned Directive contains provisions relating to preventive restructuring frameworks available for debtors in financial difficulties when there is a likelihood of insolvency, with a view to preventing the insolvency and ensuring the viability of the debtor; procedures leading to a discharge of debt incurred by insolvent entrepreneurs; measures to increase the procedures concerning restructuring, insolvency and discharge of debt.

2. Directive (EU) 2019/1151 includes the rules on online formation of companies, on online registration of branches and on online filing of documents and information by companies and branches, disclosure and registers. On the one hand, the directive aimed to make the use of digital tools and processes more efficient in setting up a company, opening a branch of that company in another Member State and providing complete and accessible information about companies. On the other hand, it aimed to create a single legal framework at Union level for the application of digital procedures in the field of companies. The usefulness of this legal normative act can also be deduced from other considerations, such as: to reduce the time and costs of setting up a company or creating a branch; to provide adequate guarantees to avoid abuse and fraud; to stimulate economic growth; to ensure equal and limited access to information on a company for all Member States. In this regard, the directive in question was

adopted so that the coordination measures contained therein apply to the laws, regulations and administrative provisions of the Member States relating to the types of companies mentioned in the regulation text. Therefore, this directive, which amended Directive (EU) 2017/1132, includes, as a new element, rules for the fully online formation of limited liability companies, fully online registration of cross-border branches and fully online filing of documents and information with business registers). The directive in question aims to increase trust and transparency in the business environment and to facilitate the operations and activities of companies in the internal market. In this respect, it is very important that companies, authorities and other interested parties have access to reliable information about other companies with which they cooperate located in the Member States of the Union. This information may be needed for business purposes or in administrative procedures or judicial proceedings. Thus, Directive (EU) 2019/1151 introduced standards for controls of the identity and legal capacity of persons that form a company, register a branch or file documents or information online.

3. Directive (EU) 2019/2121 of the European Parliament and of the Council of 27 November 2019 amending Directive (EU) 2017/1132 contains detailed rules on cross-border conversions, cross-border mergers and cross-border divisions of limited liability companies. The deadline for transposing this directive into the national legislation of the Member States was 31 January 2023. Also, according to this directive, by 1 February 2027, the European Commission will have to draw up an evaluation of the application of the directive, as well as a report on the conclusions of this evaluation, which will be presented to the European Parliament, the Council and the European Economic and Social Committee.

4. Regulation (EU) 2021/23 of the European Parliament and of the Council of 16 December 2020 on a framework for the recovery and resolution of central counterparties

This regulation comprises rules and procedures relating to the recovery and resolution of central counterparties (CCPs) authorized in accordance with Regulation (EU) No 648/2012). This normative act also contains rules relating to arrangements with third countries in the field of recovery and resolution of CCPs.

According to Regulation (EU) No. 648/2012, central counterparties (CCP) is a legal person that interposes itself between the counterparties to the contracts traded on one or more financial markets, becoming the buyer to every seller and the seller to every buyer.

To contribute to the better functioning of the single market in financial services, it is necessary to have procedures in place where a financial institution or a financial market infrastructure active in that market faces financial difficulties. In this regard, Central counterparties (CCPs) are key components of

global financial markets. CCPs centralize the handling of transactions and positions of counterparties, honor the obligations created by the transactions, and require adequate collateral from their members as margin and as contributions to default funds.

Regulation (EU) No 648/2012 of the European Parliament and of the Council requires CCPs authorized in the Union to observe high prudential, organizational and conduct of business standards. Regulation (EU) No 648/2012 also requires standardized OTC derivatives („OTC derivative contract") to be centrally cleared by a CCP. CCPs set out measures to recover from financial distress.

The lack of harmonized provisions for the recovery and resolution of CCPs across the Union is an obstacle to the proper functioning of the internal market. Therefore, it was necessary to develop such a regulatory act, which is directly and immediately applicable in the legislation of the Member States.

The first title of the regulation establishes its subject matter and defines the financial terms used in its content. The second title contains legal regulations relating to resolution authorities, resolution colleges and involvement of European Supervisory Authorities, decision-making and procedures. The third title concerns recovery and resolution planning, assessment of resolvability, addressing or removing impediments to resolvability, specific coordination procedure to address or remove impediments to resolvability. The following title contains provisions on early intervention (early intervention measures, removal of senior management and board, provision of recompense to non-defaulting clearing members). Title V refers to resolution (objectives, conditions and general principles), valuation **(**objectives, requirements, provisional valuation), resolution tools, resolution powers conferred on the resolution authority necessary to apply the resolution tools effectively. Title VI governs the relations with third countries (agreements with third countries, recognition and enforcement of third-country resolution proceedings, right to refuse recognition or enforcement of third-country resolution proceedings, cooperation with third-country authorities, exchange of confidential information. The following title details administrative measures and penalties. Tile VIII contains amendments to Regulations (EU) No 1095/2010, (EU) No 648/2012, (EU) No 600/2014, (EU) No 806/2014 AND (EU) 2015/2365 and Directives 2002/47/EC, 2004/25/EC, 2007/36/EC, 2014/59/EU and Regulation (EU) 2017/1132. The last title includes final provisions concerning review and entry in force.

In another train of thoughts, Directive (EU) 2017/1132 and Commission Implementing Regulation (EU) 2021/1042 establish rules on the system of interconnection of business registers ('BRIS'), applicable since 8 June 2017. 'BRIS' allows EU-wide electronic access to company information and documents stored in the business registers of the Member States via the European e-Justice Portal. BRIS also allows business registers to exchange

information with each other on cross-border operations and on companies and their cross-border branches.

Of particular importance is also Directive 2009/102, which was amended in 2013. It regulates the basic rules around company law on single-member private limited liability companies. The coordination measures prescribed by this directive shall apply to the laws, regulations and administrative provisions of the Member States relating to the types of company listed in its content.

It is necessary to mention, in the analyzed context, also Directive (EU) 2025/25, which amended both Directives 2009/102 and Directive (EU) 2017/1132 and which refers to further expanding and upgrading the use of digital tools and processes in company law.

Directive 2025/25 aimed to increase the amount and improve the reliability of company documents and information available in business registers or through the system of interconnection of registers, and to enable direct use of company data available in business registers when setting up cross-border branches and subsidiaries and in other cross-border activities and situations). The digital EU power of attorney established under this Directive is without prejudice to national rules on legal and statutory representation or any other types of powers of attorney.

Consequently, by the legal act commented, the system of interconnection of registers (BRIS) existing at Union level is connected with the Beneficial Ownership Registers Interconnection System (BORIS), established by Directive (EU) 2015/849 of the European Parliament and of the Council, as amended by Directive (EU) 2018/843 of the European Parliament and of the Council, which links national central registers containing information on the beneficial owners of companies and other legal entities, trusts and other types of legal arrangements, and with the Insolvency Registers Interconnection system (IRI) established in accordance with Regulation (EU) 2015/848 of the European Parliament and of the Council.

The coordination measures prescribed by this Section shall apply to the laws, regulations and administrative provisions of the Member States relating to the types of companies.

Below, we mention other important amendments made to Directive (EU) 2017/1132 by Directive 2025/25. Thus, new definitions are provided regarding terms used in the field of commercial law, other ways of establishing companies and submitting documents and information are established. Also, Member States shall provide for preventive administrative, judicial or notarial control, or any combination thereof, of the instrument of constitution and statutes of companies listed in the law. There are also changes regarding: online and other procedures (formation, registration and filing), disclosure and registers, documents and information to be disclosed by partnerships, up-to-date registers, EU Company Certificate, digital EU power of attorney, exemption from regulation and any

similar formality, safeguards in cases of reasonable doubt as to origin or authenticity, Safeguards in cases of reasonable doubt as to abuse or fraud, exemption of translation, availability of electronic copies of documents and information, Information on groups of companies, penalties.

Directive 2025/25 underlines the need for this regulatory legal act to be assessed by the European Commission, based on the five criteria (efficiency, effectiveness, relevance, coherence and value added) and present a report on the main findings to the European Parliament, the Council and the European Economic and Social Committee. The evaluation should cover the practical experience with the EU Company Certificate, the digital EU power of attorney, the reduced formalities in cross-border situations for companies, the effectiveness of preventive controls and legality checks and of making the information available free of charge through the system of interconnection of registers, and the application of disclosure requirements for partnerships. Member States shall provide the Commission with the information necessary for the preparation of the report and are obliged to transpose, through appropriate national legal acts, this Directive by 31 July 2027.

3. THE RELEVANT JURISPRUDENCE OF THE CJEU ON TRADING COMPANIES

In this section we will present some of the most relevant cases decided by the Luxembourg Court of Justice in the field under our analysis.

In the Court of Justice's view, the definition of *"establishment"* within the meaning of those articles of the Treaty involves the actual pursuit of an economic activity through a fixed establishment in another Member State for an indefinite period and registration of a vessel cannot be separated from the exercise of the freedom of establishment where the vessel serves as a vehicle for the pursuit of an economic activity that includes fixed establishment in the State of registration. The conditions laid down for the registration of vessels must not form an obstacle to freedom of establishment within the meaning of Articles 43 EC to 48 EC (Judgment of 25 July 1991, Factortame and Others, C-221/89, paragraphs 20-23, Judgment of the Court of 11 December 2007, C-438/05, paragraph 70-71).

According to the Court, freedom of establishment constitutes one of the fundamental principles of the Community and the provisions of the Treaty guaranteeing that freedom have direct effect from the end of the transitional period. Those provisions ensure the right to establish oneself in another Member State not only for Community nationals but also for companies and firms as defined in Article 48 EC (Judgment of 27 September 1988, Daily Mail and General Trust, 81/87, paragraph 15 and Judgment of the Court of 11 December 2007, C-438/05, paragraph 68).

The Court also decided that the freedom of establishment, conferred by Article 43 EC on Community nationals, includes the right for them to take up and pursue activities as self-employed persons and to set up and manage undertakings under the same conditions as are laid down by the law of the Member State of establishment for its own nationals. Furthermore, according to the actual wording of Article 48 EC, "companies or firms formed in accordance with the law of a Member State and having their registered office, central administration or principal place of business within the Community shall, for the purposes of [the provisions of the Treaty concerning the right of establishment], be treated in the same way as natural persons who are nationals of Member States" (Judgment of the Court of 5 November 2002. Case C-208/00, paragraph 56). It is not necessary for the Member States to adopt a convention on the mutual recognition of companies in order for companies meeting the conditions set out in Article 48 EC to exercise the freedom of establishment conferred on them by Articles 43 EC and 48 EC, which have been directly applicable since the transitional period came to an end (Case C-208/00, paragraph 60).

The refusal by a host Member State (`B') to recognize the legal capacity of a company formed in accordance with the law of another Member State (`A') in which it has its registered office on the ground, in particular, that the company moved its actual center of administration to Member State B following the acquisition of all its shares by nationals of that State residing there, with the result that the company cannot, in Member State B, bring legal proceedings to defend rights under a contract unless it is reincorporated under the law of Member State B, constitutes a restriction on freedom of establishment which is, in principle, incompatible with Articles 43 EC and 48 EC. (Case C-208/00, paragraph 82). Therefore, the Court ruled that where a company formed in accordance with the law of a Member State (`A') in which it has its registered office is deemed, under the law of another Member State (`B'), to have moved its actual center of administration to Member State B, Articles 43 EC and 48 EC preclude Member State B from denying the company legal capacity and, consequently, the capacity to bring legal proceedings before its national courts for the purpose of enforcing rights under a contract with a company established in Member State B.

According to the Court, a restriction on the freedom of establishment cannot be admitted unless it pursues a legitimate objective compatible with the Treaty and if it is justified by imperative reasons of general interest. Furthermore, it must be suitable for securing the attainment of the objective pursued and must not go beyond what is necessary to attain that objective (Judgment of the Court of 30 November 1995. Case C-55/94, paragraph 37, Judgment of the Court of 15 December 1995. Case C-415/93 paragraph 104, C-438/05, paragraph 75).

In the same sense, in the Case 55-94, the Luxembourg court ruled that national measures likely to make it more difficult or less attractive to exercise the fundamental freedoms guaranteed by the treaty must meet four conditions: to be applied in a non-discriminatory manner, to be justified by imperative reasons of general interest, to be likely to ensure the achievement of the objective pursued and not to exceed what is necessary to achieve it (paragraph 30).

Likewise, the freedom of establishment prohibits any national measure that is "liable to hamper or to render less attractive the exercise by Community nationals, including those of the Member State which enacted the measure, of fundamental freedoms guaranteed by the Treaty" (Judgment of the Court of 31 March 1993. Dieter Kraus v Land Baden-Württemberg. Case C-19/92; Case C-55/94). The Court also ruled that inequality in application of freedom of establishment is to be avoided (C-438/05).

In the same vein, the prohibition of the use of a trade name as the specific designation of an undertaking is a restriction on the freedom of establishment, but such a restriction is justified by overriding requirements of public interest pertaining to the protection of industrial and commercial property if the primary aim of the restriction is to safeguard trade names against the risk of confusion (Judgment of the Court of 11 May 1999. Case C-255/97).

Since the Community has thus not only an economic but also a social purpose, the rights under the provisions of the Treaty on the free movement of goods, persons, services and capital must be balanced against the objectives pursued by social policy, which include, as is clear from the first paragraph of Article 136 EC, inter alia, improved living and working conditions, so as to make possible their harmonization while improvement is being maintained, proper social protection and dialogue between management and labor (C-438/05, paragraph 79).

The article 43 EC is to be interpreted as meaning that, in principle, collective action initiated by a trade union or a group of trade unions against a private undertaking in order to induce that undertaking to enter into a collective agreement, the terms of which are liable to deter it from exercising freedom of establishment, is not excluded from the scope of that article. The article 43 EC is capable of conferring rights on a private undertaking which may be relied on against a trade union or an association of trade unions (C-438/05).

Also, the article 43 EC is to be interpreted to the effect that collective action such as that at issue in the main proceedings, which seeks to induce an undertaking whose registered office is in a given Member State to enter into a collective work agreement with a trade union established in that State and to apply the terms set out in that agreement to the employees of a subsidiary of that undertaking established in another Member State, constitutes a restriction within the meaning of that article. That restriction may, in principle, be justified by an overriding reason of public interest, such as the protection of workers, if it is

established that the restriction is suitable for ensuring the attainment of the legitimate objective pursued and does not go beyond what is necessary to achieve that objective (C-438/05, paragraph 90).

The Court has decided that, even though the provisions of the Treaty concerning freedom of establishment are directed mainly to ensuring that foreign nationals and companies are treated in the host Member State in the same way as nationals of that State, they also prohibit the Member State of origin from hindering the establishment in another Member State of one of its nationals or of a company incorporated under its legislation which also comes within the definition contained in Article 48 EC. The rights guaranteed by Articles 43 EC to 48 EC would be rendered meaningless if the Member State of origin could prohibit undertakings from leaving to establish themselves in another Member State (Judgment of the Court of 27 September 1988. Case 81/87, paragraph 16; C-438/05, paragraph 69).

Prohibitions on setting-up secondary establishments and the requirement to reapply for a license have been held to be prohibited restrictions (Judgment of the Court of 27 January 2011.C-168/09)

In the Court's opinion, freedom of establishment confers "no right on a company incorporated under the legislation of a Member State and having its registered office there to transfer its central management and control to another Member State" (Case 81/87, paragraph 25).

The freedom of secondary establishment of a company may not be exercised under certain conditions imposed by national legislation such as minimum capital and the liability of directors (Judgment of the Court of 30 September 2003. Case C-167/01).

In the Case 81/87, the Court stated that companies could exercise their right of establishment by setting up agencies, branches and subsidiaries, or by transferring all their shares to a new company in another Member State.

In the Case C-212/97, the Court took exception to a Danish authority's refusal to register a branch of a company validly incorporated in the United Kingdom.

The ECJ had to decide on a case involving the restrictions applied by the (former) state of incorporation (moving out, Wegzugstaat, company leaving the jurisdiction) (Judgment of the Court of 16 December 2008. Case C-210/06).

The European Court has held that companies are creatures of national law and exist only by virtue of the national legislation which determines their formation and functioning. A Member State may subject the right of a company to retain its legal personality under the law of that Member State to restrictions on the transfer to a foreign country of the effective center of management of the company and has the power to define the connecting factor in international company law in respect of its own companies. This power includes the possibility for each Member State not to allow a company governed by its law to

retain that status where the company intends to reorganize itself in another Member State by transferring its registered office to the territory of the latter (Case C-210/06 – Cartesio, paragraphs 99 et seq.).

Therefore, according to the Court, *freedom of establishment* does not apply where a company de facto transfers its central management and control to another Member State but retains the company law status of its country of origin. However, the ECJ has emphasized that it constitutes an obstacle to freedom of establishment if the Member State of incorporation requires the company to be reorganized or wound up, preventing that company from becoming a company governed by the law of the other Member State, in so far as that law permits (Case C-210/06, paragraphs 111 et seq.).

4. CONCLUSIONS

As can be deduced from the above, there is no codified company law at European Union level. This area was regulated within the broader framework of the internal market and, more specifically, of the freedom of establishment, being enshrined in the former Treaty on the European Economic Community, the current TFEU (art. 49-55). Primary legislation in this area was supplemented by article 16 of the Charter of Fundamental Rights of the European Union, the freedom to conduct a business.

The general framework provided by the aforementioned treaty was detailed through a series of directives and regulations, which were subsequently adopted and commented on in detail.

As regards companies formation, their capital, the obligation to communicate information, the legal situation of the companies that carry out activities in several countries, in 1968 a directive was adopted (Directive 68/151/EEC), which referred to the coordination, with a view to equivalence, of the safeguards imposed on companies in the Member States, within the meaning of the second paragraph of Article 58 of the Treaty (EEC Treaty), for the protection of the interests of members or third parties. It was not until 2009 that this directive was replaced by another directive (Directive 2009/101/EC), which was also repealed by Directive (EU) 2017/1132. To develop a positive, efficient and competitive business environment, the 2017 directive was subject to several amendments, determined by existing needs.

The ever-increasing use of digital services and the ever-faster evolution of information technology led to the adoption of Directive 2024/25 on further expanding and upgrading the use of digital tools and processes in company law.

Finally, central counterparties (CCPs), key components of global financial markets, were regulated by Regulation (EU) 2021/23 on a framework for the recovery and resolution of central counterparties.

The freedom of establishment concerning companies has been the subject of an extensive case law. The latter has established the content of the concept of

establishment and determined a series of restrictions on the freedom of establishment for companies. In this sense, a restriction on the freedom of establishment must aim at compliance with several conditions: such a restriction must pursue a legitimate objective compatible with the Treaty; the restriction in question must be justified by overriding reasons in the general interest; the restriction is likely to ensure the achievement of the objective pursued and must not go beyond what is necessary to achieve that objective.

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TRENDS AND DEVELOPMENTS IN THE USE OF DIGITAL CURRENCY

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Abstract
Money is a fundamental element of any economy, playing a crucial role in ensuring the smooth functioning of economic and commercial activities. Over time, money has undergone continuous evolution, adapting to the needs of society and technological advancements. The monetary system has constantly evolved, reaching its most recent stage of development the emergence of digital currencies. These represent an innovative category of financial instruments and include three main types: crypto-assets, stablecoins, and central bank digital currencies (CBDCs).
Crypto-assets were the first to emerge on the market as decentralized alternatives to traditional financial systems. One of their main characteristics is high volatility, which makes them difficult to use as a stable means of payment. For this reason, stablecoins were developed to provide a more predictable value, being backed by assets such as fiat currencies, gold, or other financial instruments. Since control over the money supply is essential for a country's economic policies, central authorities have initiated the development of central bank digital currencies (CBDCs). These are designed to combine the benefits of digitalization with the stability provided by national and international financial institutions. In some cases, CBDCs are developed exclusively by central banks, while other initiatives involve collaborations between multiple financial institutions to ensure an efficient and well-regulated implementation of these new forms of digital currency. Our paper discusses the evolution of crypto assets as well as some key aspects regarding central bank digital currency.
Keywords: *Crypto assets, Stablecoins, CBDC.*
JEL Classification: E42, E58, O30

1. INTRODUCTION

Over time, money has undergone significant transformations, evolving to meet the changing needs of trade and financial systems. From commodity-based currencies and metal coins to fiduciary and scriptural money, the development of global networks and digitalization has paved the way for the emergence of digital currencies. Today, digital money plays a crucial role in modernizing economies and enhancing payment efficiency, offering benefits such as faster transactions, reduced costs, and greater accessibility. However, challenges such

as fraud risks, storage concerns, cryptocurrency volatility, and regulatory uncertainties remain significant issues.

The evolution of money has also influenced payment methods, shifting from physical cash and bank deposits to electronic and digital forms. According to Ali *et al*. (2014), the significance of money is closely tied to its role in economic activity and transaction facilitation. Unlike traditional banknotes and deposits, whose value depends on central bank policies, digital currencies introduce new paradigms in financial systems.

Ahmetaj *et al*. (2022), Auer *et al*. (2022), Rodeck & Adams (2024) categorize digital currencies into three main types: crypto-assets; global stablecoins; Central Bank Digital Currencies (CBDCs).

This paper will explore these three categories in detail, dedicating a section to each. Additionally, the study includes conclusions, providing a comprehensive analysis of the evolving digital currency landscape and its implications for the global economy.

2. THE EMERGENCE AND EVOLUTION OF CRYPTO ASSETS

According to Cryptopedia (2021), crypto assets are native assets of a blockchain network and can be used as a medium of exchange, a store of value, and for paying transaction fees on the network. There are various types of crypto assets, but they all share three common characteristics (Andersen and Arnal, 2024): they are digital representations of rights; they utilize Distributed Ledger Technology (DLT), one version of which is blockchain technology; they operate on a decentralized spectrum and do not depend on central authorities.

