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How to Design More Sustainable Financial Systems: The Roles of Environmental, Social, and Governance Factors in the Decision-Making Process

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Abstract: A literature review showed that finance is a driver of sustainability. However, to achieve sustainability through finance, it is necessary to rebuild and adapt the financial system to the specifics of sustainable development. Modern financial systems can be described as one-dimensional, focusing on ensuring the economic security of transactions. Meanwhile, the growing role of risk related to non-financial factors means that the factors referred to as ESG (environmental, social, governance) become the main source threatening the stability of financial systems. Adaptation activities toward the design of so-called three-dimensional financial systems rely on incorporating ESG risk into the financial decisions of the financial institutions that make up the financial system. This is found, among other factors, in the risk assessment methodology. The general goal of the paper is to investigate which ESG criteria are incorporated into the decision-making process of financial institutions and to verify the level of sustainability of financial systems in selected OECD (Organization for Economic Cooperation and Development) countries. The main research hypothesis assumes that incorporating ESG factors into the decision-making process of financial institutions makes financial systems more sustainable. A two-stage research procedure was used to achieve the research goal. In the first stage, to determine the ESG factors that affect the level of sustainability of financial systems and identify dependencies between ESG factors incorporated by financial institutions into the decision-making process, a fuzzy cognitive map (FCM) was used. The collective map elaborating on the basis of the opinions of experts participating in the study was built using the software FCMapper_bugfix_27.1.2016. In the second stage, based on multiple-criteria decision analysis (MCDA) using the PROMETHEE method (Preference Ranking Organization Method of Enrichment Evaluation), 23 OECD countries that respect the Equator Principles were ranked according to seven groups of criteria defined for financial system assessment (financial depth, development, vulnerability, soundness, fragility, stability, and sustainability), based on a literature review. The ranking confirmed the strong position of Scandinavian countries for assuring best sustainability practices in financial institutions and in the economy. The added value of this paper can be considered at two levels: theoretical and empirical. From the theoretical point of view, it should be noted that it is the first of this kind of analysis which prioritizes ESG factors in financial decisions and ranks financial systems according to fulfilling sustainability criteria. The original empirical approach based on the two-stage research procedure provided analysis of 62 factors, of which 21 represented the environmental scope, 25 the social scope, and 16 the governance scope, which is the main advantage of the empirical study presented in the paper.

Keywords: sustainable financial systems; sustainable finance; ESG factors; risk; fuzzy cognitive mapping; MCDA; PROMETHEE

1. Introduction

Sustainability is currently one of the challenges for finance and financial markets, as evidenced by the 2008 financial crisis. The financial crisis of 2008 showed that the conventional finance paradigm, which is under development since 1950, is inadequate and cannot cope with the problems of contemporary finance and financial markets, as well as the social and environmental impacts on finance of the modern economy. The conventional finance paradigm (which peaked in 1970) is based on efficient market theory (EMT), while the modern financial paradigm is based on an extended approach and, in addition to market efficiency, also includes rational behavior [1]. In the context of the 2008 crisis, the conventional finance paradigm failed, in particular due to the inability to stabilize the financial system, control financial risk, and control indebtedness. The recent global financial crisis that resulted from the credit crunch in 2008 forced financial markets and companies to rethink systemic risk exposure.

The contemporary finance paradigm is characterized by a wider three-dimensional approach, taking into account in financial decisions not only the economic factor, but also the social and environmental consequences of the financial decisions made. Keefe (2011) and Viederman (2009) paid attention to this, stressing the role of non-financial factors—environmental, social, and governance (ESG)—in finance [2,3]. As a result, the importance of the integration of ESG factors and sustainable development with corporate and investment decisions is even greater today.

Modern finance has a much wider impact on markets and the behaviors of buyers than it did in previous decades. In particular, inclusive finance systems provide a tool for combating poverty, climate change, social exclusion, or negative externalities [4–6]. From this point of view, there is a strong interaction between finance and sustainability. Many reports and publications refer to the growing importance of the two elements of finance and sustainability considered jointly [7]. Scholten (2006) argued that finance is a driver of corporate social sustainability, especially because of the role and importance of socially responsible investments [8]. Based on a literature review, there are various interactions to be studied in the relationship between finance and sustainability, including the institutional links in capital markets [9], the concern with environmental, social, and corporate governance (ESG) criteria [10], the impact of investment (Hebb 2013), the concern with climate change and human rights [11,12], and socially responsible investment (SRI) [6,13].