Blockchain is a distributed database or ledger, also known as Distributed Ledger Technology (DLT), that operates on interconnected nodes within a computer network. A major innovation of blockchain is its ability to ensure data security without third-party intervention. Data is organized into blocks and linked in a chain, forming the so-called "blockchain." In most cases, blockchain is used in a decentralized manner, ensuring the immutability and transparency of information. Its use has facilitated efficient and instant value transfers by eliminating the need for intermediaries.

However, a known issue called the "*blockchain trilemma*" suggests that a blockchain network can not simultaneously achieve security, scalability, and decentralization. Another relevant concept is *blockchain bridges*, also known as *cross-chain bridges*, which enhance compatibility between different blockchain networks. However, they come with high risks, as they account for nearly half of all attacks on decentralized finance (DeFi).

An important factor is that crypto assets operating on blockchain rely on mechanisms essential for transaction validation and maintaining network trust, impacting both the environment and network security (Andersen & Arnal, 2024). These mechanisms are illustrated in Figure 1.

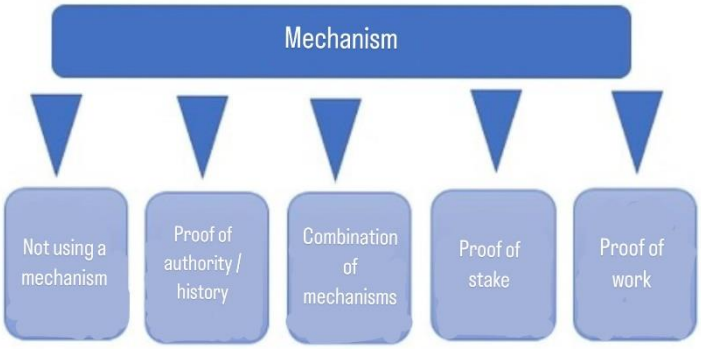


Figure 1. Types of Mechanisms for Crypto Assets Operating on Blockchain
Source: Own elaboration based on Andersen and Arnal (2024)

Figure 1 categorizes mechanisms into two groups: **Classic mechanisms,** which include *Proof of Work (PoW) and Proof of Stake (PoS)*. **Consensus mechanisms**, which include *Proof of Authority (PoA) or Proof of History (PoH), hybrid mechanisms, and even cases where no mechanism is used*. Additionally, consensus mechanisms are considered vulnerable to security attacks, threaten decentralization principles, and could have devastating effects on crypto asset networks. Proof of Work (PoW), used in Bitcoin and Ethereum until 2022, involves an energy-intensive computational competition, where nodes race to solve complex mathematical problems to validate transactions.Proof of Stake (PoS), adopted by Ethereum in 2022, selects validators based on the amount of crypto assets they hold and lock. This shift significantly reduced energy consumption and environmental impact, with Ethereum's transition cutting energy use by 99% compared to Bitcoin and Dogecoin, which still rely on PoW. Proof of Authority (PoA) or Proof of History (PoH) is used by Ripple XRP Ledger (XRPL), where a limited number of actors validate transactions. While some argue this system prevents centralized control over the ledger, critics claim it remains somewhat centralized. Solana uses a combination of Proof of Stake and Proof of History for its consensus mechanism. Tether, one of the most popular stablecoins, does not rely on any consensus mechanism. Key Considerations for Buying and Holding Crypto Assets.

According to HM Revenue & Customs (2021, updated in 2023), Andersen & Arnal (2024), two *important aspects* must be considered.

a) **Private Key** (Symmetric Cryptography)- used for encrypting and decrypting data with a single key that is kept private and exclusively used by the owner. It can be stored on a USB device, a digital storage medium, or a crypto wallet. Two types of crypto wallets exist: *Custodial wallets* managed by third-party platforms (e.g., exchanges) where users access funds through the provider.

Non-custodial wallets allow users to store their private key directly, without involving a third party.

b) **Public Key** (Asymmetric Cryptography)- uses two keys: a public key (available to anyone) and a private key (used for decryption). Transactions require the private key to decrypt data encrypted with the public key.

Crypto asset exchanges fall into two main categories (Andersen and Arnal, 2024):

- *Centralized Exchanges (CEX)* – Act as intermediaries between buyers and sellers, offering user-friendly trading experiences. However, they tend to be more expensive and prone to fraud due to their custodial nature.
- *Decentralized Exchanges (DEX)* – Facilitate direct peer-to-peer transactions, reducing exposure to external threats. However, they are often more complex to use compared to CEXs.

Using EU Regulation 2023, ASF (2022), Bank of England (2020), and Andersen & Arnal (2024), we have illustrated the characteristics of crypto assets in Figure 2.

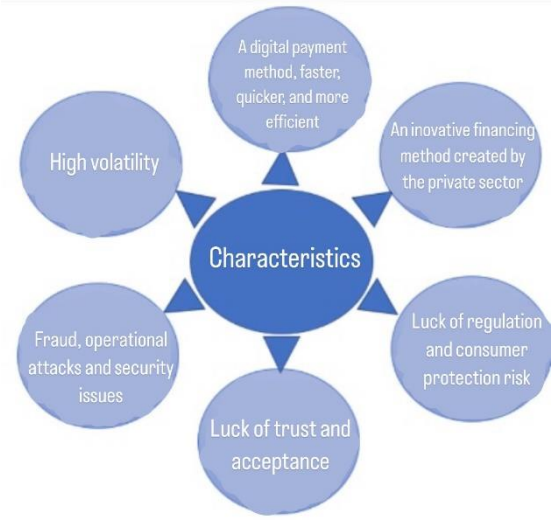


Figure 2. Characteristics of Crypto Assets
Source: own elaboration based on EU Regulation 2023, ASF (2022), Bank of England (2020), Andersen & Arnal (2024)

Examining Figure 2, we find that crypto assets represent an innovative form of financing used by market participants. They are issued by the private sector but remain unregulated by public authorities. Due to their lack of regulation and high volatility, crypto assets pose risks such as: consumer protection concerns, increase in fraud cases, operational attacks and security vulnerabilities and others. These factors contribute to decreasing trust and acceptance of crypto

assets as a means of payment. Furthermore, some crypto assets, such as Bitcoin, have a limited supply, which affects their use as a currency. Despite their risks, crypto assets offer several advantages, including: diversification of payment methods, fast transaction processing, lower costs and increased efficiency, global reach and elimination of intermediaries, connecting global markets.

As of 2024, the crypto market included nearly 9,000 crypto assets. However, only two dominated market capitalization: Bitcoin and Ethereum. Together, they accounted for over 80% of the total market capitalization, as shown in Table 1.

Table 1. Top Crypto Assets by Market Share and Total Value (March 2024)

Crypto assets	**Total Value (mdl USD)**	**Market share (%)**
Bitcoin	*1368*	*61,8*
Ethereum	*43*	*19,4*
Thether	*104*	*4,7*
BNB	*88*	*4,0*
Solana	*85*	*3,8*
XRP	*35*	*1,6*
USDC	*32*	*1,4*
Dogecoin	*26*	*1,2*
Cardano	*24*	*1,1*
Avalanche	*22*	*1,0*

Source: CoinMarketCap, Live Cryptocurrency Charts & Market Data

Table1 highlights Bitcoin and Ethereum as the dominant crypto assets. Unlike Bitcoin, which offers a single token, Ethereum supports both tokens and smart contract functionality. Bitcoin relies on Proof-of-Work (PoW), while Ethereum has shifted to Proof-of-Stake (PoS). Bitcoin's supply is capped at 21 million coins, with over 18 million already in circulation, though the halving process slows issuance. A key milestone was Bitcoin's adoption as legal tender in El Salvador in 2021, bringing economic risks.

Beyond Bitcoin and Ethereum, some of the largest crypto assets by market capitalization we can mention in the following.

a. *Tether (USDT) and USDC* – Stablecoins pegged to the U.S. dollar.

b. *Dogecoin (DOGE)* – Initially created as a joke in 2013, Dogecoin gained massive popularity and is now one of the most well-known crypto assets, ranking 8th by market capitalization.

c. *Solana (SOL)* – Developed to promote Decentralized Finance (DeFi), Solana recorded a 1,000% increase in 2023, outperforming many major crypto assets. It enables fast, large-scale transactions, similar to traditional payment networks.

d. *Avalanche (AVAX)* – Designed to facilitate fast, low-cost transactions, Avalanche has seen a significant rise in popularity due to its low transaction fees, making it an attractive platform for DeFi transactions.

e. *XRP (Ripple)* – Developed in 2012 by Ripple Labs, XRP and its ledger system were created to provide fast and cost-effective solutions for business-to-business (B2B) payments, particularly improving cross-border transactions.

3. STABLECOINS AND THEIR CHARACTERISTICS

Several authors (Bullmann *et al*., 2019; Wang *et al*., 2020; Caramichael and Liao, 2022; Barthélémy *et al*., 2023; Andersen and Arnal, 2024) highlight stablecoins as a major topic due to their rapid growth, global adoption, and financial risks. As part of the crypto ecosystem, they were introduced to reduce volatility by pegging their value to assets like the US dollar, other fiat currencies, crypto assets, or commodities like gold. Recorded on distributed ledger technologies (DLT), stablecoins serve as both a store of value and a medium of exchange.

Despite stabilization mechanisms, they remain vulnerable to operational risks, issuer behavior, and regulatory uncertainty. Their stability depends on issuance, redemption processes, and reserve levels. While offering liquidity, stablecoins face risks such as peg failures or platform collapses. Effective regulation is crucial for investor protection and financial stability (D'Avernas *et al*., 2022).

According to Li and Mayer (2022), there are three regulatory approaches for stablecoins: *capital requirements*, which establish minimum reserve levels; *token pegging*, which restricts excess economic surplus by managing the risks of the underlying assets; *reserve asset risk restrictions*, which determine the level of risk associated with reserve assets the higher the risk, the larger the required reserves to maintain price stability.

Stablecoin issuers both centralized entities and decentralized organizations implement three main stabilization strategies (Barthélémy *et al*., 2023):

- *holding reserves in US* dollars for each token issued, with a promise of 1:1 redemption.
- *over-collateralizing crypto assets locked in a smart contract*, ensuring adequate reserves to maintain peg stability. If the collateral value falls, automatic liquidation mechanisms are triggered.
- *incentivizing arbitrageurs to maintain the peg*, similar to foreign exchange interventions.

As highlighted by Bullmann *et al*. (2019), D'Avernas *et al*. (2022), stablecoins can be categorized based on the type of reserves backing them a classification illustrated in Figure 3.

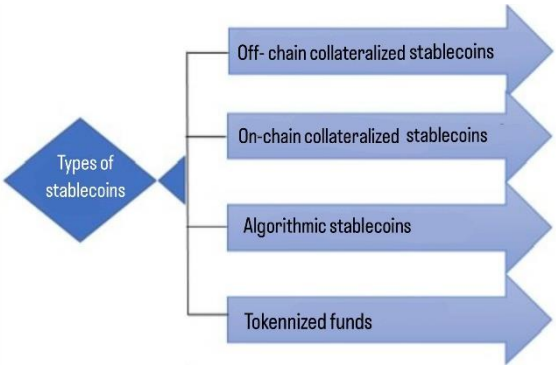


Figure 3. Types of Stablecoins Based on Their Reserve Structure
Source: Own elaboration based on Bullmann *et al*. (2019), D'Avernas *et al*. (2022)

Figure 3 highlights the classification of stablecoins into *on-chain and off-chain collateralized stablecoins, algorithmic stablecoins, and tokenized funds*. *Collateralized stablecoins* rely on backing assets that users can redeem, always requiring an entity responsible for managing the reserves. *On-chain collateralized* stablecoins are governed by smart contracts, and redemption may involve selling rights to future revenues. *Algorithmic stablecoins* are theoretical constructs designed to maintain price stability relative to a reference currency. They are managed by algorithms and not fully backed by the assets they represent. *Tokenized funds* are created on existing blockchain-based platforms and serve multiple purposes, including financing, decentralization, access to platform-specific services, and gaming. These tokens can also represent tangible or intangible assets and function as governance mechanisms for blockchain projects.

The composition of a stablecoin's reserves is crucial for understanding its impact on credit supply. Caramichael and Liao (2022) explore *three possible reserve frameworks* and their effects on credit intermediation, outlined below:

✓ **Narrow Banking Framework** - stablecoins are fully backed by commercial bank deposits, which are in turn entirely backed by central bank reserves. This method would ensure the stablecoin's security, as it effectively functions as a central bank digital currency (CBDC). However, it poses a risk of credit disintermediation during financial stress or panic, as commercial bank deposits could migrate massively to stablecoins, disrupting credit supply.

✓ **Two-Tier Intermediation Framework**- stablecoins would be backed by commercial bank deposits used for fractional reserve banking. Stablecoin issuers rely on bank deposits as reserve assets, while commercial banks engage in fractional reserve banking using stablecoins and/or stablecoin deposits. This framework preserves banking intermediation, as stablecoin deposits are treated similarly to non-stablecoin deposits in terms of regulatory oversight and risk limits.

✓ **Securities-Based Framework**- stablecoin issuers could hold cash-equivalent securities such as Treasury bills and high-quality commercial paper instead of depositing funds in commercial banks. These securities could be acquired directly or indirectly through market intermediaries.

To construct a scenario where fiat-backed stablecoins are widely adopted within a stylized version of the banking system, Carmichael and Liao (2022) consider several key elements:

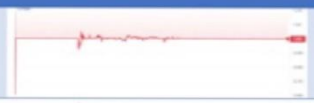
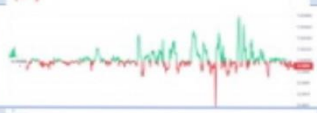
1. **Sources of entry** include both physical banknotes and commercial bank deposits. Households and businesses may choose to convert part of these liquidity sources into stablecoins.
2. **Reserve framework** are several reserve frameworks for stablecoins can be explored, including a *narrow framework*, where stablecoins are fully backed by commercial bank deposits, which are in turn fully supported by central bank reserves. Also, a *two-tier intermediation framework*, where stablecoins are backed by commercial bank deposits used for fractional reserve banking.
3. **Impact on balance sheets** includes evaluating how inflows and reserve allocations affect liquidity, lending, and financial stability.
4. **Interdependence and fund flows** involves visualizing the flow of commercial bank deposits and banknotes converted into stablecoins, as well as how these funds are allocated into reserves in the form of commercial bank deposits and securities.

In recent years, stablecoins have seen significant development, experiencing continuous growth in popularity. Thus, Table 2 further highlights the top 5 most used stablecoins as of May 2024, along with some essential details about them.

Table 2 highlights the top five stablecoins: Tether, USDC, DAI, First Digital USD, and USDD. Tether stands out with the highest trading volume and market dominance, followed by USDC and DAI.

Tether and USDC are the most popular, with market capitalization surging from $5 billion in 2020 to nearly $200 billion in two years. Launched in 2014, Tether is backed by US dollars, other fiat currencies, and gold, though it has faced occasional instability. USDC, introduced in 2018, is regulated, fully backed by US dollars, and undergoes regular audits for transparency. Despite being designed for stability, stablecoins remain sensitive to external factors. Financial institution bankruptcies can trigger temporary devaluations or even collapses, as seen with UST, which failed due to technical flaws (Barthélémy *et al*., 2023; Andersen and Arnal, 2024).

Table 2. Analysis of the Top 5 Stablecoins in the Market, May 2024

Stablecoins	Trading volume (mln USD)	Market position	Evolution
Tether (USDT)	43.346	3	
USDC	3.864	6	
DAI	188	24	
First Digital USD	3.812	37	
USDD	4.745	109	

Source: CoinMarketCap, Live Cryptocurrency Charts & Market Data

Caramichael and Liao (2022) emphasize that there is potential for growth in stablecoins across several *areas*, which are highlighted below.

- *More inclusive financial and payment systems* by enabling faster, cheaper, and more inclusive payments, reducing payment barriers for cross-border transfers, and allowing broader participation in financial systems.
- *Tokenized financial markets* that could bring benefits such as real-time settlement, increased liquidity, and enhanced transparency. Stablecoins would play a crucial role in facilitating transactions and supporting tokenized assets.
- *Supporting next-generation innovations* like Web 3, which involves a shift towards decentralized networks and efficient micro-payments. Such innovations could lead to the widespread use of stablecoins in online services and the digital economy.

4. CENTRAL BANK DIGITAL CURRENCY: RECENT DEVELOPMENTS, CREATION PROCESS STAGES, BENEFITS, AND RISKS

According to Rösl and Seitz (2022), Stanley (2022), Kiff *et al*. (2020), central bank digital currency (CBDC) represents a digital version of money, issued and monitored by central banks with enhanced security and inherent stability, as opposed to the volatility associated with crypto assets. In 1993, the *Bank of Finland* launched *Avant*, a smart card that represented an electronic form of cash. Although this system was abandoned in the early 2000s, *it can be*

considered the precursor to the world's first CBDC. However, CBDC research did not see significant global development until recently, spurred by technological advances and the decline in cash usage.

Figure 4 presents a taxonomy comparing cash with four types of digital money (CBDC, sCBDC, stablecoins, and crypto assets) based on criteria such as the issuer, legal status, central bank backing, attachment to a fiat currency, peer-to-peer transfer capability, and programmability.

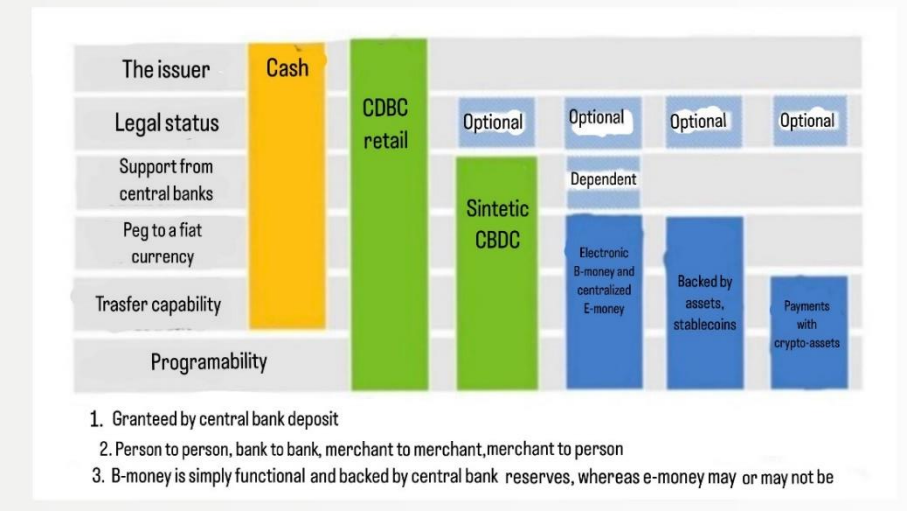


Figure 4. Types of money and their key attributes
Sourse: Kiff *et a*l. (2020)

Figure 4 highlights key differences among digital currencies. Central bank digital currencies (CBDCs) are the only ones meeting all six essential attributes: public issuance, legal status, central bank backing, fiat anchoring, transfer capability, and programmability. Cash lacks only programmability, while cryptocurrencies have just transfer capability and programmability. Stablecoins and centralized electronic money add fiat anchoring, while synthetic CBDCs also include central bank support but remain incomplete compared to full CBDCs. Other digital currencies, such as synthetic CBDCs, stablecoins, and crypto assets, lack at least one key attribute, particularly legal status, limiting their economic influence.

Figure 5 further categorizes central bank digital currencies into wholesale and retail types.

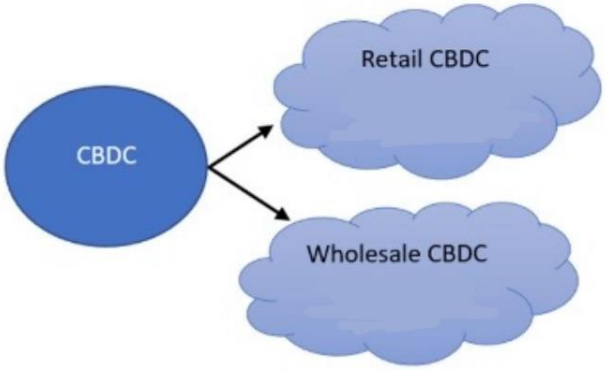


Figure 5. **Types of CBDCs from the perspective of the intended public**
Source: elaborated based on Rösl and Seitz (2022), PwC (2021), Li and Mayer (2021)

It is important to highlight that traditionally, money issued by central banks was only available to the public in the form of cash. Regarding the development of digital currency, it takes place from the perspective of two types: retail and wholesale. Retail CBDCs aim to create a digital form of money issued by central banks that is accessible to everyone. In contrast, wholesale CBDCs focus on facilitating digital transactions between banks, such as securities settlement and cross-border payments, in a safer and more efficient manner.

One of the main compromises of CBDCs is anonymity, which is initially provided by crypto assets. Addressing this issue requires special attention from governments, focusing primarily on the security of the process as well as the proper design and architecture of CBDCs. Therefore, an appropriate architecture must be approached to ensure CBDCs meet their initial objectives and provide security and safety for transactions. Three main architectures identified by Auer *et al*. (2022), Li and Mayer (2021) can be seen in Figure 6.

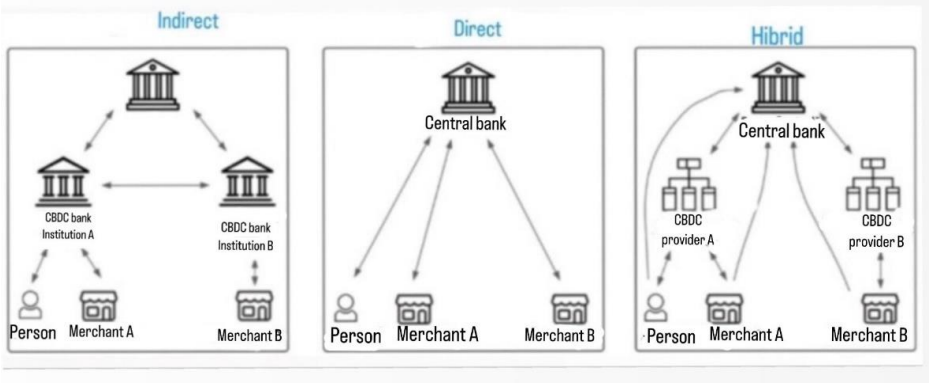


Figure 6. CBDC architecture: indirect vs direct vs hybrid
Source: Li and Mayer (2021)

Figure 6 presents three CBDC models. The direct model allows the central bank to process all payments and track transactions, similar to cash. The indirect (synthetic) model relies on banks as intermediaries, with the central bank holding claims but not processing transactions. The hybrid model combines both, enhancing resilience but requiring a more complex infrastructure.

Kiff *et al*. (2020) suggest that a flexible CBDC architecture can adapt to user needs and technologies, promoting competition and interoperability. As shown in Figure 7, CBDC systems can operate in single-tier or multi-tier structures.

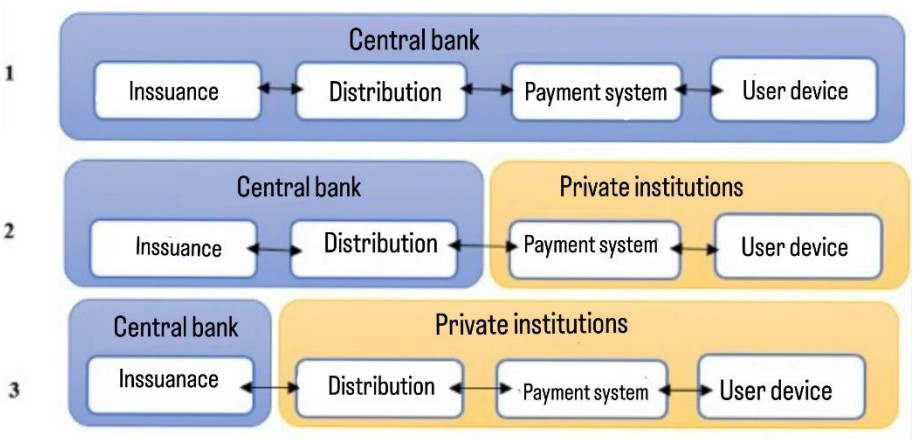


Figure 7. Levels of responsibilities assumed by the Central Bank
Sourse: Kiff *et al*. (2020)

In the *single-tier model*, the central bank manages all CBDC functions, including issuance and wallet management, providing full control but requiring significant resources and potentially competing with private payment providers. *The multi-tier model* (or platform model) allows the central bank to issue CBDC while outsourcing account management to private entities, reducing disruption, and easing integration with consumer technology. The choice depends on financial sector stability, infrastructure, and available resources.

For efficient CBDC operation, key considerations include:

✓ *Transaction Security*: The central bank issues CBDC, while payment service providers (PSPs) facilitate transactions, ensuring integrity and preventing reversals or block removal.

✓ *Security & Confidentiality*: Distributed systems store data across multiple locations for real-time access, while decentralized ledgers distribute trust among entities.

✓ *Prevention of Double Spending & Counterfeiting:* Robust validation mechanisms protect user confidentiality and transaction legitimacy.

✓ *Availability & Design Limits:* Offline capabilities and holding limits, like the Bahamas' "Sand Dollar," help ensure stability and prevent financial disruptions.

✓ *Smart Contracts & Programmability:* Automating transactions via blockchain-based contracts enhances efficiency while maintaining security.

Bordo and Levin (2017) and Li and Mayer (2021) outline two CBDC issuance models:

- *Central Bank Token Issuance*- Similar to Bitcoin, this model allows direct transfers between parties without intermediaries, using Distributed Ledger Technology (DLT) for verification.
- *CBDC Account-Based Issuance*- Individuals and firms hold electronic funds in CBDC accounts at the central bank or supervised institutions. Payments are processed directly by the central bank, requiring authentication and validation, extending the current banking system.

In Figure 8, the key differences between token-based and account-based CBDC systems are illustrated, focusing on how transactions and authentication occur in each model.

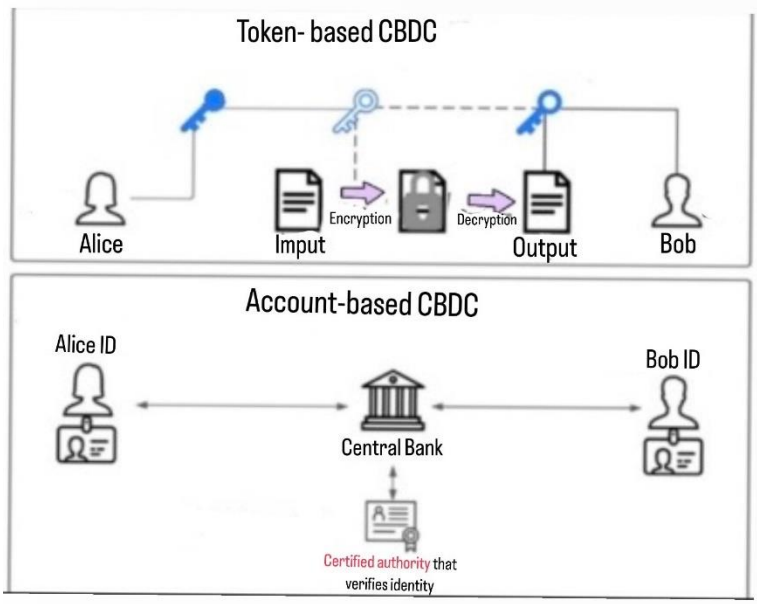


Figure 8. CBDC Access Models: Token-Based vs. Account-Based
Source: Li and Mayer (2021)

Both token-based and account-based CBDCs use digital ledger technology for transactions, but token-based systems are more vulnerable to counterfeiting

and require strong validation methods. Account-based systems offer instant, fee-free payments, while token-based ones are less efficient and more costly. Implementing an account based CBDC could boost GDP by 3%, but it should complement, not replace, private payment systems to maintain competition.

CBDC research is driven by global trends like the rise of cryptocurrencies, stablecoins, tech companies in payments, and digital payment growth post-COVID. Central banks see CBDCs as a way to improve payment efficiency, enhance financial stability, and promote inclusion, especially in emerging markets.

Thus, Figure 9 highlights the intensity of these motivations from the perspective of the two types of CBDCs: wholesale and retail, distinguishing how developed and emerging economies approach the issuance of CBDCs based on these factors.

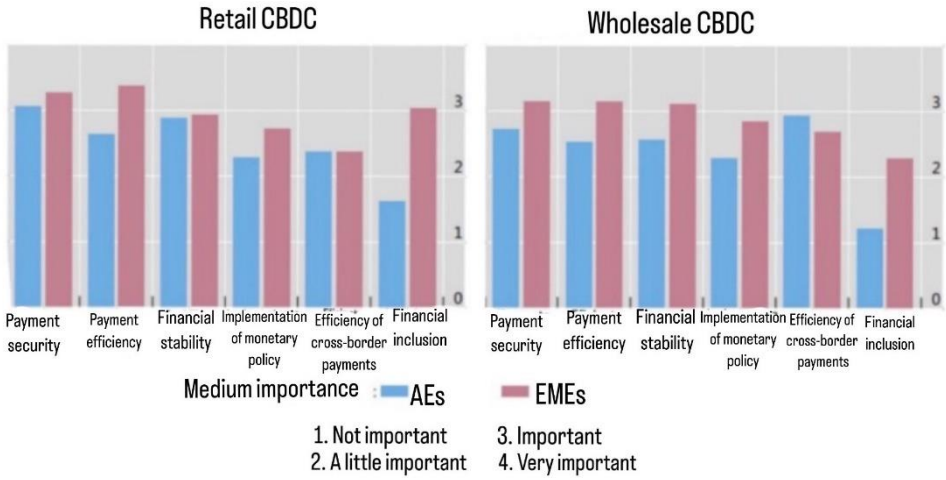


Figure 9. Motivations for issuing CBDC for central banks in developed (AEs) and emerging (EMEs) countries
Source: Auer *et al*. (2022)

Figure 9 highlights key priorities for retail CBDCs in emerging countries, focusing on payment security, transaction efficiency, and financial inclusion, while also considering financial stability and cross-border payments. In developed countries, financial inclusion is less critical, but payment security remains a top priority alongside other motivations. For wholesale CBDCs, priorities align with retail CBDCs but with a stronger emphasis on payment security in developed markets. In emerging markets, financial inclusion plays a smaller role, while other factors remain significant.

As CBDC projects evolve, a structured methodology for project management becomes essential, especially in research and development.

According to Tourpe (2023), the "5 P methodology" provides a structured approach tailored to different development strategies. Large-scale projects, including digital currencies, require a flexible yet systematic framework to assess feasibility, risks, and benefits, as illustrated in Figure 10.

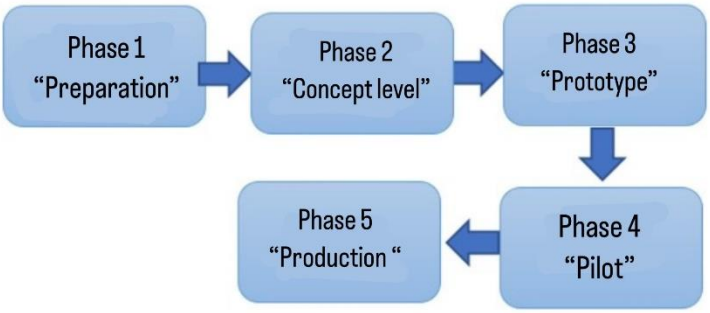


Figure 10. Phases of creating a central bank digital currency
Source: Own elaboration based on Tourpe (2023)

Figure 10 outlines the five stages of CBDC development: Preparation, Concept, Prototype, Pilot, and Production. Each stage helps the team manage the process efficiently, with key decisions on whether to advance, pause, partially transition, or stop the project.

1. *Preparation* - Establishes foundations, evaluates risks (technological, legal, monetary), and explores potential use cases.
2. *Concept* - Tests initial hypotheses, defines success conditions (policy goals, user needs, legal/financial aspects), and conducts market research before deciding on further development.
3. *Prototype* - Develops and tests a prototype in a controlled environment with stakeholders, assessing feasibility before moving forward.
4. *Pilot* - A near-final stage involving real-world testing, scalability, and user experience analysis to determine readiness for launch.
5. *Production* - Focuses on maintaining and improving the CBDC system, ensuring resilience, flexibility, and long-term innovation.

5. CONCLUSIONS

Over time, money has evolved significantly, driven by the need to enhance trade efficiency. From commodity money and metal coins to fiduciary and scriptural forms, digitalization and global network expansion have enabled the emergence of digital currencies. Today, digital money is becoming increasingly relevant, supporting economic modernization and payment optimization. Its advantages include fast transactions, lower costs, and global accessibility. However, risks such as fraud, storage challenges, cryptocurrency volatility, transaction irreversibility, and public distrust remain. The introduction of digital

currencies aims not only to improve payment efficiency but also to fulfill money's three essential functions: medium of exchange, store of value, and unit of account.

Cryptocurrencies initiated the digitalization of money, providing alternatives to traditional currencies but facing regulatory challenges. Due to their high volatility, they are not considered true money, as they only partially fulfill monetary functions. Bitcoin continues to dominate the cryptocurrency market, followed by Ethereum and Tether.

Stablecoins were developed to address cryptocurrency volatility by implementing stabilization mechanisms. Their stability depends on the management of issuance, redemption, and reserve backing, while proper regulation is essential for investor protection and financial market stability. Tether and USD Coin are among the most popular stablecoins, experiencing significant growth in recent years.

Initially, central bank-issued money was available to the public only as cash. The rise of cryptocurrencies and stablecoins in the private sector has prompted central banks to explore digital currencies (CBDCs). CBDCs are digital versions of central bank money, offering enhanced security and stability. Their introduction could bring significant changes to the financial system, making it crucial for governments to design effective models that prevent economic disruptions.

While the widespread adoption of alternative payment methods beyond the national currency remains unlikely in the near future, CBDCs are not the only way central banks can modernize the economy.

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DIGITAL TRANSFORMATION IN BANKING: KEY FEATURES, TRENDS, AND FUTURE PERSPECTIVES

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Abstract
In an era defined by the rapid advancement of digital technologies, the banking sector is undergoing a profound transformation. This evolution is absolutely necessary in order to enhance operational efficiency, ensure high security for financial transactions, and meet the growing expectations of the clientele. However, the changes in banking services and products cannot occur without challenges. While they bring numerous advantages, such as increased accessibility and faster transactions, they also introduce certain risks. These risks include cybersecurity threats, regulatory challenges, and the need for continuous technological adaptation. To address these concerns, banks are actively seeking ways to mitigate potential threats while simultaneously embracing innovation. The constant need to keep up with technological progress has led to the emergence of new trends in the banking sector. Digitalization, automation, and the integration of artificial intelligence are shaping the future of financial services, offering both opportunities and challenges for institutions and consumers alike. In this study we aim to highlight the main characteristics of the transition from traditional to digital banking, the main advantages and risks, as well as the future trends of the digitized banking sector.
Keywords: digitalization, banking sector, key technologies, opportunities and risks, future trends.
JEL Classification: G21, L86

1. INTRODUCTION

Traditionally, banks carry out financial intermediation activities, therefore, playing an important role in the economic development of nations. Nowadays, new technologies, along with the increasing complexity and sophistication of techniques and products, have contributed to redefining the nature of classic bank activities. The global banking sector is facing new challenges arising from the significant increase in the number of customers, as well as the number and, most importantly, the volume of transactions conducted by them. Furthermore, since the beginning of the millennium, with the grand technological progress, customer expectations towards banking products and services have changed. As a result, banks are shifting their focus from administrative functions to technical and commercial aspects in order to better meet the needs of its clientele

(Bădulescu, 2007). On the one hand, digital transformation enhances efficiency, reduces operational costs, and improves customer experience by offering faster, more accessible, and personalized financial services. On the other hand, digitalization comes together with an increased cybersecurity risk, operational risk, and problems related to the digital inclusion of the clientele. Given these factors, banks must adopt a balanced approach, leveraging the benefits of digitalization while proactively addressing potential challenges and ensuring a seamless transition for all stakeholders. Future trends in the digitized banking sector focus on minimizing these risks and benefiting from the emerging innovations, securing a trustful, long-term relationship with its clients.

Our study aims to highlight the main innovations that have shaped the evolution of the banking sector through digitalization, as well as the key characteristics of the new technologies adopted by banks in the transition to digital banking. Moreover, we strive to emphasize the fact that the digitalization process has both advantages and challenges, which banks must carefully consider. The future of the banking sector will be highly digitalized, integrating innovations like artificial intelligence and blockchain while fostering collaborations with FinTechs. Additionally, authors such as Petare et al. (2024) highlight the emergence of Central Bank Digital Currencies (CBDCs) as a key element in the evolving financial landscape.

In order to achieve the research objective, our paper is organized as follows: section 2 provides a description of the main events in the evolution of traditional banking, as well as the key technology features in banks' digitalization; section 3 emphasizes both the benefits and challenges that should be considered, while section 4 highlights the future trends of the bank sector. The paper ends with some conclusions.

2. EVOLUTION OF TRADITIONAL BANKING SERVICES AND KEY TECHNOLOGY FEATURES IN BANKS' DIGITALIZATION

The transformation of traditional banking services has been driven by accelerated technological advancements, reshaping the way financial institutions operate and interact with customers. As banks shift to a new era characterized by digitalization, they integrate key technological innovations that enhance efficiency, security, and customer experience, leading to structural changes in the banking landscape.

The first signs of the technological revolution in the banking sector emerged in the field of payment methods, specifically with the introduction of bank cards back in the 1950s. The advancement of communication channels and calculation methods led to the development of a telematic infrastructure that enables the automated processing of payments. In this way, the term *electronic payment* was born. According to the Romanian legislation, this concept can be defined as ”any payment transaction initiated through electronic payment

instruments" (NBR, Regulation No. 4 / 13.06.2002). Over the years, the value of this type of payment shows an upward trend in the majority of countries. For example, in the European Union, these reached 240 trillion EUR in 2021, compared to 184.2 trillion EUR in 2017 (Meyer and Teppa, 2024). Some authors (for example, Căpraru, 2014) underline a set of main features of electronic payments, such as:

- presenting the encoding / decoding of payment transactions during their execution;
- moving through electronic messages via telecommunication lines between participants;
- high speed of execution, being processed almost in real-time;
- reducing the default risk;
- prevention of human errors in payment processing;
- increasing the bank's operational risk (the probability of system failure or potential fraud).

The *bank card* is an instrument of electronic payment that is considered to be "a success of the modern banking" (Turliuc, 2002). At the same time, it represents an instrument that offers access to a variety of automated banking services. The use of bank cards relies on essential technological infrastructure, including ATMs and POS terminals. These devices enable secure and efficient transactions, allowing customers to access their funds and make payments. Derived from simple magnetic stripe cards that revolutionized the financial industry through the electronic storage of information, *smart cards* represent plastic cards containing semiconductor elements that allow them to store or process information (Patriciu *et al.*, 2001).

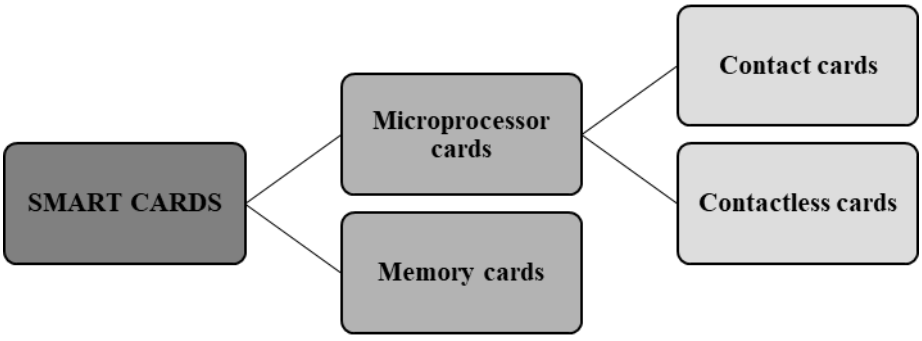

Figure 1. Types of smart cards
Source: authors elaboration based on Patriciu *et al.* (2001, pp. 232-233)

As reflected in Figure 1, these are grouped in two main categories: memory cards (incapable of processing information, serving as storage devices similar to the old magnetic stripe cards) and microprocessor cards (equipped with a large storage capacity and a microprocessor that processes information locally), which are further divided into contact and contactless cards. The difference between the latter consists in how the information is transmitted to the card reader. Contactless technology refers to the ability to make a payment with a card or an electronic device by holding it at a small distance from the merchant's terminal.

The progress of these cards used for electronic payments doesn't stop here, and the concept of *virtual bank cards* marks a new era in the digitalization of the banks' payment instruments. Their operating principle is similar to physical cards, being easy to use for making payments online or through POS terminals with the help of a smartphone and an app, such as Apple Pay or Google Pay. However, the main disadvantage is that they cannot be directly used at ATMs to withdraw cash. The virtual card can exist alongside a physical card and is issued through mobile banking apps. This technology has become an essential element in nowadays' society, being widely accessible to the general public, as highlighted in a recent study by the European Central Bank (2022). The results emphasize that, overall, in the euro area, 94% of respondents have access to a bank card, with the highest values (99%) recorded in Germany and Finland.

Another aspect of the evolution of traditional banking services due to digitization is the transition from classic cashless payment instruments, such as checks and paper payment orders, to similar digital formats known as *eCheck* and *electronic payment orders*. These innovations work according to the same rules, following a similar circuit, but they are distinguished by their digital form, as they are being transmitted as encoded electronic messages and offer a higher level of security compared to paper versions (Kumar and Dalal, 2017). Moreover, those who use eChecks are provided with an electronic checkbook, which stores and provides information about the client's private key and certificate, which are used in the process of generating and signing electronic checks (Băcioi, 2015). Additionally, it should be noted that these instruments employ a two-factor authentication mechanism (in addition to the digital signature, there is also a PIN code), which enhances the security level of the transactions.

Due to the accelerated evolution of technology, the banking sector has undergone a transformation in terms of current services, like deposits, loans, and payment methods, as well as services related to specialized activities, such as those concerning financial markets or international financing. Among the factors that have had a major influence on the transformation of these services is the COVID-19 pandemic. As a result of the imposed restrictions, the banks' customers were forced to use alternative channels for accessing banking services. The use of software apps provides the opportunity to diversify and

multiply banking services, as well as to process banking transactions in real-time. Thus, we can state that the pandemic has acted as a catalyst for the digitalization of the banking sector. Flejterski and Labun (2016) highlight that, due to the digital transformation of banking activities, there is also a change in the functions that banks perform (see Table 1).

Table 1. Banks' activities: past versus present

Bank tasks	Past	Present
Providing a system through which payments can be made	The presence of banknotes and coins, physical bank cards, accompanied by a medium level of security.	Contactless payments and payments made through mobile apps, assuring a higher level of security
Raising funds for financing big projects	Exclusive – a small number of people are capable of making investments while being well informed about the subject in question	Inclusive – a significant number of people can invest through trading platforms and crowdfunding, receiving all the necessary assistance
The transfer of resources over time, between regions and industries	Loans and deposits intermediated by the bank	Direct transfers between agents, low level of intermediation
Risk management	Use of "Big Numbers" theory: portfolio diversification reduces portfolio volatility	Use of Big Data analysis to determine risk pricing with greater accuracy

Source: Flejterski and Labun (2016, pp. 5-15)

Thanks to digital transformation, new key players have emerged in the banking market, significantly altering the competitive landscape. These players, beside FinTech companies, and tech giants, also include digital banks, known as *neobanks*. These are defined by Rybakov (2019) as "branchless banks which offer high quality internet and mobile banking services". Neobanks typically operate with a smaller workforce compared to traditional banks, with most employees focusing on specific tasks such as managing call centers or maintaining the bank's telematics infrastructure. However, these institutions are increasingly adopting advanced technology, such as robo-advisors and chatbots, to interact with customers more efficiently. By relying on artificial intelligence and automation, neobanks can offer 24/7 customer support and personalized financial advice. One of the key characteristics of neobanks is their strong emphasis on creating user-friendly, innovative banking products and services, which are primarily tailored to meet the needs of individual customers, offering a more flexible and accessible alternative to conventional banking. Consequently, digital banks that target businesses and corporate clients have a smaller market share (Evdokimova, 2018). The most popular neobanks in Europe are Wise, Revolut, and Straling Bank,

followed by Lunar, Bunq, N26, and Monese. The number of countries these banks operate in is reflected in Figure 2.