On the other hand, there are many challenges and limitations that prevent the effective use of finance to provide sustainability, particularly regarding the design of sustainable financial systems [14]. After the experience of the 2008 crisis, contemporary financial systems faced the need to adapt to the challenges associated with risk created by so-called non-financial factors, which include the ESG factors. The significance of these factors and the risk associated with them is reflected in global risk rankings, e.g., the Global Risk Report 2019, which draws attention to the leading role of ESG risk. Financial systems whose monitoring and measurement assessment is based on the analysis of economic factors are not adjusted or adapted to manage ESG risk.

There are three factors that need to be improved based on a literature review, namely, (a) measurement (better indicators and tools for assessing sustainable development goals (SDGs), (b) policy reforms to create benefits for financing and investing in sustainable development, and (c) improving communication among stakeholders in order to better match supply and demand for sustainable financing of SDGs [15]. Similarly, however, an extended approach was presented by Zorlu (2018), stating an urgent need for progress in the following areas: (a) incorporating climate-related risks into global monitoring of financial stability and stress tests, (b) tracking and assessing flows and

stocks of sustainable finance, (c) developing taxonomies of sustainable assets, and (d) developing sustainable finance roadmaps and increasing co-operation regionally [16].

A financial system that does not address and take into account social and environmental factors is unsustainable. This type of financial system also does not ensure the effective financing of sustainable development goals that are strongly targeted at minimizing the ESG risk. The question then arises of how to design a sustainable financial system and what role the ESG factors play in building such a system. Incorporating ESG factors into financial institutions' decision-making processes is not a new concept. The United Nations Environmental Program Financial Initiative requires the implementation of ESG factors since 1992 [17]. However, although many documents still recommend their use, they remain a challenge for financial markets [18].

ESG risk has particular relevance to financial institutions, especially banks, in relation to their roles as financial intermediaries and as capital raising agents. Financial institutions are significant catalysts in promoting economic development. Banks' internal regulations also show that environmental risk must be taken into account with respect to their own ethical guidelines, prestige, and reputation risk [19,20]. Also, sustainability rating agencies provide ESG information for the elaboration of sustainability indices [21]. In sum, the general concept is "to integrate sustainability concerns into the financial sector to make it part of the solution: a stable financial system serving a sustainable footprint of mankind on earth" [22]. The question of how to do this remains open and still under discussion.

The specific objective of the study is to deliver a methodological approach for designing and assessing sustainable financial systems. The main research hypothesis assumes that incorporating ESG factors into the decision-making process of financial institutions makes financial systems more sustainable. The original contribution and approach presented in this paper consists of prioritizing ESG factors taken into account in the decision-making process of financial institutions, identifying their impact on sustainable financial systems, and proposing a new approach to assessing and comparing financial systems with a clear division into sustainable and unsustainable financial systems.

The main objectives of the study are as follows:

- To identify ESG factors that matter for sustainable financial systems;
- To define and provide a main methodological approach for sustainable financial systems;
- To rank the sustainability level of financial systems in OECD countries;
- To provide recommendations for designing a sustainable financial system.
- The main research questions are as follows:
 - What ESG (environmental, social, and governance) factors are incorporated by financial institutions into the decision-making process?
 - Which pillar of sustainable development (economic, social, environmental) is represented the most in the ESG factors incorporated by financial institutions into the decision-making process?
 - What are the differences in sustainability of financial systems among OECD countries reflected by ranking position?

The paper is organized as follows: Section 1 provides an introduction; in Section 2, theoretical aspects referring to financial stability, sustainable finance, and sustainable financial system assessment are presented. The presence of ESG factors in the methodologies of rating agencies is discussed. The importance of ESG factors to financial institutions is pointed out with special stress on changes in ESG ranking positions since 2008. This section is also focused on discussing sustainable financial systems in the context of definition and measurement. Section 3 presents the methodological approach, data collection procedure, and description of the PROMETHEE method (Preference Ranking Organization Method of Enrichment Evaluation) and cognitive mapping, as well as ESG factors selected for analysis, and financial and non-financial factors included in the multiple-criteria decision analysis (MCDA) assessment. Finally, research results are presented and summarized in the form of a cognitive map and country ranking. This section also includes findings of the study and a discussion based on related work. The last section, Section 4, contains the conclusion.