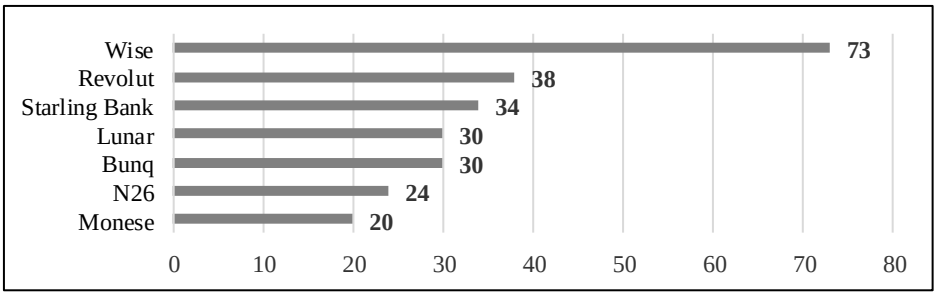

Figure 1. Number of countries of operation for online banks in Europe as of January 2025

Source: Statista, available at: https://www.statista.com/statistics/763970/number-of-countries-of-operation-for-select-online-banks-in-europe/

We also observe that among the competitors of traditional banks are FinTech companies, where the concept of finance merges with technological innovation (Wewege, 2020), benefiting from the significant growth in demand for digital financial services (Papathanassiou, 2024). These companies stand out by focusing on the use of technology to improve various aspects of financial services, while digital banks offer a full range of banking products and services, operating with a banking license but without any branches. A comparative analysis between these is reflected in Table 2.

Table 2. Comparative analysis between digital banks and FinTech companies

	FinTech companies	Digital banks
Description	Start-ups with a high level of technological development, focusing their activities on P2P lending, Forex transactions, cryptocurrencies crowdfunding, and blockchain	Start-ups with a high level of technological development, operating as a bank. They are independent or part of a parent company. They focus their activities on P2P lending, Forex transactions, crowdfunding, and micro crediting
Examples	Ripple, Stripe, WeFinance	Starling, Monzo, Revolut
Strengths	Service quality, attractive prices, accessibility	Service quality, accessibility, attractive prices, bank license
Weaknesses	Low trust from clients, bank expertise, business scalability	Scalability of the business, financing
Perspectives	Service providers for banks and Big Tech companies	Integrated part of the banking ecosystem

Source: Rybakov (2019, p. 27)

The main beneficiaries of the FinTech revolution are the customers. Due to the fact that they are cost-effective, FinTech companies offer a diverse variety of services at a low price. This is the main reason they became competitors of traditional banks. Some of the terms associated with FinTechs and their products are: ”peer-to-peer lending”, ”WealthTech”, and ”crowdfunding”.

P2P lending platforms establish a connection between individuals with financial resources and those experiencing a resource deficit. In its initial form, this type of alternative lending removes financial institutions from the lending process, simplifying the borrowing procedure (Minescu, 2018). This experience is, in fact, 100% digital, which helps reduce the time required for granting loans and, thus, enhances the overall efficiency of the process. Among the factors that led to the emergence of this service are the 2008 financial crisis (which contributed to a decrease in the volume of loans offered by banks, with small and medium-sized enterprises being the most affected), the favorable conditions provided to participants, and, last but not least, advancements in technology and data analysis methods.

Table 3. Key features of different types of crowdfunding

	Form of contribution	**Form of return**	**Motivation of funder**	**Platform examples**
Donation Crowdfunding	Donation	Intangible benefits	Intrinsic and social motivation	GoFundMe, Fundrazr
Reward Crowdfunding	Donation / Pre-purchase	Rewards but also intangible benefits	Combination of intrinsic and social motivation, and desire for reward	Kickstarter, RocketHub
Crowdfunded Lending	Loan	Repayments of loan with interest. Some socially motivated lending is interest free	Combination of intrinsic, social, and financial motivation	Lending Club, Zopa
Equity Crowdfunding	Investment	Return on investment in time if the business does well. Rewards also offered sometimes. Intangible benefits – another factor for many investors	Combination of intrinsic, social, and financial motivation	Equity Net, Crowdcube

Source: Baeck and Collins (2013, p. 13)

The impact of digitalization is clearly evident in financial markets as the Internet has a great contribution to their expansion and globalization. Thus, financial market transactions are carried out much more easily and quickly via the Internet, offering great economic benefits and reduced costs to a vast number of people (Welfens, 2002, p. 67). However, both those with a surplus of resources and those facing financial difficulties can now take advantage of a new tool that facilitates their connection, known as *crowdfunding* – a widely recognized concept in this digital era, which serves as an alternative to capital market or bank financing. This can be described as a process through which various projects or businesses secure funding via small contributions from a large number of sources – in contrast to traditional financing methods where large sums are obtained from a single or limited number of sources (Baek and Collins, 2013). There are different types of crowdfunding which can be categorized on various criteria such as the form of contribution, the type of reward offered to investors, and the motivations driving to participate in this type of financing. A summary of these categories is presented in Table 3.

Traditional client fund management services (such as brokerage and financial advisory services) are provided by a range of institutions, including private banks, insurance companies, and brokerage firms. However, the 2008 financial crisis had a negative impact on this sector, leading to a decline in client trust in such services. This created the premise for the emergence of *WealthTech,* defined by Minescu (2018, p. 107) as a new generation of companies developing financial technologies that offer digital solutions to transform the asset management industry and create alternatives to traditional investments.

The most popular examples of WealthTech are robo-advisors, also referred to as ”automated wealth managers”. These are highly transparent technologies that use automated techniques to create and manage portfolios composed of financial instruments. Robo-advisors have the advantage of eliminating the influence of human decision-making and intuition in the investment process, a factor that is often present in traditional investment banks. On the other hand, since this technology is still relatively young, it cannot yet be definitely stated that it surpasses the capabilities of a human professional. Some examples of robo-advisor platforms are Ellevest, Charles Schwab, Betterment, and TrueWealth.

Due to the fast development of FinTech, as well as the evolution of technology, banks need to develop digital strategies in order to maintain a significant market share and efficiently manage their expenses. Embracing the process of digitalization will contribute to reducing the number of branches as the majority of services will be provided online. In addition to that, the number of bank employees will also be diminished, and their place will be taken by *chatbots*.

Chatbots are defined by Doherty and Curran (2019) as a software instrument that uses natural language processing to ensure the human machine interaction and machine learning. The idea of such a technology emerged in the 1960s and the first chatbot was created in 1995, named A.L.I.C.E. (Artificial Linguistic Internet Computer Entity). The majority of banks benefit from this technology as it contributes to establishing a nice relation with the clients (Mogaji *et al.*, 2021). Therefore, banks are encouraged to adopt chatbots in the digitalization process because they offer the clientele the opportunity of getting fast responses and the communication process, which was traditionally realized through employees, becomes more efficient.

At the core of chatbot technology lies a highly significant technological innovation that is currently a major topic of interest - artificial intelligence, commonly referred to in specialized literature by the acronym AI. Artificial Intelligence has the remarkable potential to accelerate company productivity growth, expand and create new opportunities, enhance consumer well-being, and bring vast benefits to the economy and society as a whole. Although the concept itself dates back to the 1950s, the capabilities of this technology have advanced at an accelerated pace only in recent years, making it a subject of deep interest for industry developers, investors, regulators, and society as a whole. Due to the vast volume of available data, advanced computing algorithms, and rich infrastructure, AI has become an omnipresent technology in various forms, including virtual assistants, robots, and self-driving vehicles.

Real-time data analysis is a crucial element in the operations of financial institutions (Ashta and Herrmann, 2021), and artificial intelligence, alongside machine learning, creates a vast range of opportunities for banks, which must, however, understand and effectively manage the risks that this technology may generate. Some key characteristics that have led to AI's impact on the banking sector include fast information processing, lower-cost data storage, advanced and well-developed algorithms, and complex, detailed datasets made possible by the ongoing digitalization of society (Financial Stability Board, 2017, p. 55). AI is particularly emphasized in detecting and preventing banking fraud. Another key application of artificial intelligence in the banking sector is credit scoring - a method used by banks to assess a client's ability to repay a loan. Goh *et al.* (2020) illustrate AI's role in credit scoring through two techniques: Support Vector Machines (SVM) and Random Forest (RF), which are highly attractive due to their flexibility in handling a wide range of data templates. Apsilyam, Shamsudinova and Yakhshiboyev (2024) emphasize the most common areas of AI application in the banking sector:

- robo-advisor, used by banks in financial consulting services;
- Natural Language Processing (NLP), used for chatbots and virtual assistants for the clientele;

- automatized lending, with the help of techniques specific to credit scoring and credit risk management;
- fraud prevention, realized by algorithms which find anomalies and suspicious activities;
- identification of market trends, AI being used in complex data analysis offering useful information for the banks.

A recent topic among the key technologies driving the digital development of the banking sector is cryptocurrencies. These are defined as virtual or digital currencies that use computing and economic principles, and cryptography to ensure information security, making them more difficult to counterfeit (Constantinescu, 2020, p. 11). The primary motivation behind their creation was the desire to develop a payment instrument that ensures anonymity and remains unaffected by a state's financial policies, unlike traditional currencies (Nakamoto, 2008). From an economic perspective, cryptocurrencies do not fully fulfill all the functions of money (such as serving as a store of value), which raises debates about their promotion as an alternative to national currencies. However, they can still be used as a means of payment, increasing public interest in using them for various activities such as investments or transactions. For example, a survey conducted by the European Central Bank (2024) found that approximately 9% of respondents in the euro area held crypto assets, compared to 4% in 2022. The primary reason for holding cryptocurrencies was investment purposes, accounting for 64% of responses, as highlighted in Figure 3.

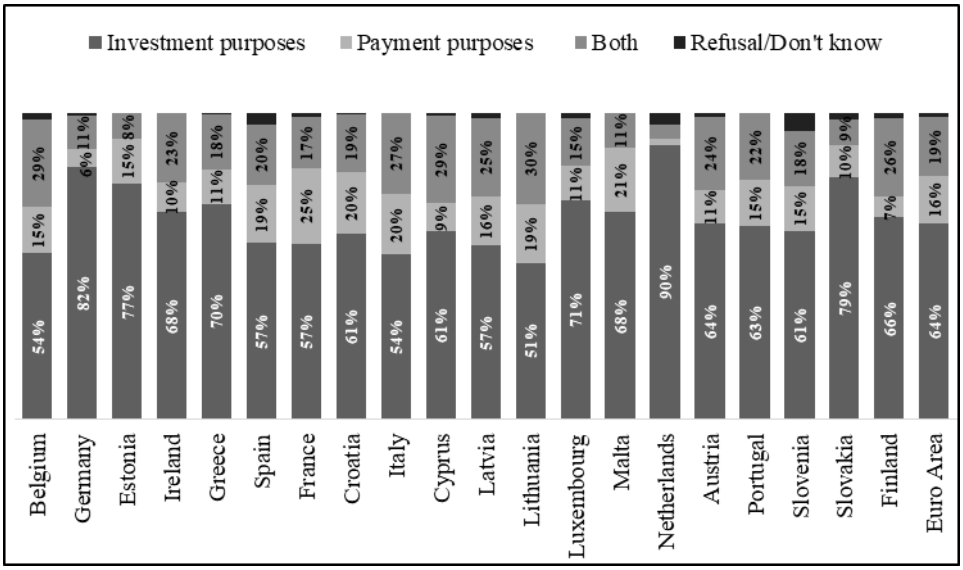

Figure 3. Use of crypto assets in the Euro Area, breakdown by country (December 2024)

Source: European Central Bank (2024, p. 66)

Cryptocurrencies represent an important innovation in the digitalization of the banking sector, particularly because they have contributed to shaping the concept of *blockchain*. This technology underpins the operation of crypto assets and has become a topic of interest for banks. It is defined as a transaction database with multiple copies, divided into blocks of validated information that are added to a chain of previous transactions by the entire network (Minescu, 2018, p. 156). The term "blockchain" derives from this grouping of data into blocks, which are interconnected, forming a chain (Constantinescu, 2020). This technology enables more efficient tracking of transactions and updates within the database while reducing network overload. Its implications in the banking sector are diverse, including intra and interbank transfers, auditing processes, and the Know Your Customer (KYC) procedure which improves the efficiency of customer identity verification in terms of cost and time by leveraging data from the interbank SWIFT registry (UniCredit, 2016).

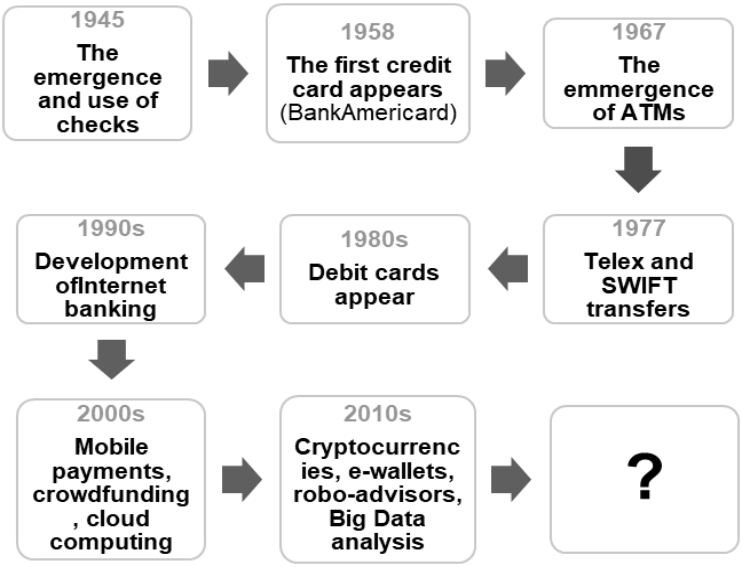

Figure 4. Technological innovations in the banking sector over time
Source: author's elaboration based on Ashta (2018)

Overall, all the technologies described and reflected in Figure 4 have a significant influence on the way banking activities are conducted. The remarkable evolution of the IT sector leaves its mark on the range of products and services offered by banks, which strive to embrace digitalization and meet all customer expectations. As highlighted, there is a growing trend in the adoption of technologies in the banking sector, driven by the emergence of FinTech companies, which intensify competition in the financial sector and represent a new challenge for traditional banks.

3. OPPORTUNITIES AND CHALLENGES OF DIGITAL BANKING

The continuous evolution of technology leaves its mark on the functioning and organization of the banking sector. The impact of digital innovations on banks is both positive and negative, resulting from the wide range of advantages as well as the risks they generate. This impact is felt by both banks and their customers. Due to digital technologies, which have contributed to shaping a digitized image of the banking sector, the specialized literature includes a wide range of studies that highlight the benefits and drawbacks of banking sector digitalization (Sardana and Singhania, 2018; Harchekar, 2018; Bhosale, Kadam and Jagtap, 2020; Litvishko *et al.*, 2020; Balkan, 2021).

Therefore, in general, the following advantages of the digital revolution in banking are highlighted:

- IT innovations create a more facile way of distributing banking services and products;
- digitalization contributes to the creation of new business models in the banking sector;
- digital channels are an efficient way of collecting necessary information in the process of decision making in the day-to-day activity of a bank;
- clients have uninterrupted access to the bank services and products, as digital banking operates in a 24/7 regime, unlike traditional banking;
- reduced prices for the bank's products and services, due to the reduced operational costs;
- digital banking maximizes the level of satisfaction of the clientele as they are offered personalized products and services, adapted to their needs and expectations;
- the risk of losses caused by human errors is eliminated;
- the discrepancy between urban and rural areas in terms of access to banking services is eliminated;
- due to the growing popularity of cashless payments, the need to manage large amounts of cash disappears, as well as the risk of counterfeit currency circulating;
- digitalization contributes to income growth as the bank can penetrate new markets internationally.

It should not be ignored that digitalization brings a series of benefits to the investment sphere as well. Capital markets have been digitized, leading to the gradual disappearance of physical interaction in the process of trading securities, which have been dematerialized (no longer issued on paper), as highlighted by Moșteanu *et al.* (2019). This has expanded accessibility for a wide range of investors. As emphasized by the European Central Bank (2023, p. 48), the number of retail investors who, during the pandemic, carried out their activities

on the capital market using mobile applications, saw a significant increase. The increase in the number of market participants brings the advantage of risk distribution, as well as ensuring lower trading costs. Furthermore, technological advancements have led to the promotion of a wide range of investment opportunities and ideas through social networks.

The process of digital transformation in the banking sector can create a series of benefits for the financial sector in terms of contributing to meeting customer expectations. However, it can also be a factor of instability, amplifying the risks to which the financial sector is already exposed (Beau, 2023). Additionally, it should be considered that, within banking regulations, there is no specific direction outlined regarding how banks should identify, monitor, evaluate, and manage the risks involved in the process of implementing digital technologies (Papathanassiou, 2024).

Some of the most important risks and disadvantages which appear in the process of digitalization are highlighted in the specialized literature (Harchekar, 2018; Aguayo and Ślusarczyk, 2020; Balkan, 2021; Indriasari *et al.*, 2022; Murinde, Rizopoulos and Zachariadis, 2022; Fayziev, 2024) and include:

- risk related to cybersecurity, caused by the vulnerability of banks to cyberattacks such as hacking, phishing, and malware, which can lead to both financial losses and the deterioration of customer trust in the bank;
- bank fraud through digital channels, which manifests through methods such as the theft of personal and banking data, card cloning, or unauthorized access to bank accounts;
- job losses for a wide range of employees, who are being replaced by digital technologies such as chatbots or virtual assistants, as well as a decrease in labor demand through the automation of banking processes;
- the technical complexity of digital systems, which refers to both their implementation and maintenance, requiring additional work from IT professionals, as well as financial resources;
- reduced accessibility for certain categories of people, explained by the fact that the digitalization process is uneven and can be characterized by pronounced divergences in terms of customer access to the internet or IT tools such as computers, mobile phones, tablets etc.;
- banks' dependence on third parties, such as FinTech companies, which are responsible for providing IT services and maintaining their digital systems;
- operational risk, caused by technical errors and problems that arise during the use of digital technologies and are often encountered due to the short time some banks allocate for testing and implementing technological innovations.

According to the author Vyas (2012), electronic banking presents certain limitations, including the danger of using card data in e-commerce, as well as the precarious security and fraud risk at Automated Teller Machines (ATMs).

However, it is important to note that banks are attempting to take measures to minimize these dangers. For example, to avoid the risk of thefts at ATMs, Huntington Bancshares (USA) has installed a red button on its banking machines, which allows customers to directly contact a police department in case of suspicious activities (Chorafas, 1999, p. 403).

In addition to all the risks, the use of artificial intelligence technologies and tools could strengthen the market dominance of BigTech companies, contributing to a reduction in the need for employees, leading to mass layoffs. Moreover, due to potential programming errors or the introduction of flaws in the algorithm behind this technology, the risk of distributing incorrect information arises, increasing vulnerabilities in terms of security.

Regarding the emergence of cryptocurrencies and the increased interest of the population in them, Constantinescu (2020) highlights, in addition to the risks associated with their trading, a series of general security implications of cryptocurrencies. Thus, the author emphasizes the idea that, due to the fact that it is not strongly regulated, this technology is also used for dishonest and illegal purposes. Relevant examples include:

- the use of cryptocurrencies in money laundering and organized crime activities;
- cryptocurrencies are used in order to avoid taxation;
- financing illegal activities, such as terrorism, espionage and information warfare;
- promotion of extremist ideologies through cryptocurrency funding.

Social media represents another threat to the banking sector due to the fact that information spreads at an exceptionally high speed, increasing the risk of a phenomenon known as a social media bank run (NBR, 2024). The rapid dissemination of negative information regarding the financial situation of a credit institution triggers an immediate reaction from depositors. They rush to withdraw their funds from banks, a process facilitated by digital channels such as internet and mobile banking, which exacerbates liquidity issues for the credit institution. A clear and recent example is the case of Silicon Valley Bank (SVB) in March 2023. One of the catalysts of this bank's collapse is considered to be the significant number of posts on the Twitter platform by its depositors, which included the term "withdraw," and the link between the bankruptcy and social media was demonstrated through the empirical study conducted by Cookson *et al.* (2023).

Banks and financial institutions must monitor the direction in which the IT field is developing and take advantage of the opportunities it can offer. Additionally, it is crucial that, in the pursuit of achieving objectives related to the implementation of digital technologies in the banking sector, the emerging risks of this process are considered, as they can cause significant losses for banks and lead to the deterioration of their public image.

4. TRENDS AND FUTURE OUTLOOK OF BANK DIGITALIZATION

Identifying the trends and patterns by which the banking sector evolves through digitalization is crucial for banks as it enables them to develop effective strategies for personalizing their products and services. This is particularly important in the context of the growing significance of digital services for the sustainable socio-economic development of countries (Dudin, Shkodinskii and Usmanov, 2021).

Analyzing the specialized literature, we conclude that many authors (such as Hamidi and Safareeyeh, 2019; Wewege, Lee and Thomsett, 2020; Garg *et al.*, 2021; Indriasari *et al.*, 2022; Petare *et al.*, 2024) highlight certain general trends and perspectives in the digitalization process of the banking sector, namely:

- increasing customer satisfaction levels by launching personalized products and services that meet their needs and expectations;
- strengthening collaboration between banks and FinTech companies, which will contribute to the creation of innovative solutions for emerging risks and challenges in the digitalization process;
- improving digital identity verification processes for new banking customers, as well as implementing technologies that enable the secure sharing of data between banks and authorized third parties;
- further development of electronic payment services and the integration of blockchain technology to ensure transaction transparency;
- automating a wide range of internal processes to reduce banks' operational costs;
- increasing overall competition in the banking market, driven by the emergence of new players such as digital banks and FinTech companies;
- boosting investments in technologies that enhance the cybersecurity of banking operations;
- launching new digital currencies, including Central Bank Digital Currencies (CBDCs).

Throughout history, banking activities have undergone profound transformations, which are continuously evolving due to the digitalization of the economy and the necessity of implementing ICT in managing client-bank relationships. The internet remains a crucial component of banking, helping to maintain the connection between banks and their clients while maximizing customer satisfaction—an aspect that will ensure the continued integration of this technology into banking operations. Its use is expected to expand further in the near future, driven by favorable factors highlighted by Căpraru (2009, p. 144):

- continuous improvement of internet security;
- increased use of computers and internet access in households, as highlighted in Figure 5, which reflects the proportion of households with internet access in both urban and rural areas;

- the increasing sophistication and education level of clients regarding ICT applications;
- the tendency of banks to diversify the range of banking operations conducted through internet-connected applications.

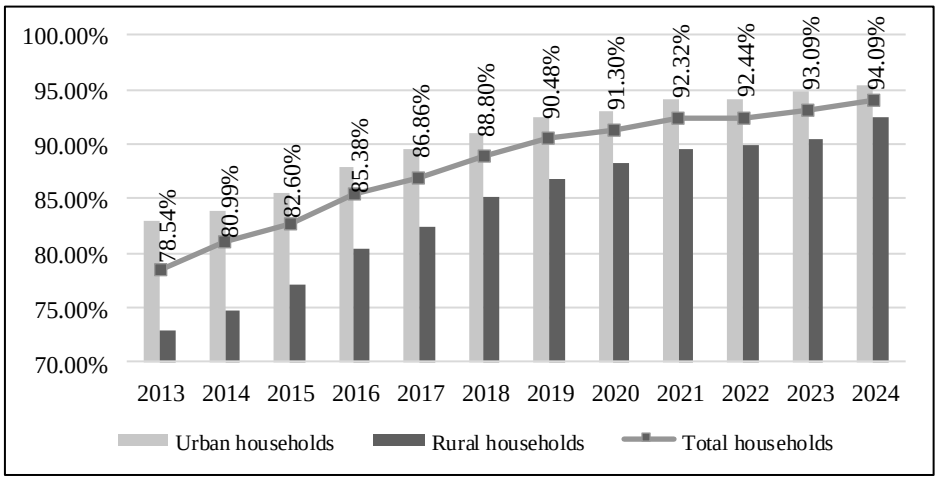

Figure 5. The evolution of the share of households with internet access in the member states of the European Union from 2013 to 2024

Note: until 2019 the available data for all 28 member states are considered, while from 2020 onwards the average is calculated for the 27 EU member states (excluding the UK)
Source: author's elaboration based on Eurostat Database

The implementation of digital technologies in the activities of banks contributes to improving financial inclusion, given that all digital channels used help in increasing the number of clients by providing broad access to the products and services offered by banks. According to a report elaborated by NBR (2024), a significant increase can be observed in the number of clients – both individuals and legal entities – who use digital channels in their interactions with banks (see Figures 6 a and b). This highlights the growing trend of an increasing number and volume of transactions occurring on digital banking platforms. As more customers embrace digital channels for their banking needs, the frequency of transactions—such as payments, transfers, and investments—has significantly risen. This surge is driven by factors like the convenience of mobile banking, faster transaction processing times, and the broader adoption of online payment systems.

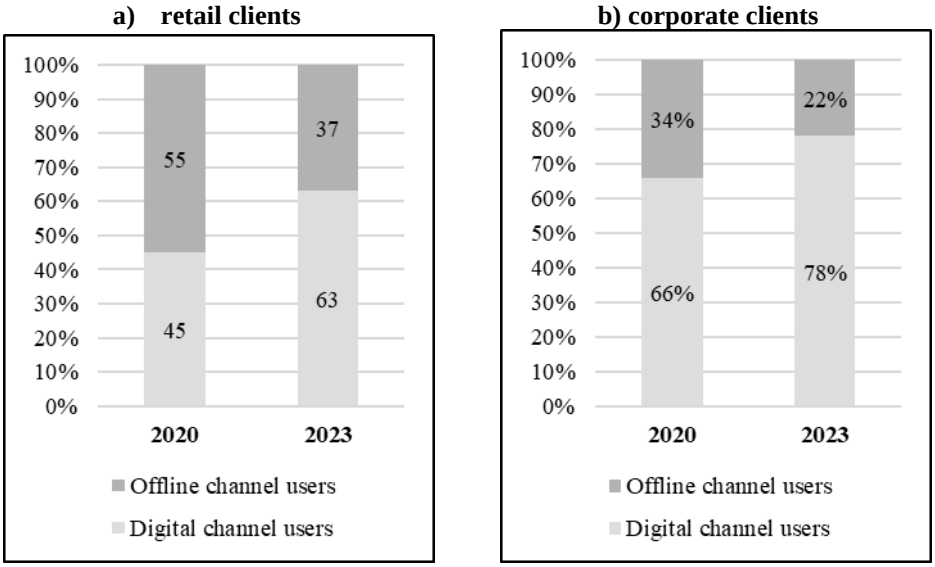

Figure 6. The share of digital channel users out of the total bank clients, 2020 versus 2023

Note: "digital channel users" are clients who benefit from internet banking and online banking services, while "offline channel users" are those who rely on traditional banking

Source: author's elaboration based on NBR (2024)

Among the prospects for the development of a digitized banking sector, we can highlight the intensification of competitiveness in the banking market. Digitalization provides banks with access to a large number of new clients, and we must note the emergence of new competition resulting from the blurring of boundaries (Chirleșan, 2023, p. 23). Another factor contributing to the intensification of competition in the banking products and services market is the rapid increase in the number of FinTech companies, as evidenced in Figure 7. Thus, we see that the value recorded in 2018 has experienced significant growth to the present.

One of the most significant catalysts for the digital transformation of the banking sector was the COVID-19 pandemic, which became the most influential factor in history in shaping digital banking services, forcing banks to revolutionize traditional strategies and communication models with clients (Dudin et al., 2021). It is remarkable that the most significant advances in the FinTech field occurred specifically during 2020–2021, given that the restrictions imposed by the pandemic left their mark on the classic connection between clients and banking service providers. The trend of increasing the number of FinTech companies represents a new challenge for traditional banks, and the most appropriate solution is the adoption of new digital technologies and the promotion of innovative banking methods, considering the possibility of collaborations between credit institutions and FinTech companies.

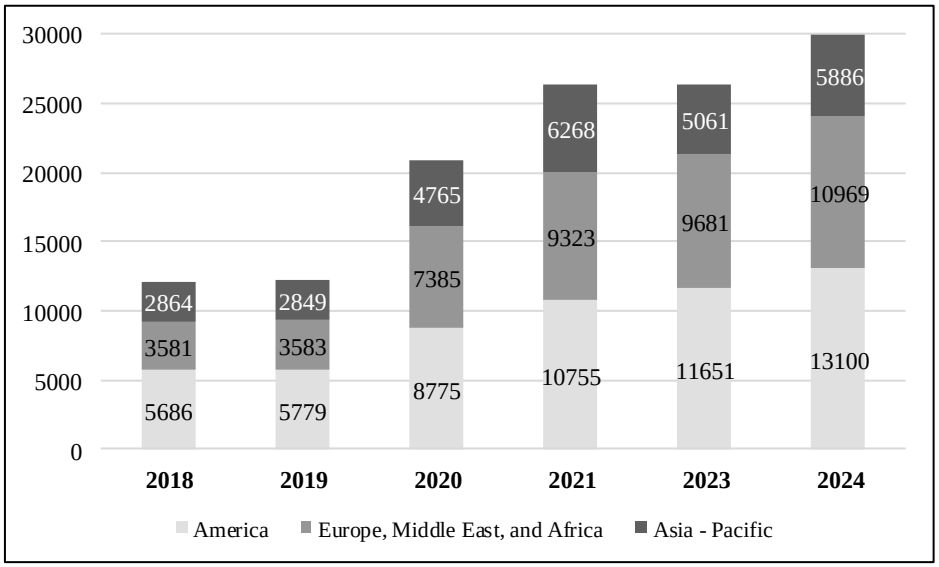

Figure 7. Number of FinTech start-ups by region (2018 – 2024)
Source: author's elaboration based on Statista, available at: www.statista.com/statistics/893954/number-of-fintech-startups-by-region/.
Note: data for 2022 is not available.

Another well-highlighted trend in the contemporary banking sector is the emergence and growing use of *digital currencies*. These are defined as currencies that exist only in digital form (they do not have a physical form, meaning they are not found as banknotes or coins), and can only be transferred, stored, and spent in the digital environment, through electronic wallets, online transfers, online commerce, or other interconnected networks (Constantinescu, 2020, p. 187). Due to the popularity of this term and the increasing interest of the population in these currencies, along with the development of blockchain technology, Central Banks worldwide have considered that it is the right time to investigate and implement their own digital currencies, known by the acronym CBDC (Central Bank Digital Currency). The launch of these currencies will help maintain the important position of Central Banks in the financial intermediation process and the economy as a whole (Moșteanu *et al.*, 2019, p. 174). In Figure 8, the countries that are still researching this concept (Chile, Mexico, Poland, Mongolia, etc.) are highlighted, as well as the countries whose Central Bank digital currency is in the testing phase (Russia, China, India, Euro Area countries etc.), and the states where CBDCs have already been launched (Nigeria, Zimbabwe, Jamaica, Bahamas).

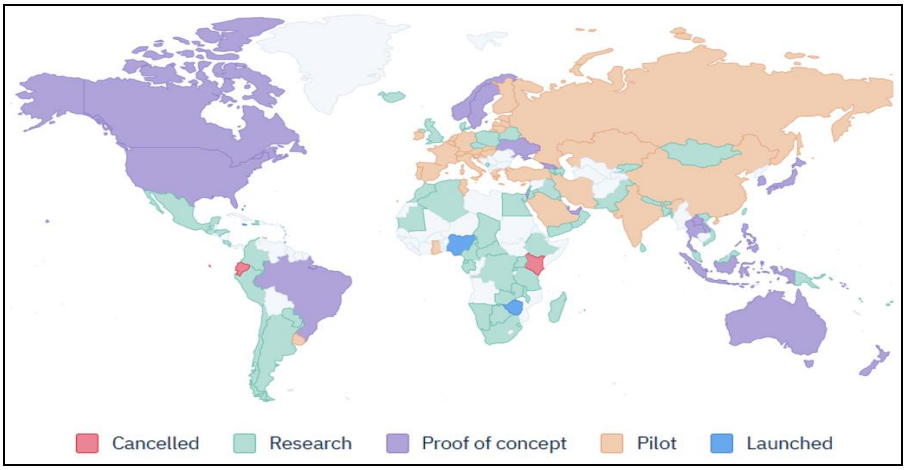

Figure 8. Current state of Central Bank Digital Currency adoption (January 2025)

Source: CBDC (Central Bank Digital Currency) Tracker (2025), available at: https://cbdctracker.org

One of the major current issues nowadays is global warming. Both the population and economic agents are concerned with minimizing the level of pollution arising from daily activities, and banks are no exception. Although banking activities are not directly related to the general state of the environment, the actions of their clients, arising from interactions with them, leave an imprint on the global ecosystem (Nath, Nayak and Goel, 2014). Thus, there is a need for the adoption of environmentally friendly strategies, which are known in specialized literature as *green banking*. Given that conducting banking operations involves an excessive consumption of materials (such as paper), to achieve their eco-friendly policy goals, banks are forced to automate banking processes, which involves using digital technologies. Thus, services such as mobile banking and internet banking represent an efficient and environmentally friendly way to conduct activities with minimal impact on nature.

However, the downside of digitalization in relation to green banking is that digital technologies consume a large amount of energy, which raises the need to include innovations in the banking industry that have as low an energy consumption as possible. The issue is not about abandoning the digitalization process in the banking sector, as there are solutions for its adverse effects on the environment. Brunori *et al.* (2023) emphasize the idea that digital technologies are key factors in the transition to a green economy and the achievement of sustainability goals defined within the European Green Deal. Therefore, banks are considering financing green technologies in order to contribute to reducing carbon emissions, as well as continuing the digital transformation of the sector (Shaumya and Arulrajah, 2016).

5. CONCLUSIONS

Nowadays, our society is undergoing a profound transformation, characterized by a series of radical changes across all areas of activity, driven by technological progress. Obviously, banks represent a key element in our lives that is no exception from the shift to a digitized society. Therefore, the process of digitalization has become a relevant topic among researchers and policy makers.

The transformation of traditional banking services has been driven by rapid technological advancements, reshaping the way financial institutions operate and interact with customers. Among the key technologies that have reshaped the global banking sector are those related to the digitalization of payment processes and the connection between banks and their customers. Artificial intelligence, which is based on computer algorithms, plays a particularly important role in simplifying and optimizing banking services such as lending and risk management. It is also at the core of innovations like chatbots and virtual assistants, which facilitate the connection between clients and banks. Inevitably, a number of changes in the banking sector have been driven by the emergence of new players: digital banks, also known as neobanks, and FinTechs. These can be seen from two perspectives: as competitors or as partners. By combining finance and technology, they create a wide range of competitive services that attract the attention of banking product consumers.

Digitalization offers banks many benefits, such as being always available to the customer, cost efficiency due to reduced operational costs, or making payment transfers in real-time. However, the bank sector faces some barriers, such as cybersecurity risks, operational risk, or increased expenses due to the implementation of innovations. Highlighting both the advantages and disadvantages of digitalization helps form a complete picture of the studied phenomenon and its effects.

Regarding current and future trends in the banking sector, we can underline several ideas. One major trend is the growing adoption of digital technologies, such as artificial intelligence and blockchain, which are revolutionizing banking operations. These innovations enhance efficiency, streamline processes, and improve customer experience by offering personalized services. Additionally, there is a significant shift toward digital-only banks, or neobanks, which operate without traditional physical branches, offering a more flexible and cost-effective alternative to conventional banks. Another important trend is the increasing use of Central Bank Digital Currencies (CBDCs), which could reshape the future of digital payments and monetary policy. Last, but not least, collaboration between traditional banks and FinTech companies is becoming more common, as financial institutions seek to leverage the agility and innovative capabilities of FinTechs to meet evolving customer needs. This partnership is expected to accelerate the development of new financial products and services, driving further transformation in the banking landscape.

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ANALYSIS OF THE BENEFITS AND RISKS OF INTEGRATING ARTIFICIAL INTELLIGENCE TECHNOLOGIES IN THE FINANCIAL SECTOR: A DUAL PERSPECTIVE

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Abstract
Over time, Artificial Intelligence (AI) has evolved from abstract theories into practical solutions, fundamentally transforming how data is managed and used in financial institutions, as well as the services offered to their customers. In this paper, I will highlight the impact of AI-based technologies, focusing on evaluating the necessity of their use in financial institutions and analyzing customers' preferences for new products and services. As such, I have conducted a detailed analysis of the benefits and risks associated with AI technologies in the financial sector, considering the perspectives of both financial institutions and their customers. As future research directions, we plan to examine the influence of the widespread implementation of AI technologies on job availability.
Keywords: artificial intelligence, economics, finance, digitalization, client
JEL Classification: O33, M10, L20

1. INTRODUCTION

In the current context, the role of digitalization and Artificial Intelligence (AI) technologies has significantly expanded across various financial sectors of the economy. Emerging AI technologies bring a range of benefits and risks that impact both financial institutions and their clients. This dual impact underscores the need to approach this topic from a two-dimensional perspective, evaluating the influence of intelligent technologies on the functioning of financial markets and the services provided by financial institutions.

The choice of this research topic is driven by the ongoing debate surrounding the advantages and risks of AI implementation in the financial sector. Such investigations can contribute to informed decision-making and the development of appropriate policies in this continuously evolving field.

The research questions guiding this study, which aims to explore the specifics of AI technologies, will be examined from a dual perspective: that of ***financial institutions*** and their ***clients***. From the perspective of financial institutions, the following questions will be addressed:

• What long-term advantages can be achieved by implementing AI technologies in financial institutions, particularly in terms of profit, efficiency, and market positioning?

• How can the risks associated with AI be mitigated to enhance firms' operational performance?

From the clients' perspective, we will address the following questions:

• To what extent do clients trust AI-powered products and services?

• How do clients perceive the integration of new AI technologies within financial institutions?

The objective of this scientific communication is to thoroughly analyze the necessity of using AI technologies in financial institutions and to evaluate clients' preferences regarding new products and services, providing answers to the questions mentioned above. The main objectives will be addressed methodically. In the first chapter, I will review the existing literature. In Chapter 2, I will describe the methodology used in the research. Chapter 3 will present the data and results of the study from a quantitative analysis perspective. In Chapter 4, I will assess the benefits and risks associated with AI implementation. In the final chapter, I will use statistical data to discuss the level of technology adoption in the EU and Romania, analyzing the specific applications of AI in finance. The conclusion chapter will include key insights, future research directions, limitations encountered during the analysis, and practical strategies for effectively integrating AI into the country's economic activities.

2. ARTIFICIAL INTELLIGENCE: A BRIEF ANALYSIS OF THE SPECIALIZED LITERATURE

AI can be defined through multiple interpretations, depending on two key dimensions: the thinking dimension and the behavioral dimension. Each of these dimensions, in turn, evaluates success in terms of either human performance or reasoning, representing an ideal concept of intelligence.[1] According to the first interpretation, AI is defined as "the automation of activities we associate with human thinking, activities such as decision-making, problem-solving, learning…" (Bellman, 1978, p. 3). Another definition of AI presents it as "the study of mental capabilities through computer models" (Charniak and McDermott, 1985, p. 6). In the second interpretation, AI is "the art of creating machines that perform functions requiring intelligence when performed by humans" (Kurzweil, 1990, p. 14). Under this interpretation, from a rationalist perspective, AI is "a field of study that seeks to explain intelligent behavior in terms of computational processes" (Schalkoff, 1990, p. 8).

[1] Leon, F., Artificial Intelligence – Principles, Techniques, Applications, Tehnopress Publishing, Iași, 2006, p. 24

As a science, Artificial Intelligence has drawn on many ideas and techniques from other disciplines. In over 2,000 years of philosophical tradition, theories of reasoning and learning have emerged alongside the idea that the mind operates as a physical system. From mathematics, we have formal theories of logic, probability, and decision-making. From psychology, we have tools to investigate the human mind and language to articulate the resulting theories… And from computer science, we have the necessary tools to make AI a reality.[2]

In the specialized literature, debates have emerged regarding the role and positioning of AI technologies in finance. Baxter Hines argues that digitalization will transform the traditional financial market into one that is more modern, fair, and transparent.[3] The financial environment is volatile, and the ability to anticipate and adapt swiftly to market fluctuations is crucial. In addressing these important aspects, AI has become a timely topic in financial activities. According to Zhiyi Liu, intelligent technology enables financial institutions to develop new products and services that meet customer demands and improve overall performance.[4] However, there are also dissenting opinions. Some authors[5] approach this concept with skepticism, arguing that an algorithm lacks the ability to emotionally interact with a human subject. According to them, it is not enough to have an extensive database to truly understand risk inclinations, convey trust to clients, or find stable configurations that predict the future. We live in an uncertain, unstable, and unpredictable world, and finance is one of the typical examples of this uncertainty, as algorithmic forecasting failures demonstrate.

Following the analysis of these sources, I observed a gap regarding the scientific studies on the impact of AI technologies in finance, which would address both the interests of financial institutions and those of their clients. A dual perspective is necessary to form a more relevant and current overview, which can guide the search for effective solutions and beneficial action directions for all participants in economic activities within financial institutions. Therefore, I have decided to gather data that will create a foundation for more comprehensive studies and research in this field. In this exploratory paper, I aim to confirm the hypothesis that AI increasingly dictates the performance of economic entities and provides a wider range of services, ensuring a more enjoyable experience for clients.

[2] Ibidem, p. 24.
[3] Hines, B., Digital Finance. Security Tokens and Unlocking the Real Potential of Blockchain, Wiley, 2020, p. 1
[4] Liu, Z., Digital Finance. How Innovation Reshapes the Capital Markets, Springer Nature Singapore, 2023, p.14
[5] Viale, R., et al, Artificial Intelligence and Financial Behaviour, Edward Elgar Publishing, 2023, p.1-5

3. METHODOLOGY

In conducting this research, I employed both quantitative and qualitative methods. This dual approach was necessary to address the study's multidimensional requirements.

To determine the importance and relevance of implementing AI technologies in financial institutions, I employed qualitative methods, including the analysis of annual reports, the collection of significant data from specialized literature, official articles, and statistical sources. Furthermore, I used logical analysis methods, such as examining case studies and relevant examples, to illustrate the practical applications of AI at both national and international levels.

To gather data on customer perspectives, I adopted a quantitative method: the questionnaire, owing to its numerous advantages. These include efficiency in data collection, the ability to gain detailed insights into respondents' opinions, standardization of questions, ease of comparative analysis, precision in responses, clarity of results, and the presentation of findings in an easy-to-interpret format.

I designed the questionnaire using Google Forms and distributed it online to individuals interested in innovations within the financial sector. Simple random sampling was employed due to its practicality and the short time frame (5 days) required for data collection and processing. A total of 121 respondents participated in the questionnaire, of whom 108 passed the filter question. Consequently, only individuals who interact with financial institutions at least occasionally were included in the sample. This sample is representative, as the study aims to analyze customer preferences regarding AI implementation in financial institutions and draw relevant conclusions.

The questionnaire consists of four sections. The first section includes the filter question, which allows respondents who are not clients of financial institutions to exit the survey. The second section, comprising eight questions, collects key data on customers' preferences for AI technologies in finance. The third section contains four questions focused on the improvement of AI-based products and services in financial institutions and strategies to enhance customer trust. The final section includes five questions on socio-demographic characteristics, addressing respondents' age, gender, occupation, education level, and monthly income. All questions were set as mandatory to prevent missing data errors.