2. Literature Review

2.1. Stable versus Sustainable Financial Systems: Decision-Making Criteria and Methodology of Assessment

The experience shown in the literature indicates that a stable financial system should be based both on actions aimed at maintaining security at the market level (in the commercial part of the financial system) [23,24] and on obtaining optimal values and maintaining a favorable state of public finances [25]. The concept and definition of a stable financial system evolved, and its understanding is influenced by various factors, including past financial crises. There were many attempts to define financial stability and also more radical approaches, arguing that it is impossible to define financial stability at all [26]. In the literature review, the concept of financial stability is presented in two prisms. The first defines financial stability by negating stability, that is, introducing the concept of financial instability. The second prism is a direct definition of financial stability. In the literature, a number of alternative definitions are available, and the most common definitions are presented in Table 1.

Table 1. Financial stability definitions.

Financial stability definition—a prism that defines financial instability	Author
Financial instability occurs when shocks to the financial system interfere with information flow so that the financial system can no longer do its job of channeling funds to those with productive investment opportunities [27].	Mishin (1994)
Financial instability is characterized by both high probabilities of default and low profits [28–31].	Goodhart et al. (2004, 2005, 2006) Tsomocos (2003) Bårdsen et al. (2006)
Financial instability is characterized by both high probabilities of default and low profits. Moreover, it is allowed that the authorities (government and/or the central bank) determine the level of debt above which (and the profit below which) a financial environment becomes fragile, given the idiosyncrasies of a particular economy [32].	Tsomocos (2003)
Financial instability occurs when problems (or concerns about potential problems) within institutions, markets, payments systems, or the financial system in general significantly impair the supply of credit intermediation services, so as to substantially impact the expected path of real economic activity [33].	Rosengren (2011)
Financial stability definition—a prism that defines financial stability	Author
Financial stability refers to the stability of key institutions and markets that make up the financial system stability. It requires (1) that the key institutions in the financial system are stable, in that there is a high degree of confidence that they continue to meet their contractual obligations without interruption or outside assistance, and (2) that the key markets are stable, in that participants can confidently transact in them at prices that reflect fundamental forces and changes in fundamentals [31,34].	Crockett (1997)
Financial stability is characterized by no serious disturbances and an absence of financial crises in the economy of a country [35].	Fidrmuc & Schardax (2000)
Financial stability is linked to the shared responsibility of various entities [36].	Icard (2002)
Financial stability is a situation characterized by these three basic criteria: (1) some important set of financial asset prices seem to diverge sharply from fundamentals; (2) market functioning and credit availability, domestically and perhaps internationally, are significantly distorted; (3) aggregate spending deviates (or is likely to deviate) significantly, either above or below, from the economy's ability to produce [37].	Ferguson (2002)
We deal with financial stability when met with four conditions: (1) monetary stability takes place, (2) the level of employment in the economy is close to the natural level, (3) there is confidence in the operation of key financial institutions and markets in the economy, and (4) there are no movements in the prices of financial and non-financial assets, which would undermine the fulfillment of the first two conditions [38].	Foot (2003)
Financial stability is defined in terms of its ability to facilitate and enhance economic processes, manage risks, and absorb shocks. Moreover, financial stability is considered a continuum: changeable over time and consistent with multiple combinations of the constituent elements of finance [39].	Schinasi (2004)
For mature financial systems, the financial stability challenge can be characterized as maintaining the smooth functioning of the financial system and its ability to facilitate and support the efficient functioning and performance of the economy [40].	Schinasi (2009)
Financial stability reflects the ability of the financial system to consistently supply the credit intermediation and payment services that are needed in the real economy if it is to continue on its growth path [33].	Rosengren (2011)

Source: own elaboration.

The concept of financial stability is also determined by central banks, which often assess financial stability for their reports and are responsible for its monitoring. Analysis of the definition and development of approaches to the understanding of financial system stability, as discussed by central banks, indicates the following [41–44]:

- A stable financial system is capable of efficiently allocating resources, assessing and managing financial risks, maintaining employment levels close to the economy's natural rate, and eliminating relative price movements of real or financial assets that will affect monetary stability or employment levels.
- The financial sector performs its functions in a continuous and effective manner, even in the case of unexpected and unfavorable disturbances of significant scale.
- A financial system is in a range of stability when it dissipates financial imbalances that arise endogenously or as a result of significant adverse and unforeseen events.
- In stability, the system will absorb the shocks primarily via self-corrective mechanisms, preventing adverse events from having a disruptive effect on the real economy or on other financial systems.
- Financial institutions should (or must) disclose whether they are facing substantive economic, environmental, and social sustainability risk exposure and how to manage these risks. Taking into account the risk of ESG is becoming an important element (challenge) for the stability of the financial system.
- The financial system—which comprises financial intermediaries, markets, and market infrastructure—is capable of withstanding shocks and the unraveling of financial imbalances. This mitigates the prospect of disruptions in the financial intermediation process that are severe enough to adversely impact real economic activity.

The concept of financial stability is not only defined differently but also differently interpreted, as shown in Table 1 and in the definitions of central banks. It should also be concluded that the concept of financial stability is understood both narrowly and broadly. The narrow understanding of financial stability refers to banks and financial institutions entering the market system (private system). On the other hand, the broad understanding of the financial system includes the stability of both pillars of the financial system: the public financial system and the market financial system (private system). Čihák et al. explained that the global financial crisis meant not only increased financial instability; the crisis also translated into difficulties along other dimensions, such as more people and firms finding it increasingly difficult to access financial services. Moreover, finance and financing are not just about stability [45]. The degree to which financial systems channel society's savings to those with the most promising investment opportunities is fundamentally important for economic growth, poverty alleviation, and the degree to which individuals have the opportunity to pursue their economic aspirations. These factors are important for financial stability. To achieve financial stability, it is necessary to have in place mechanisms designed to prevent financial problems from becoming systemic and/or threatening the stability of the financial and economic system, while maintaining (or not undermining) the economy's ability to sustain growth and perform its other important functions [38,39,46].

The literature review provides information on how the financial system can facilitate decision-making on the trade-offs between economic, social, and environmental goals of sustainable development [1,46,47]. Analysis of definitions regarding the concept of financial stability indicates the development of this concept under the influence of the global financial crisis. The new paradigm indicates the need to take into account risk factors, and, in particular, in the new paradigm, ESG factors take a special place. Moreover, the evolution highlights the broadening of this concept to a value to society as the stakeholder triple line: people, planet, and profit [1,48].

The literature review points to the evolution of the approach to sustainable finances [47,49]. On this basis, one can also point to the evolution of the balanced financial system approach and paradigm shift. While the concept of sustainable finance is well defined in the literature, so far, little attention was paid to sustainable financial systems. Both concepts are in line with the need to adjust finances to the specifics of sustainable development. Sustainable finance is usually defined as addressing environmental, social, and governance (ESG) impacts of financial services [22]. This is one of many definitions, albeit a very general and popular one; the others are summarized in Table 2.

Table 2. Sustainable finance definitions.

Sustainable Finance Definition	Author
Sustainable finance considers financial, social, and environmental returns in combination [50].	Schoenmaker (2017)
The sustainable finance concept embraces behavioral developments, but expands the economic agent to a moral human being, as advocated in the business ethics literature [51].	Soppe (2004)
Sustainable finance deals with institutional policies, or systems of analysis, where all financial decisions aim at a long-term integrated approach to optimize a firm's social, environmental, and financial mission statement [52].	Soppe (2009)
Customer Relationship Management (CSR) or sustainable finance can be defined as the provision of financial capital and risk management products and services in ways that promote or do not harm economic prosperity, the ecology, and community well-being [53].	Strandberg (2005)
Sustainable finance implicitly assumes that “finance”, corporate or otherwise, should be used in a manner to generate economic activity that does not compromise the future ability to produce the same level of economic activity [54].	Wilson (2010)

Source: own elaboration based on related work.