The collected data was analyzed and serves as the basis for the tables and figures presented in Chapter 3, which discusses the questionnaire results.

4. RESULTS

In this chapter, we will analyze information regarding clients' perspectives on the use of AI technologies within financial institutions and draw conclusions based on these data.

Upon analyzing the responses to the filter question, we found that 89.3% of the individuals who accessed the survey interact, at least occasionally, with financial institutions either online or in person and benefit from their services on a daily, weekly, or monthly basis. These individuals constitute the sample. Respondents who do not interact with financial institutions, representing 10.7% of the total, exited the survey, and their responses were deemed non-representative. This result highlights a high demand for financial institution services, suggesting that these institutions should focus on effectively meeting their clients' needs.

Table 1 refers to the socio-demographic characteristics of the respondents.

Table 1. Socio-demographic characteristics

Variables/Description	Resp.*	Variables/Description	Resp.*
Age		*The last completed level of education*	
18-20 years	24,1%	High school education	56,5%
21-25 years	60,2%	Higher education: Bachelor's	30,6%
26-30 years	5,6%	degree	10,2%
31-40 years	4,5%	Higher education: Master's degree	0%
>41 years	5,6%	Higher education: Doctoral studies	2,7%
		None of the above	
Gender		*Monthly income (RON)*	
Female	81,5%	<900	15,7%
Male	18,5%	900-2500	35,2%
Occupation		2501-3300	13,9%
Student	70,4%	>3300	19,5%
Employee	25,9%	Prefer not to answer	15,7%
Others	3,7%		

*Note: *Resp. – percentage of respondents*

Source: developed by author

According to the table above, 89.9% of the sample consists of individuals aged between 18 and 30 years, demonstrating a strong tendency among young people to adapt to and show interest in new technologies. Additionally, 97.3% of respondents have completed at least a high school education, indicating a relatively high level of education within the sample. This was expected, as understanding certain terms and concepts used in the questionnaire requires a certain degree of education.

It is also noteworthy that female respondents constitute a higher proportion of the sample than male respondents. Regarding income levels, the sample is characterized by relatively low earnings, with only 19.5% of respondents earning more than the minimum wage. This suggests that clients are likely to prefer financial services leveraging AI, as such technologies minimize costs and expenses through increased efficiency.

Finally, 25.9% of respondents are employees, while 70.4% are students. This distribution accounts for the relatively low income levels observed in the sample.

Tables 2 and 3 show the results obtained from evaluating the respondents' preference for using AI technologies in the financial sector.

Table 2. Customer preference regarding AI

Variables/Description	**Resp.***	**Variables/Description**	**Resp.***
Evaluate your overall previous experience with using applications that utilize AI technology within financial institutions::		*Evaluate how comfortable you feel when using financial services that utilize AI technology:*	
Very positive	6,5%	Very comfortable	12%
Positive	54,6%	Comfortable	60,2%
Neutral	37%	Neutral	21,3%
Negative	1,9%	Uncomfortable	5,6%
Very negative	0%	Very uncomfortable	0,9%
Do you believe AI can improve the overall customer experience within financial institutions?		*What level of trust do you have in AI systems used within financial institutions?*	
Yes, definitely	30,6%	Very high	10,2%
Yes, probably	50,9%	High	39,8%
I am not sure	14,8%	Moderate	44,4%
No, probably not	2,8%	Low	5,6%
No, definitely not	0,9%	Very low	0%
To what extent do you believe AI can improve the efficiency and accuracy of financial processes/services within institutions?		*To what extent do you believe AI can contribute to increasing transparency and security in financial transactions?*	
Very much	19,4%	Very much	24,1%
Much	42,6%	Much	49,1%
Moderately	35,2%	Moderately	20,4%
Little	2,8%	Little	5,5%
Not at all	0%	Not at all	0,9%

*Note: *Resp. – percentage of respondents*

Source: developed by author

Table 3. Customer preference for AI vs. human agents

Would you prefer to interact with a human agent or an AI interface for the following services?	**Human agent**	**AI interface**	**It depends on the situation**	**I'm not sure**
Assistance	22,2%	10,2%	64,8%	2,8%
Managing your own funds	44,4%	19,5%	29,6%	6,5%
Creating a savings plan	49%	29,7%	17,6%	3,7%
Contracting a loan	61,1%	18,5%	17,6%	2,8%
Making investments	52,8%	22,3%	20,3%	4,6%
Creating a pension plan	45,3%	24,1%	21,3%	9,3%
Contracting insurance	42,6%	36,1%	16,7%	4,6%
Transferring funds	34,2%	46,4%	14,8%	4,6%
Currency exchange	19,4%	59,3%	18,5%	2,8%

Source: developed by author

Following the analysis of the results, we found that a very small proportion of respondents had negative previous experiences (1.9%) or feel uncomfortable (6.5%) regarding the use of applications that employ AI technologies within financial institutions. This result demonstrates that new technologies are, for the most part, perceived as useful and efficient, and in practice, they do not present difficulties in delivering financial services. Furthermore, 81.5% of respondents believe that AI could enhance their overall experience with financial institutions. 62% think that AI can significantly or very significantly improve the efficiency and accuracy of financial processes and services within institutions, while 73.2% believe that AI can contribute greatly or very greatly to increasing transparency and security in financial transactions.

Based on the data analysis from Table 3, we reached the following conclusions: respondents are not ready to fully replace the services provided by human agents with those offered through AI technologies. Although the majority of respondents feel comfortable using AI-based financial services, many still have more trust in human agents when it comes to assistance (22.2% vs 10.2%), managing personal funds (44.4% vs 19.5%), creating savings plans (49% vs 29.7%), obtaining loans (61.1% vs 18.5%), making investments (52.8% vs 22.3%), setting up retirement plans (45.3% vs 24.1%), and obtaining insurance (42.6% vs 36.1%). However, AI is preferred for activities such as fund transfers (46.4% vs 34.2%) and currency exchange (59.3% vs 19.4%). These results indicate that the majority of respondents (44.4%) have moderate trust in AI systems used within financial institutions.

Next, we will analyze the factors that contribute to the reduced trust in AI systems and explore ways to improve services and increase the trust of financial institution clients. These data are presented in Table 4.

Table 4. Improving Services and Increasing Customer Trust

Variables/Description	Resp.	Variables/Description	Resp.
What do you think are the main benefits of using AI within financial institutions?		*Main customer concerns regarding the use of AI in the financial sector*	
Increased efficiency	69	Data privacy	60
Personalized services	49	Decision accuracy	62
Improved accessibility	55	Excessive dependence	40
Reduced human errors	58	on technology	35
		Lack of human interaction	
How could financial institutions build more trust in the use of AI technologies in their services?		*What measures do you think should be taken to ensure the responsible and ethical use of AI within financial institutions?*	
By providing more information on how the AI system works	69	Stricter regulations in the field	40 77
By offering additional guarantees regarding the security of personal data	64	Continuous monitoring of algorithms	56
By increasing transparency in the decision-making process of algorithms	36	Transparency in the decision-making process of algorithms	45
		Proper staff training	

Source: developed by author

After collecting the data, we identified the main concerns of customers, the most important being the fairness of decisions made by algorithms (62 responses), followed by data privacy (60 responses), excessive dependence on technology (40 responses), and lack of human interaction (35 responses). To overcome these barriers and increase trust in the use of AI technologies in financial services, these institutions should implement measures such as: providing more information on how the AI system works (69 responses), offering additional guarantees regarding the security of personal data (64 responses), increasing transparency in the decision-making process of algorithms (36 responses), stricter regulations in the field (40 responses), continuous monitoring of algorithms (77 responses), transparency in the algorithmic decision-making process (56 responses), and proper training of staff (45 responses). Thus, we conclude that if AI-based financial services manage to gain more trust from customers, their needs would be met more efficiently, significantly improving their experience.

5. BENEFITS AND RISKS ASSOCIATED WITH AI TECHNOLOGY IN THE FINANCIAL SECTOR

5.1. Benefits and Risks from the Perspective of Financial Institutions

(+) Key areas in the financial industry where AI adds significant value compared to traditional approaches are as follows:

1. Credit Assessment: Many financial institutions engage in lending activities. To accomplish this task, it is essential to assess individuals or companies accurately.

2. Algorithmic Trading: When the market reacts swiftly to various stimuli, a lack of timely action may lead to missed opportunities. For this reason, institutions invest heavily in complex systems capable of making quick decisions and autonomously executing trades.

3. Process Automation: AI technologies offer many advantages in terms of automation, significantly improving the efficiency of routine and time-consuming tasks. Examples include document digitization, form processing, and extracting relevant information from documents.

4. Increased Efficiency: AI technologies streamline financial processes by reducing transaction costs and time, ensuring quick and reliable processing of large data volumes. This reduction in service costs and advancements in databases enhance financial inclusion by expanding the range of services available to users.

5. Advanced Databases: The processing of massive data volumes helps to understand the institution's current state and make appropriate decisions, improving accessibility.

6. Fraud Prevention: AI in financial crime has become an area of interest for all professionals within financial institutions.[6] There are numerous machine learning algorithms specializing in recognizing fraudulent behavior, blocking potential attacks, and detecting suspicious transactions, thus enhancing security.

(-) AI technologies also present some potential risks to economic stability:

1. Data Distortion: Incorrect data fed into a trading algorithm can have serious consequences for the entire system, leading to unsuccessful transactions and financial losses.

2. Interconnected Networks: A single point of failure in a technology or infrastructure, such as a cyberattack, can cause cascading effects capable of destabilizing markets and disrupting access to financial services across multiple institutions, creating market panic.

3. Regulatory Challenges: Regulatory authorities must strike a balance between fostering innovation and mitigating associated risks. Strict regulations

[6] Gupta, A., Dwivedi, D. N., Shah, J., Artificial Intelligence Applications in Banking and Financial Services, Springer Nature Singapore, 2023, p.57

may stifle innovation, while lenient ones could increase the system's vulnerability to potential threats.

4. Cybersecurity Challenges[7]: These threats can lead to data errors, financial losses, and the erosion of trust in the system.

5. High Investment Costs: AI technology requires a substantial amount of financial resources and equipment. Many organizations cannot afford to develop their own AI-based systems and must resort to service providers.furnizorilor.

5.2. Benefits and Risks from the Perspective of Clients

(+) The benefits offered to clients through the implementation of AI within financial institutions include:

1. Robo-Advisors: These provide asset management services and portfolio recommendations based on investors' risk preferences, disposable income, and individual goals. The main advantages of these systems are ease of use, lower costs, and the lack of need for financial knowledge.

2. Personalized Banking Experience: The banking sector aims to leverage AI to offer personalized banking experiences for each individual. A relevant example is the implementation of chatbots.[8] Using advanced techniques, they can understand the client's intent and guide them in resolving issues.

3. Objectivity: AI-based assessment systems have the ability to make impartial and objective decisions, eliminating errors caused by human factors, such as a bank employee's mood on a given day or other factors that might influence the decision.

(-) Among the risks, we can list the following:

1. Biased Data: Algorithmic systems, if not controlled and updated, may lead to discriminatory practices, such as unfair loan denials.

2. Functional Errors: Discrepancies may arise between the products offered to clients by AI and their actual needs. Thus, some clients may refuse to use online banking services.

3. Resistance to Change: This is driven by limitations, risks, low understanding, and a lack of trust in AI technologies from clients.[9]

6. IMPLEMENTATION OF AI TECHNOLOGIES IN ROMANIA AND THE EU

In recent years, AI technologies have started to be increasingly used in finance, both in Romania and in other EU member states. According to the diagram in Fig. 1, 8% of enterprises in the EU used AI technologies in 2023,

[7] Gera, R., et al, Artificial Intelligence, Fintech, and Financial Inclusion, CRC Press, 2023, p.155
[8] Ng, J., Shah, S., Hands-On Artificial Intelligence for Banking, Packt Publishing, 2020, p.16
[9] National strategic framework on Artificial Intelligence 2023-2027

with Romania ranking last. Thus, in 2023, fewer than 1 in 10 companies in the EU utilized AI technologies.

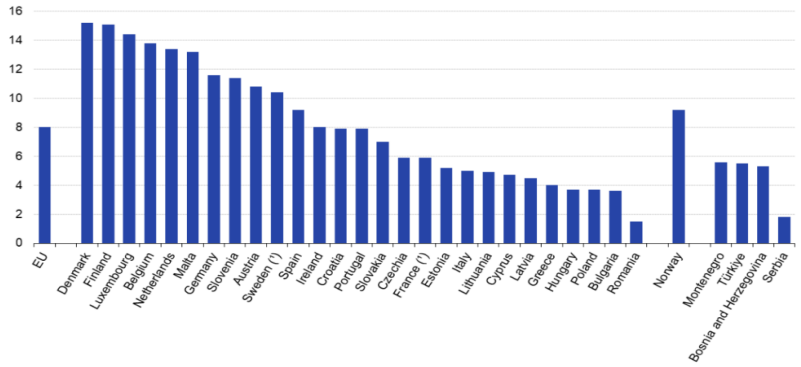

Figure 1. Enterprises in the EU using AI technologies, 2023 (% of enterprises)
Source: Eurostat (isoc_eb_ai)

When we consider how AI and machine learning are used in the financial and banking industries, customer service is likely the first area that comes to mind, along with both local and international examples. Chatbots like George, Ana (Raiffeisen), Livia (BT), and Ada (BCR) have positioned themselves as automated representatives for the customer service departments of the most well-known banks in Romania, facilitating interactions with millions of clients. However, customer service is merely the tip of the iceberg in terms of revolutionary technology use. There is a significantly broader range of benefits and applications, both for financial institutions and end consumers.[10]

Governments in Romania and the EU have encouraged the adoption of AI technologies in the financial sector through specific initiatives and regulations. On March 13, 2024, the European Parliament voted in favor of approving the Artificial Intelligence Act ("AI Act"), which regulates AI development to ensure it does not pose a risk to humanity.[11]

According to FINMA's 2023 annual report, most institutions using AI closely monitor developments in this field. Complete automation is rarely pursued, and the human factor is still considered highly important. Most institutions do not see the risks as fundamentally new and are already addressing them within their existing risk management processes.[12]

[10] https://futurebanking.ro/ia-si-machine-learning-in-industria-bancara-si-in-cea-financiara
[11] https://www.europarl.europa.eu/
[12] FINMA annual report 2023

Across the EU, there are numerous projects and collaborations between financial institutions and research organizations aimed at developing and implementing AI-based solutions. These initiatives focus on improving financial services, risk management, and regulatory compliance. For instance, on March 14, 2024, Banca Transilvania integrated Microsoft 365 Copilot and GitHub Copilot, AI-based assistants.[13] Through a partnership with Microsoft, Banca Transilvania also launched the AI Search function on the "Întreb BT" platform in October 2023, an online search engine with over 2,000 banking-related questions and answers.

According to the 2023-2024 investment report from the European Investment Bank, companies that use AI tend to perform better than those using other advanced digital technologies. These companies are, on average, larger, pay higher salaries to their employees, and are more productive.[14] In Fig. 2, the types of AI technologies used in the EU are represented according to company size. A positive correlation is observed between company size and AI technology usage. Larger companies appear more likely to adopt AI technologies, a trend likely attributable to the greater financial and human resources available for implementing and managing these technologies. The relatively low percentage of small and medium-sized companies using AI technologies indicates a need for policies and initiatives that encourage and support these companies in adopting new technologies.

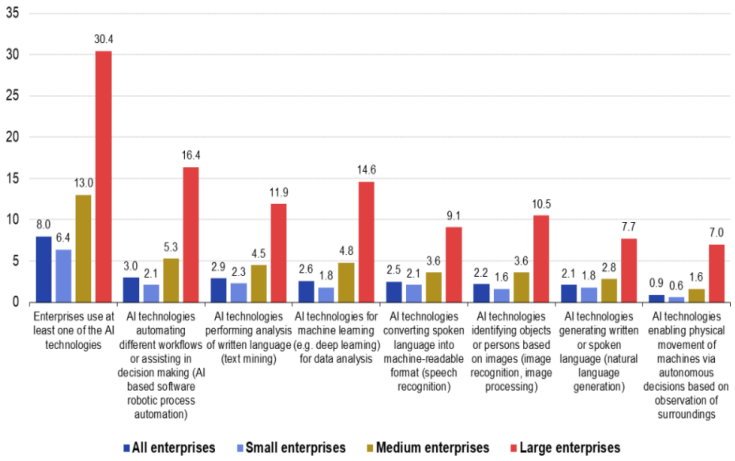

Figure 2. Enterprises in the EU using AI, by type of technology and size, 2023 (%)
Source: Eurostat (isoc_eb_ai)

[13] https://www.bancatransilvania.ro/news/comunicate-de-presa/BT-integreaza-microsoft-365-copilot-si-github-copilot-asistenti-ai
[14] EIB Investment Report 2023/2024

7. CONCLUSIONS

As a result of this detailed research, the goal of analyzing the necessity of AI in financial institutions and assessing client preferences for new technologies was successfully achieved. Thus, the initial hypothesis was confirmed, showing that AI increasingly dictates the performance of economic entities and offers a wider range of services, ensuring a more pleasant client experience.

From the perspective of financial institutions, we concluded that company performance improves with the implementation of intelligent technologies. By identifying and analyzing the benefits and risks associated with the use of AI in finance, we found that most risks can be mitigated and minimized through specific regulations or investments. Ongoing collaboration among policymakers, regulatory authorities, financial institutions, and technology companies is essential for maintaining a safe and stable financial ecosystem. In this ongoing debate over the benefits and risks of AI in financial institutions, the advantages prevail. These advantages relate to higher profit, efficiency, and market positioning for institutions that integrate new technologies into their activities. The adoption of AI in the financial sector is essential due to its long-term benefits for the economy, including a significant increase in company productivity and enhanced competitiveness. Thus, using AI in finance is both rational and reasonable.

From the perspective of financial institution clients, we conclude that AI can address various customer needs, enhancing their overall experience. By offering personalized services, rapid assistance, and fraud prevention, AI becomes an essential tool for increasing customer satisfaction and fostering long-term relationships. Although AI systems do not yet inspire the same level of trust as human agents, financial institutions could adopt various measures to boost customer trust and alleviate concerns. AI technologies could significantly contribute to company performance by streamlining activities and, thereby, reducing client costs.

As practical strategies for AI implementation, we suggest that financial institutions conduct surveys and questionnaires on this topic, aimed at understanding client needs, assessing acceptance levels of AI technologies, and gathering information on issues clients face when interacting with new technologies. Based on these results, financial institutions can make relevant decisions and adopt practical solutions to minimize risks and improve their products and services.

During this study, certain limitations arose, such as limited experience in conducting scientific communications, time constraints, and a small sample size, which may not provide as representative data as a larger sample would.

This research can serve as a foundation for new studies in the fields of finance and AI. Future research directions may include analyzing the impact of large-scale implementation of intelligent technologies on job opportunities or conducting more in-depth studies on the influence of AI on customer behavior.

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FINTECHS: AN ALTERNATIVE TO DIGITAL BANKING

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Abstract
FinTechs have experienced significant growth in the post-pandemic period, both in terms of the number of new companies established and, more importantly, their complexity. Their advantages attracted the attention of many banking clients, forcing the traditional banking institutions to reduce their fees and integrate the newly technological developments into their processes and products. As we look ahead, several exciting trends are expected to redefine the FinTech industry. Within this paper we investigate the benefits and risks that arise with the development of the FinTech industry and provide an overall image of the financial technologies landscape in the European Union and Romania. This paper points towards the fact that FinTechs have the potential to significantly change the financial sector landscape by providing innovative products and services which respond to users' needs for security, speed, and low cost.
Keywords: Fintech, international payments, financial inclusion, blockchain, banking, technologies
JEL Classification: E51, G23

1. INTRODUCTION

Over the last decade, financial technologies have experienced remarkable growth. As well as being closer to customers, they offer low-cost alternatives to both traditional and digital banking. Since their emergence in the 21st century, financial technologies have been destined to be integrated into the backend systems of established financial institutions, such as banks. The digitization trend and the need for the population to adapt to this process has facilitated the development of FinTechs, with a shift towards consumer-oriented services.

FinTechs are non-bank financial institutions that operate in the digital environment, offering innovative financial solutions. Essentially, FinTechs are used to help both individuals and businesses. For example, FinTechs can help companies, business owners and consumers better manage their financial operations, as well as life itself, as it is highly diversified (investments, insurance, personal financial management, etc.)

To grasp their true importance, it is essential to examine a statistical retrospective. According to the latest data reported by *ATOS in LookOut Industry*

Trends Banking, recent years have seen investments in FinTechs reach approximately 50 million US dollars. Over 500 new financial technologies are developed annually, a momentum driven by high demand, as two out of three financial transactions are now conducted online.

According to the *New Age in Banking whitepaper*[1], it can be seen that different generations are adopting to new technologies differently, but the FinTech target for 2020-2030 remains the Millennials and Generation Z. Unlike Generation X, who tend to focus on simply keeping cash in their accounts, Millennials and Gen Z seek banking products that act as companions and advisors, helping them achieve their financial goals.

Moreover, in recent years, FinTech popularity has grown significantly on a global scale to a degree that:

- 96% of global consumers are aware of at least one innovative financial service.
- 3 out of 4 (75%) global consumers use FinTech services.
- 64% of global consumers have adapted to online financial services.

The trend in innovative finance over the next few years is aligned with the financial literacy trend, as 85% of Millennials surveyed by Credit Karma/Qualtrics report feeling too exhausted to think about or manage their personal finances. What's more, FinTech companies rely on a best-in-class customer experience, which is shaped by the integration of machine learning (ML) and user experience (UX).