Sustainable finance is an evolving paradigm of finance [1]. Many factors, especially non-financial factors (i.e., ESG), are responsible in the present day for the transformation of the conventional finance paradigm to a sustainable one. Urban and Wójcik proposed a revisited multilevel-perspective (MLP) concept based on Geels to explain the sustainable finance transition [55] (Figure 1). We extended this proposal by including “social exclusion” and “negative externalities” into the sociotechnical landscape, and pointing out the role of greening financial markets, the greening economy, and CSR at the niche innovations level. A sustainable financial system is a part of this concept, at least in a narrow sense, and is defined as a resilient system that contributes to the needs of society by supporting sustainable and equitable economies, while protecting the natural environment [56]. There are many studies confirming the relationship between financial systems and economic development [57–59], but there are few studies on the degree to which financial systems (a) impact the quality of information, (b) influence sound corporate governance, (c) ensure an effective mechanism of risk management, (d) mobilize savings, and (f) facilitate trade [45]. In the context of sustainability, one should also add an inquiry into how the financial system influences the assurance and implementation of sustainable development principles. In order to illustrate the relationship between the financial system and sustainability, the sustainable financial system presented in Figure 1 was used. Figure 1 presents a sustainable financial system as an inclusive system that incorporates three sustainability pillars into the decision-making process at the financial institution level. This means that this system incorporates ESG factors into financial institutions’ decision-making processes. This approach to the financial system is supported by the literature recommendations and regulations. The regulations, ethical standards, and governance are reflected and included in Figure 1 as supportive factors that are conducive to the development of sustainable financial systems. In the field of regulation, it is worth pointing to initiatives such as the Principles for Responsible Investment (2006), the Equator Principles (2006), the Collevccio Declaration (2003), and the United Nations Environment Program Finance Initiative (UNEPFI), [22,60–62].

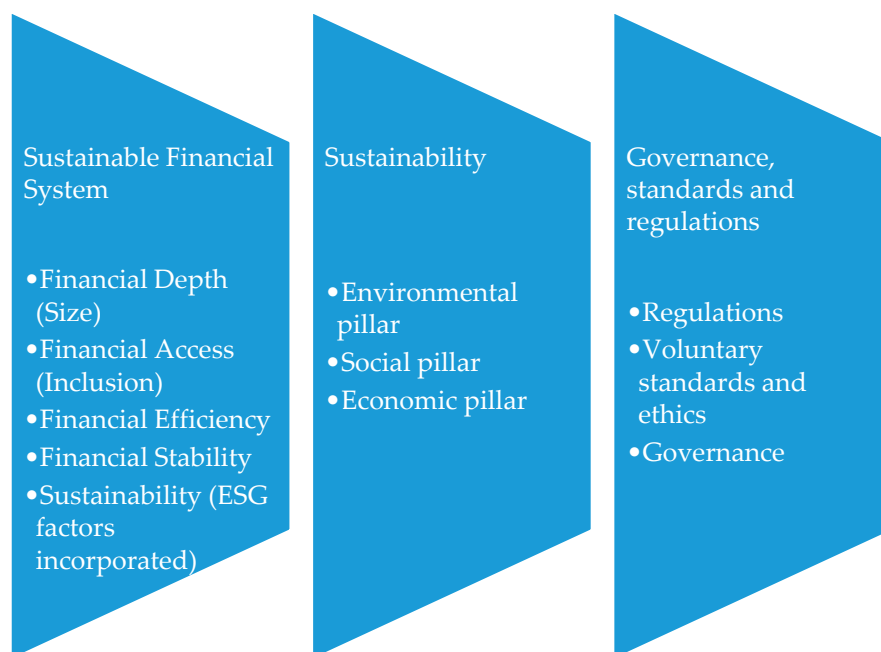


Figure 1. Sustainable financial system Source: own elaboration based on Gerster (2012) p. 3 and Čihák et al. (2012).

2.2. The Criteria for Assessing and Measuring the Performance of Financial Systems with Special Stress on Sustainability

Referring to Čihák et al. (2012), financial systems may be compared and analyzed based on criteria such as (1) depth, (2) access, (3) efficiency, and (4) stability [45]. For each criterion, there is a special measurement with selected indicators separately for financial institutions and for financial markets. These criteria correspond to the sustainable development approach. Čihák et al. (2012) noted that finance, with good policies, can be both pro-growth and pro-poverty reduction [45]. This is in line with the social dimension of sustainable development, and none of the criteria proposed by the authors refer to the environmental pillar of sustainability. The assessment of a sustainable financial system requires the inclusion of all dimensions of sustainable development, which is expressed in Figure 2 by adding sustainability to the criteria for assessing and measuring the performance of financial systems. The ESG factors taken into consideration by financial institutions (especially rating agencies) in the context of meeting the sustainability requirements are listed in Table 3.