Before proceeding with the detailed analysis of FinTechs, it's worth mentioning that, according to the global unicorn rankings for March 2024, the financial sector holds second place, with a total of 390 unicorns, depending on the industry.[2]

2. BENEFITS AND RISKS OF FINTECH

Those who use the services provided by FinTechs enjoy a diverse range of benefits[3], including:

- **low costs**: the key advantage when FinTechs compete with traditional finance companies is that most offer lower fees than banks, as they have lower staff costs and fewer fixed assets compared to physically-based institutions.
- **fast and efficient service**: customers no longer need to visit a physical location to carry out transactions. Counters are replaced by a user-friendly interface accessible 24/7, optimizing time. On average, FinTechs provide

[1] Intellias "New Age in Banking Whitepaper: The Era of Tech Change Has Arrived",2022. Available online: https://intellias.com/new-age-in-banking-whitepaper/
[2] Statista, "Number of global unicorns as of 2024, by industry",2024.
[3] Mfsa "FinTech: Risks and Benefits",2023.

a response to applicants in a short period, ranging from 10 minutes to 48 hours.

- **enhanced protection:** in certain cases, FinTech offerings provide enhanced protection for consumers and investors. For example, solutions using blockchain technology (Distributed Ledger Technology, DLT) offer full transparency and traceability of transactions made on the platform. Furthermore, the continuous development of Machine Learning (ML) and Artificial Intelligence (AI) is applied for identity verification and fraud detection to reduce financial crime.
- **inclusion**: a major benefit of financial technologies is the increase in financial inclusion. In 2023, it is estimated that 2 million people will be able to engage with the financial market through mobile financial apps[4]. The need for FinTech has never been greater than during the pandemic and post-pandemic years, when several financial services companies transitioned to digital solutions in response to COVID-19 restrictions.
- **diversity of choice**: FinTech promotes competition by offering a wide range of products and services to consumers. To stand out, companies will innovate and focus on attracting customers with various customizations and suitable financial products

Figure 1. Top FinTech benefits for consumers
Source: Report Plaid's 2022 Fintech Effect Survey

In Figure 1, we highlight and reinforce the fact that, for consumers, the greatest advantage of financial technologies is the ability to save precious time and better manage their resources.

In fact, FinTech is fundamentally transforming the way financial transactions are conducted. Living in the era of the "FinTech Revolution," it is crucial to take certain risks while remaining vigilant. It is natural that a financial transaction is not completely risk-free, this is also true of innovative financial technologies.

[4] Atos,2024"Atos reports full year 2023 results". Available online: https://atos.net/en/2024/press-release_2024_03_26/atos-reports-full-year-2023-results

Some of the most common risks are:

- **possible fraud or illegal behavior:** FinTech companies themselves warn that many of their customers are not well-equipped to manage their money. This suggests that consumers are often unfamiliar with complex financial models and techniques. As a result, operators or related parties may engage in illegal activities, which increases the risk of fraud.
- **lack of transparency about fees and other features**: when there is misinformation or a lack of transparency regarding changes in prices, features, and risks of the products purchased, consumers may become wary and perceive the situation as risky.
- **lack of physical communication branches**: this disadvantage arises when services are provided, and difficulties are typically resolved directly through the app or via email. While some FinTechs use blockchain technology as a differentiator to enhance security, not all do so, which can jeopardize user data security. Moreover, the reliance on online communication excludes a large portion of the population who lack internet access, making it difficult for them to become banked.
- **high risk of product unsuitability and ethical issues**: while FinTech provides access to a wide array of financial products, including the newest and most complex ones, consumers who lack the knowledge and experience to evaluate such products may end up purchasing products or services that are unsuitable for their financial needs. The absence of human intervention can also lead to ethical concerns related to accountability, transparency, data bias, and determining responsibility in cases of algorithmic error or bias.

As we can see, however, the benefits are overwhelmingly customer-cantered, as are the risks. Having measures in place to minimize but not exclude these risks can help both companies and the customer. As highlighted in Figure 2, the balance tends to prevail in favour of the benefits, which denotes an opportunity for entrepreneurs and creates a safe environment for customers.

It is recommended that the consumer should find out as much as possible about the FinTech company they wish to use, make sure that the contractual clauses (terms and conditions of the application, privacy policy and security practices) satisfy them and find out from the outset what risks they are taking on and which ones the company is assuming.

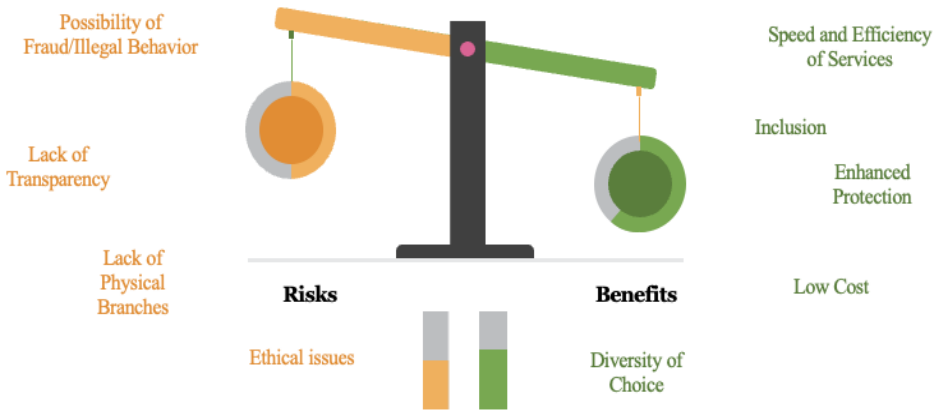

Figure 2. The balance of benefits and risks of FinTechs
Source: created by the author based on the sources studied

In terms of security when interacting with the app it is preferable to create strong passwords and additional security features such as two-factor authentication. Monitoring financial account activity on a regular basis mitigates the risk of suspicious transaction going undetected. And as a final recommendation would be to avoid using public Wi-Fi to access financial accounts.

3. TYPES OF PRODUCTS AND SERVICES

The variety of offers provided by FinTechs attracts both customers and investors, who are increasingly eager to finance them every year.

Thus, the world of FinTech can be classified into 3 main categories, depending on the service they offer[5]

- Payment and settlement services.
- Investment management services;
- Loans, deposits and attracting/mobilizing capital.
- InsureTech is considered a supplementary service.

In the following, we describe each component in detail, noting the importance and weights in total services.

One of the biggest categories is **payments, clearing and settlement services**.

FinTech has developed services to ease the relationship between traditional bank payments. FinTechs offer services that overcome some of the restrictions of the traditional payments system (such as: geographical barriers, the need to go to

[5] Constantin-Marius Apostoaie, "Finance and Risk Management, Digital finance"

a bank to transact, and bank hours of service). Subcategories of these services being:

- digital and mobile wallets.
- mobile points of sale.
- peer to peer transfers.
- foreign exchange.
- digital currency/crypto.

1. ***Digital wallets*** are platforms, accessible via web browsers and apps, used for making online payments. These platforms are linked to various traditional payment options, such as debit or credit cards, coupons, gift cards, and loyalty cards. ***Mobile wallets*** are digital wallets accessible through mobile phone apps, which sometimes include digitized versions of credit or debit cards. The biggest beneficiaries of the eWallet market are retail and e-commerce, which hold the largest market share, with an overall share of 30%. The eWallet app industry is valued at 100 billion dollars, with leading apps like PayPal - a digital payments platform that enables users to connect and transact online, on mobile devices, through an app, or in person - generating millions in profits. Some of the most widely used mobile wallets include Google Wallet, which offers services to send money via their app, Gmail, or on the web using the recipient's email address or cell phone number, along with merchant transactions. Apple Pay and Samsung Pay operate in a similar manner.

2. ***Mobile Point of Sale*** (MPOS) although serving the same purpose as debit and credit card payment terminals, there are 3 main differences between mPOS and traditional POS:

- Connection, mPOS are connected to mobile phones via audio jacks or Bluetooth so fintech companies connect them to banking networks
- Portability, mPOS are more portable than traditional POS because allow merchants to accept payments anywhere the internet is available.
- Proprietary, mPOS are owned by the fintech companies that provide them, many of which are cloud-based.

One drawback is that customers may be hesitant to use these services due to concerns about the potential misuse of their debit or credit card information by FinTech providers. We can further emphasize the growth potential of mPOS (mobile point of sale) systems with numbers. According to Fact.MR, the mPOS market is predicted to witness a Compound Annual Growth Rate (CAGR) of 33.5%. The estimated market value for 2032 is expected to reach USD 446.3 billion, compared to just 23 million in 2022. Key players in the mPOS market include Bixolon Co., Ltd., Citizen Systems Europe GmbH, Dspread Technology, Inc., Oracle Corporation, and Zettle.

3. ***Peer-to-peer transfers*** (P2P) transfers are services that provide digital or mobile wallets, allowing users to transfer money between any two wallets within the platform. The process works as follows: a user adds funds to their personal

wallet by depositing money into a bank account associated with the P2P transfer company. To make a P2P transfer, the service provider charges a fee to move money from the sending user's wallet and add it to the receiving user's wallet. The key benefit of this system is that it doesn't require money transfers between banks, as the funds associated with both wallets are part of the provider's payment ecosystem. P2P transfer services typically perform fewer security checks and serve customers exclusively through online or mobile platforms. FinTech P2P transfer services benefit from lower operating costs and can charge lower fees compared to traditional providers, which contributes to their growing market share. In response, some traditional companies are partnering with or acquiring FinTech competitors to modernize their operations and regain market share by offering services to unserved or underserved populations.

Among the most popular and widely used are:

- Wise (formerly TransferWise) offers money remittance services using the ratio of real (middle market) exchange for transactions.
- Remitly is the US-based digital remittance company, it allows people to send money from Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, the Netherlands, Norway, Spain, Sweden, the United Kingdom and the USA to over 150 around the world including the Philippines, India, Mexico and over 40 African countries.

The popularity of these services is evident in the market assessment, highlighting the widespread adoption of this technology. The global P2P payments market has been valued, as we observe in Fig.3, at USD 2.21 trillion in 2022 and is expected to reach around USD 11.62 trillion by 2032, its growth is indubitable.

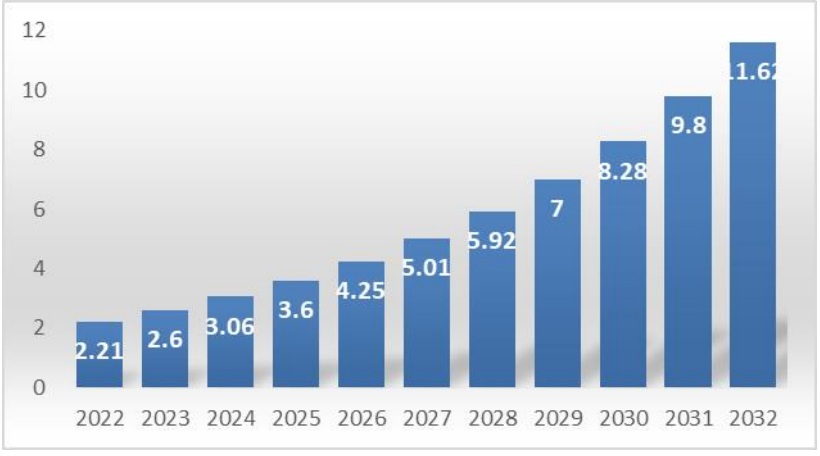

Figure 3. P2P payment market size 2022 - 2032 (USD trillions)

Source: SDK.FINANCE, 2024, Alex Malyshev [Understanding P2P Payments: Functionality, Trends and Benefits, Available at: https://sdk.finance/understanding-p2p-payments/

4. **Foreign exchange** (FX) FinTechs leverage P2P technology to match currencies in one country (typically in small amounts) and mirror transfers with foreign currencies in another country through digital wallets or a digital platform that utilizes an asset-backed digital currency. These platforms help reduce currency risk by converting money in near real-time, minimizing the impact of fluctuating market rates. Representative platforms in the FX FinTech space include Bitso, Berry FX, Kuarix, and Kantox.

5. **Digital/crypto currencies** are a medium of exchange created and stored electronically, using encryption techniques, to control the creation of monetary units and to verify the transfer of funds, decentralized from the Central Bank.

Nowadays, people have started to immobilize their monetary resources in digital models, but due to some disadvantages nevertheless most of them remain reserved. The disadvantages being: irreversible transactions, anonymous owners behind the accounts and the uniqueness of making transactions only in a particular cryptocurrency system.

The most popular cryptocurrencies in April 2024[6] are shown in the chart below (Fig.4), as well as their market capitalization and annual returns. We observe that the leading position is held by Bitcoin, with the largest and considerably larger than the others, market share of USD 1.3 trillion.

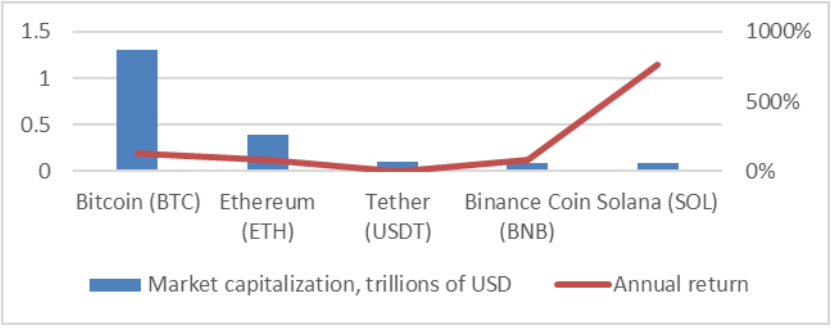

Figure 4. Top digital currencies in April 2024

Source: M. Adams, L. Dammeyer, "Top 10 Cryptocurrencies of April 2024", Forbes, 2024.

The second main category, **investment management services**, is characterized by online and mobile investment platforms, automated investment advice, investment simulation platforms and foreign exchange trading supported by virtual currencies

Main services provided including trading, investments and foreign exchange.

[6] M. Adams, L. Dammeyer, "Top 10 Cryptocurrencies of April 2024," Forbes, 2024.

1. E-Trading and high-frequency trading allows managing a portfolio of financial assets as in traditional trading and investing (includes stocks, bonds and equity holdings of start-ups). There are also automated trading platforms that use powerful computerized resources to trade many orders in a very short time: frequency trading (HFT); profits are made by buying low and selling high quickly, but at speeds on the order of milliseconds. The platforms that speak for themselves are Kuspit and Admiral Markets.

2. Copy-trading presumes that investors and traders copy certain managed positions of licensed traders and investors through contracts for difference (CFD) platforms. Well-known firms in this sector are:

- Ayondo allows customers to track top traders, ranked by performance and number of followers to replicate or build portfolios based on these top traders (including risk-free demo accounts). The best trades in return earn rewards for allowing people to follow their trades.
- CopyFX helps users to manage their own risks, as well as to Share your trading experience for extra profit. It offers its clients to choose one of two roles: investor or trader.

3. Robo-advisers replace human brokers by offering specific investment suggestions.

The advice is calibrated according to the investor's risk appetite and objectives. The advice also includes providing users with information about the trading activities of so-called top traders (i.e. investors with unusually high returns). Further benchmarking, we have analysed the top companies in this field, indicating their strengths. For example, Robo Advisor by CMC Markets offers an excellent match for all types of traders with a wide product offering, while Interactive Brokers provides up to 4.83% interest earnings on instantly available USD cash balances, and XTB is exclusively for traders who want to minimize their costs - trading and/or foreign

The third category encompasses FinTech companies providing new channels for **lending and capital raising** that target the underserved and underserved populations.

Main channels include:

- **Lending Markets**: P2P Lending: These are online services that connect investors (who are not the originators of the loans) with borrowers through a digital platform. Successful companies in this space include Prosper, LendingClub, and Funding Circle.
- **Online Banking**: These are platforms provided by banks that allow users to perform various operations in real time. Mobile banking offers the same services as online banking platforms, but users access them through specialized mobile applications. Examples of excellent online and mobile banking services include Nubank, NatWest, Lloyds, and Halifax.

- **Crowdfunding**: This is a non-traditional method of raising funds by collecting small amounts of money from many people via an internet-based platform. Crowdfunding platforms connect project initiators with donors or contributors, whose reward depends on the crowdfunding method and the success of the project.

There are three main types of crowdfunding methods: equity crowdfunding (Crowdcube, Seedrs), reward crowdfunding (Kickstarter, IndireGoGo), crowdfunding for donations (GoFundMe).

The average funding per campaign in the crowdfunding market is $8.15k in 2024.

From a global comparison perspective, Figure 5 shows that the highest transaction value is reached in the United States (504 million USD in 2024). With a significant gap and enviable by other countries.

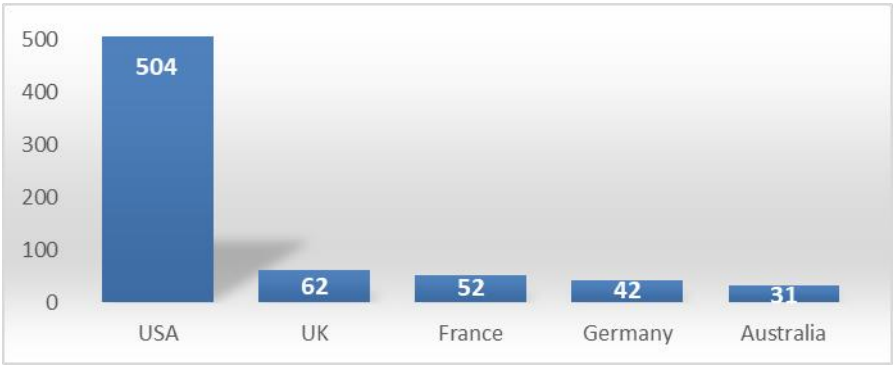

Figure 5. Top countries in crowdfunding based on transaction values, million USD
Source: Alternatives finance: Crowdfunding Statistics. Available at: https://alternatives.financesonline.com/crowdfunding-statistics/

The final FinTech category, **InsureTech**, involves the use of big data analytics, typically through machine learning methods, to assign customized insurance policies and diversify coverage options and pricing models. Providers often rely on smart contracts to automate the enforcement of insurance agreements. These contracts, created and stored using blockchain technology, are enforced through pre-programmed sets of rules that execute automatically. The global Insurtech market is expected to reach 166.7 billion USD by 2030. The compound annual growth rate (CAGR) of the Insurtech market is estimated to be around 43.9% between 2021 and 2030.

From 2019 through the first half of 2023, InsurTech companies around the world have collectively secured a total of $34.8 billion in funding.[7]

Analyzing the annual FinTech 2023 effects report, we observe that customer trends for the year are focused on three key objectives. From Figure 6, it is clear that saving and investing their own money, with 42% of respondents, remains a major area of interest for the population. This focus on financial goals will likely drive increased utilization of financial technology products and services, which will cater to the growing consumer demand.

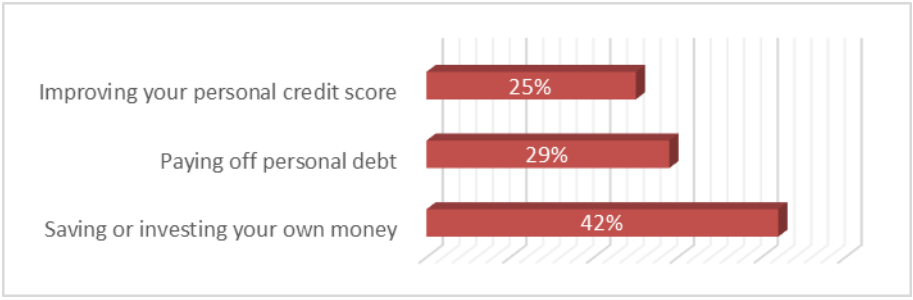

Figure 6. Top financial targets for 2024
Source: Fintech Effect | 2023 Consumer trend report

Thus, generalizing, each component of FinTech has its own attributes, with significant impact on the population, being complementary and facilitating the lives of customers.

4. FINTECHS IN ROMANIA AND THE EUROPEAN UNION

Among the countries of the European Union, Western Europe is home to the largest number of FinTech companies, including start-ups such as Funding Circle, Revolut, and TransferWise. Some of these FinTech start-ups have achieved "unicorn" status - an industry term used to describe companies that have reached a $1 billion valuation - and have evolved into "blue chips" within the sector.

[7] Fintech global "Global Insurtech investment falls short in H1 2023 whilst deal activity remains stable",2023. Available at: https:

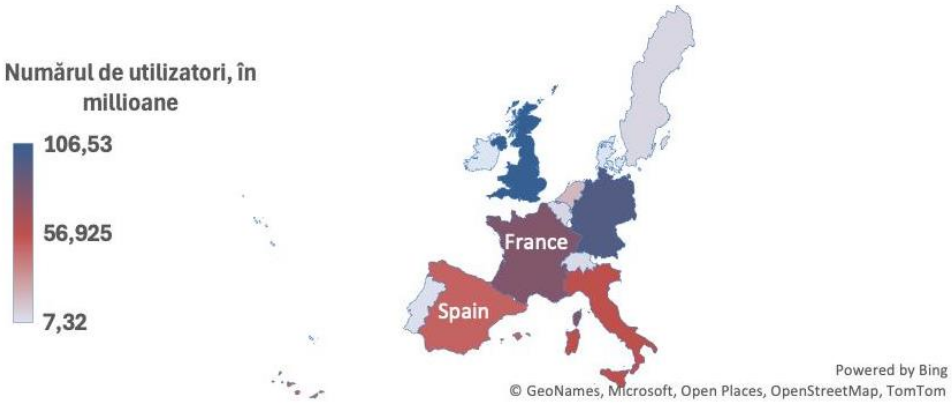

Figure 7. Number of FinTech users in selected European countries in 2023 (in millions)

Source: Statista: Fintech Users in Europe by Country. Available at: https://www.statista.com/statistics/1384900/fintech-users-europe-by-country/

In 2023, the United Kingdom (UK) had the largest number of FinTech users in Europe, with approximately 106.53 million users, as shown in Figure 7. This is despite the fact that the UK is no longer part of the EU post-Brexit, as KPIs are considered for all EU-27 countries. The UK was followed by Germany and France, with 96.4 million and 79.4 million users, respectively. Further information and methodological notes can be found in Statista's Digital Market Insights.

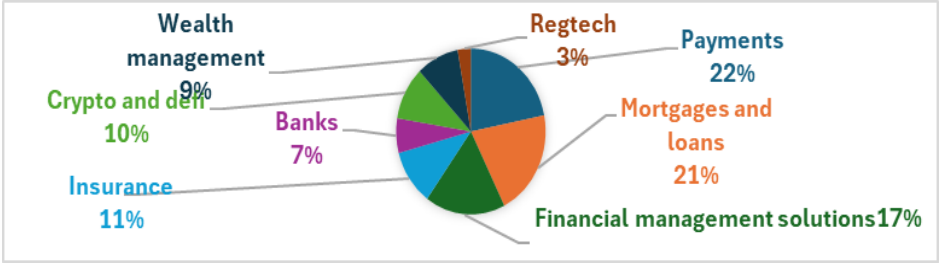

Figure 8. FinTech industry venture capital funding by sub-industries (%)

Source: https://dealroom.co/blog/fintech-q1-2023-report

Although there has been a general slowdown in FinTech activity across Europe, promising new businesses are still emerging, particularly in the early stages. These startups are focused on building the fundamental infrastructure for the future and are benefiting from the expertise of many talented engineers. Significant shares are held by companies focusing on payments (22%) and mortgages/loans (21%), followed by financial management solutions, as depicted

in Figure 8. As the FinTech industry continues to evolve and mature, these companies are well-positioned to lead the next wave of innovation and growth.[8]

The analysis highlights the growth of FinTech activity across every European country, but it also reveals a significant divergence in maturity and performance between FinTech ecosystems by country. There are substantial gaps between the top third of countries and the rest, as shown in Figure 9. Two countries that stand out for their superior FinTech ecosystem performance are the United Kingdom (an ex-EU member) and Sweden.

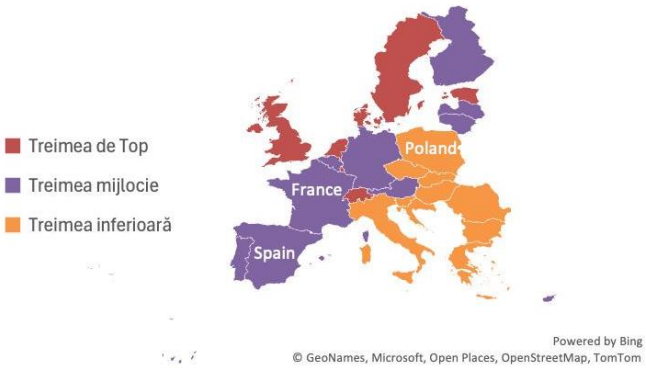

Figure 9. FinTech industry financing with venture capital by sub-industries
Source: DEALROOM.CO, L. Chiavarini,2023, [Fintech Q1 2023 report]. Available at: https://dealroom.co/blog/fintech-q1-2023-report

If the FinTech ecosystems in all European countries were able to achieve the same level of performance as the best in the region, the advantage could be substantial. The number of FinTech jobs in Europe would increase by a factor of 2.7 to over 364,000, funding volumes would more than double from €63 billion to almost €150 billion, and valuations would increase by a factor of 2.3 to almost €1 trillion - almost double the combined market capitalization of the top ten banking players in Europe as of June 2022.

Currently, the FinTech solutions market is in a state of continuous development[9] , both on both the individual and the corporate segment. According to Statista[10] , the largest market segment in Romania is Digital Payments, with a total transaction value of €8,041.00 million in 2022. In addition, Digital Payments

[8] L. Chiavarini, Dealroom.co, "Fintech Q1 2023 report," 2023. Available at: https://dealroom.co/blog/fintech-q1-2023-report
[9] , I.C.M. BĂLȚOI "The fintech ecosystem in Romania" ,2020. Available online: https://intapi.sciendo.com/pdf/10.2478/picbe-2020-0026
[10] Statista "Digital Payments - Romania"2022. Available online: https://www.statista.com/outlook/dmo/fintech/digital-payments/romania

is predicted to reach a total transaction value of 15860 million euros in 2027 in 5 years. Below, we can observe the structure of FinTech products in Romania (Figure 10), the leading sector being payments and mobile wallets, which denotes that Romanians predominantly use financial technologies for convenience and to reduce costs with intermediaries, with a 10% gap being financial infrastructure.

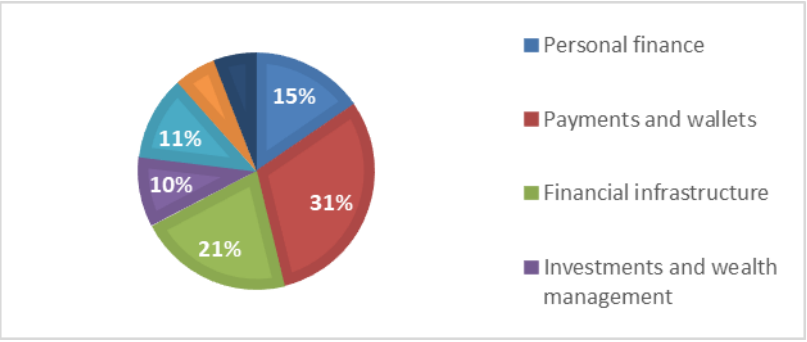

Figure 10. Structure of FinTech product types in Romania, %
Source: FUTURE BANKING, Report Romania's FinTech map 2022

For investors, Romania's labour force, business incubators and tax breaks will make Romania an even more attractive place for investors in the future, especially in this field.

5. CONCLUSIONS

As FinTech is a technology-driven industry, it is constantly evolving, introducing new products and services to the market. In 2024, several key trends are shaping the industry. The first trend is the integration of artificial intelligence (AI) to enhance applications and secure customer service. Green FinTechs and sustainable investments are also gaining traction, driven by the global push for addressing climate change and the promotion of Sustainable Development Goals (SDGs) by many countries. In tandem with traditional and central banks, financial technologies are providing additional support to facilitate operational processes.

New companies entering the FinTech space have the opportunity to attract funding and potentially become unicorns. In fact, the FinTech industry was the number one unicorn industry in 2021. Although the trend of new unicorns has slowed, the number of established unicorns continues to grow.

Both domestic and international markets view FinTech as an opportunity for development, capitalization, and value creation. As a result, investments are increasing year by year, with tangible effects expected in the near future rather than decades. Consumers are increasingly attracted to FinTech products but remain cautious about the security of their personal data and the integrity of their money. For this reason, traditional or digital banks remain a safer option for

certain segments of the population. In this context, FinTechs can partner with banks to help improve operational efficiency, thereby gaining credibility in the eyes of consumers.

In conclusion, the FinTech landscape in 2024 is filled with potential and innovation. These trends are only a glimpse of the growing opportunities at the intersection of finance and technology. FinTechs continue to redefine and democratize financial services, promising a more inclusive and technologically advanced financial future.

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A BIBLIOMETRIC ANALYSIS OF PUBLICATION ON EXPERIENTIAL LEARNING IN BUSINESS MANAGEMENT FIELD

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Abstract
The research is related to identifying strategies for developing new methods for working with students using experiential learning. We try to discover if this type of learning by using role playing, gamification, simulation games generated in the mind of people who want to develop skills more interest rather than classical teaching methods. Another objective is to search and identify other experiential learning methods or models applied in the education process. The methodological approach is based on used of the bibliometric software R-Stata Bibliometrix, Science Mapping Workflow and the results on authors search about experiential learning in the international databased SCOPUS and we select articles in the field of business management and accounting.
Keywords: experiential learning, gamification, teaching methods, management, simulation
JEL Classification: M53

1. INTRODUCTION

According to Armstrong, experiential learning refers to learning which uses the learner's experience as base (Armstrong, 1977), an old form or the fist form of learning, as the apprentice, under the supervision of a craftsman, would learn the trade by doing tasks and asking for advice when they felt they had no solution to the problems that arose during the creation of the product. Nowadays, the shift from the industrial era, when simulations were used to optimize various processes, to the information era, where computers allow us to develop applications that simulate the functioning of competitive markets, has enabled the development of an innovative form of experiential learning supported by technology. This differs from the traditional approach, where an experienced

person would present relevant aspects of the respective field. Experiential learning or learning by doing in management field, is well-documented approach that enhances student learning business processes through opportunities to combine theoretical knowledge and practical experiences into a specific context generated by game with the scope to improve engagement and develop collaboration, decision-making, problem-solving and critical thinking (Heyworth-Thomas, 2023), (Faisal et. al, 2022). Other perspectives of experiential learning start from the theory develop by Kolb and in this situation, experiential learning is a process of constructing knowledge that involves a creative tension among the four learning modes that is responsive to contextual demands (Kolb, Kolb, 2012). This form of unconscious learning (learning through experience) involves people reflecting on their own experiences in order to explain them and understand various aspects (concepts, theories, principles) that can later be applied in practice. According to Kolb, the process of experiential learning consists of four successive stages that can be repeated at a higher level, giving this type of learning a cyclical nature with four stages: i) *concrete experience* (planned or accidental), ii) *observation* of the lived experience and reflection (thinking) on it, iii) *development of abstract concepts* and generalizations based on the lived and reflectively observed experience, iv) *testing* the implications of these concepts in new situations (Kolb, 1984).

To use this form of education in student training allows them to develop specific skills such as: strategic leadership, overall business acumen, competence in financial, awareness of cross-functional alignment, communication in the language of business (Hussin et. al. 2022). Business games are, in most cases, software programs designed based on economic models that simulate the behavior of systems through experiments conducted on: i) the whole system - integral games, which require participants to make decisions regarding the core activities of the company (marketing, sales, production/operations, human resources, finance, etc.); ii) a specific function - functional games that allow the experimentation of decisions in only one functional area (marketing, sales, etc.).

2. METHODOLOGY

The research presented in this paper is based on search about *experiential learning* in Scopus databased and identified 234 documents (articles, conferences proceeding, etc.) who was analyzed with R-State Bibliometrix software. Uploaded the information obtained into the software based on the concept of social network analysis, offer us the opportunity to observe the evolution of experiential learning between 1978-2024 through: i) *thematic evolution* – an cluster analysis based on two notions: centrality and density (Callon et al., 1991), ii) *co-occurrence network*, an approach to facilitate the understanding and visualization of the structure of different text items and their

content (Puerta et al., 2020). iii) *thematic maps* are a spatial representation of relationships between disciplines, fields and documents or authors.

3. RESULTS

The thematic evolution of the concept of experiential learning is shown in Figure 1, and for a clear representation of the phenomenon, we decided to use 4 cutting points. It can be observed that in the first period, 1978-2002, the main research directions were "learning", "game," and "education". In the following period, 2003-2013, we can identify a long list of specific concepts related to 'experiential learning,' such as: learning, management, teaching, education, simulation, games, etc. Then, the research directions shift to skills, virtual, and game-based, with researchers seeking to identify ways to transfer knowledge and skills (in the period 2014-2017). The period 2018-2021 is characterized by an evolution towards simulation, engagement, management, design, and training simulation. Another explanation is related to the fact that the COVID-19 pandemic affected traditional learning methods, shifting from classical education to online learning, which allows for a better application of this form of teaching, based on simulations, games, and business games. In the most recent period, 2022-2024, research is oriented towards improving the modalities of learning and teaching.

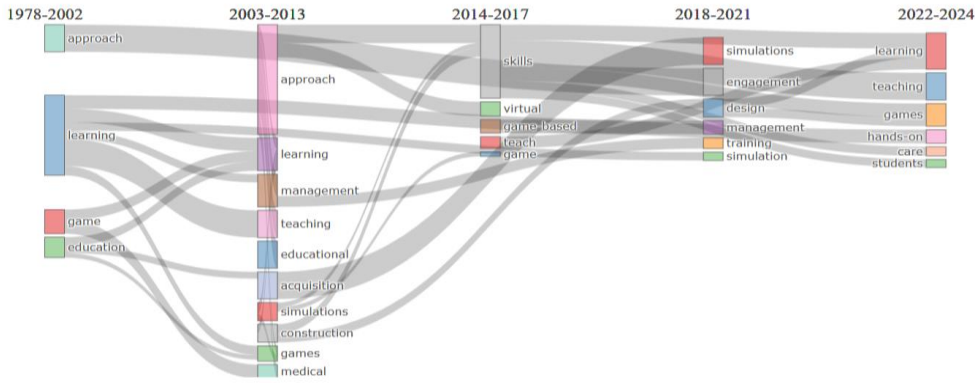

Figure 1. Thematic evolution, unigram titles
Source authors' own processing in R-Stata Bibliometrix

In Figure 2, we analyzed the co-occurrence of the words from the title of the articles included in our research (234, scientific article, conference proceeding, etc), and could show that the concepts related with experiential learning are grouped into different clusters and the main clusters are: learning, simulation, and experiential, with nodes that have large dimensions

(betweenness, which signifies according to Wasserman and Faust that these factors depend on the 'other factors' in the set of factors, especially the factors that lie on the paths between the two and could potentially have power and some control over the interactions between the two nonadjacent factors, where the value for “learning” is 296.91 (Table 1), meaning that this node is connected to another 296.91 words (Figure 2). The closeness, how close a node is to all other nodes in the set of cluster (Wasserman and Faust, 1994) in the case of learning is 0,016 indicating that information circulates rapidly within the network. This value suggests a central and important position in the network.

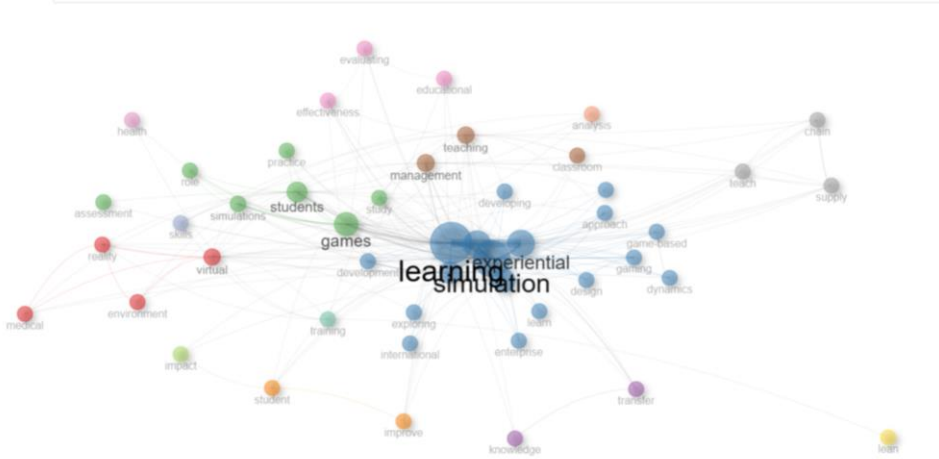

Figure 2. Co-occurrence network, unigram titles
Source authors’ own processings in R-Stata Bibliometrix

The second most used word is 'simulation' with a betweenness of 277.00, and the closeness is 0.017, which means that this node has 277 connections, very strong with a central and important position in the network (Table 1).

Table 1. Closeness of co-occurrence network, unigram titles

NODE	BETWEENNESS	CLOSENESS
learning	296.91	0,016
simulation	277.00	0,017
Games	84.13	0,0136
Game	64.68	0,0135
Training	53.35	0,010

The terms 'games/game' are relevant in the network with a betweenness of 84.13/64.68 but a very low closeness of 0.0136/0.0136. However, as can be seen in Figure 1, they are central and important nodes for the experiential learning network.

Thematic map analysis is based on centrality (intensity of its links with other clusters) and density (characterizes the strength of the links that tie the words making up the cluster together), and Callon, Courtial and Laville (1991) to develop the matrix with four quadrants or cluster: *Quadrants 1* - Clusters of type 1 are both central to the general network (they are strongly connected to other clusters) and have intense internal links (they display a high degree of development), *Quadrants 2* - Clusters of type 2 are central, that is to say that they are strongly connected to other clusters, but the density of their internal links is relatively low, *Quadrants 3* - Clusters of type 3 are not central - we will call them peripheral - and the strength of their internal links leads us to suppose that they correspond to research problems whose study has already been well-developed, Quadrants 4 - Clusters of type 4 are both peripheral and little developed. They represents the margins of the network.

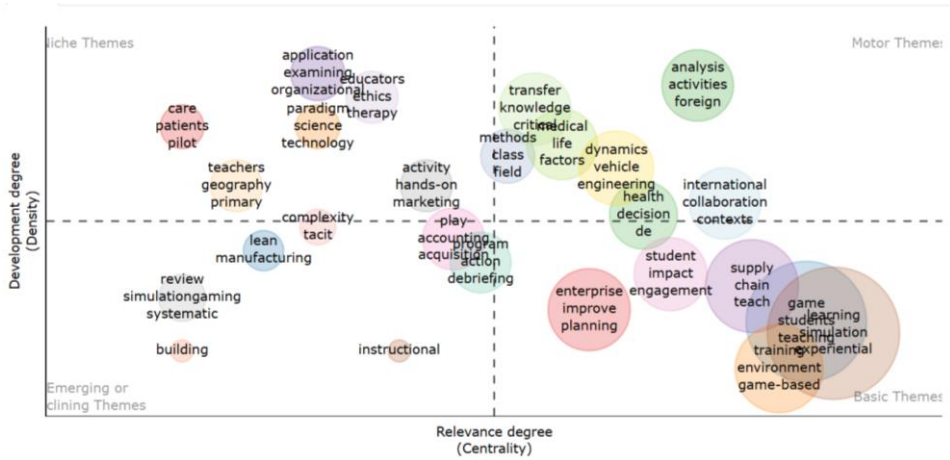

Figure 3. Thematic map, unigram titles
Source authors' own processing in R-Stata Bibliometrix

So, in this situation, according to Callon, Courtial, and Laville (1991), we can observe that the concepts identified as relevant for research—games, simulation, experiential—are situated in quadrant 2, central but not yet sufficiently developed from the perspective of the research conducted and included in the SCOPUS database. What is interesting is that some concepts related to the development and transfer of knowledge through this form of experiential learning are peripheral and undeveloped (Figure 3).

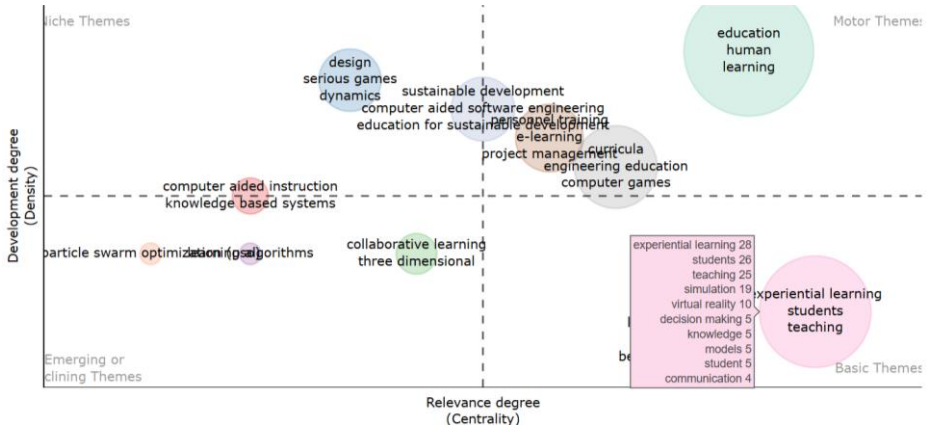

Figure 4. Thematic map, unigram keywords
Source authors' own processing in R-Stata Bibliometrix

The thematic analysis based on keywords highlights that the central and well-developed concepts in quadrant 1 are education, human, and learning, while experiential learning, students, and teaching are in quadrant 2, central but underdeveloped. Peripheral and underdeveloped areas in the current research include collaborative learning, knowledge-based systems, and learning algorithms, which have a high potential for development in the near future (Figure 4).

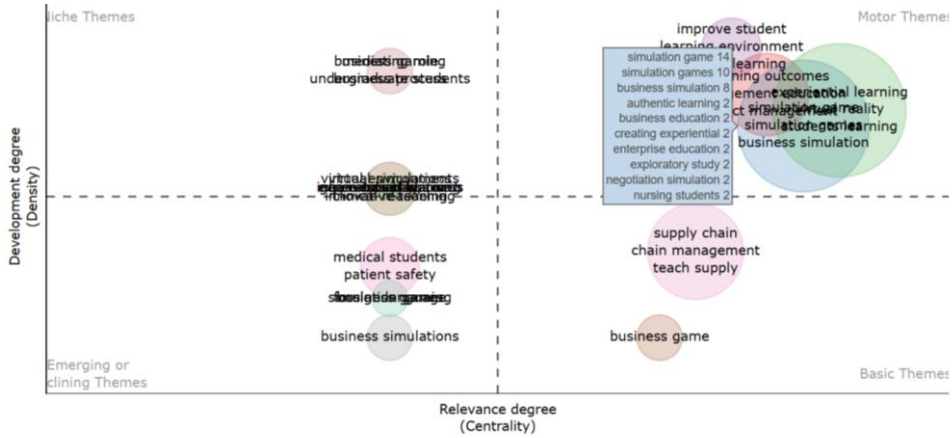

Figure 5. Thematic map, bigram titles
Source authors' own processing in R-Stata Bibliometrix

The bigram thematic analysis highlights that the central and well-developed themes this time are in the area of simulation games, business games, and **experiential learning—research themes that are important for the field.**

4. CONCLUSIONS

The qualitative analysis, using R-State Bibliometrix, of the 254 publications identified in the international SCOPUS database of scientific articles, allows us to gain an overview of the evolution of the concept of experiential learning. There are several useful elements from the perspective of the importance of certain words for this field, such as: learning, simulation, and games, which cover some directions in the areas of economic or medical education. We observe that, with COVID-19, these forms of education have become much more relevant for universities or training companies compared to a few years ago, when their importance was marginal and infrequently used. Computer-assisted learning may become a relevant way in the future for knowledge transfer from teacher to students, leading to a better understanding of processes that can easily be modeled and transformed into simulations.

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