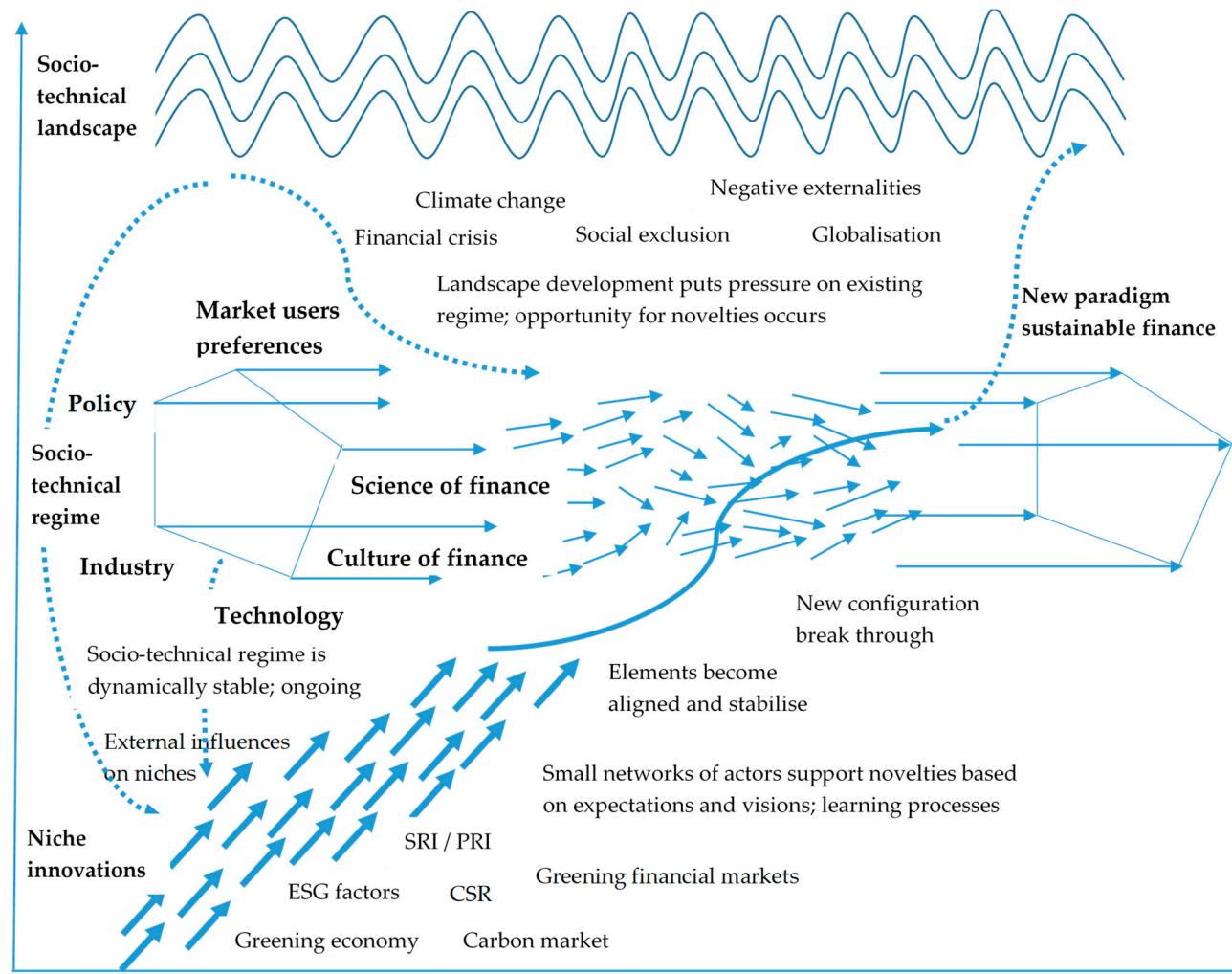


Figure 2. Sustainable finance paradigm. Revisited multilevel perspective (MLP) concept. Source: own elaboration based on Urban M.A., Wójcik D. Dirty Banking: Probing the Gap in Sustainable Finance. Sustainability 11, 1745, p. 5.

Table 3. ESG (environmental, social, governance) factors incorporated by financial institutions into the decision-making process.

Environment	Social	Governance
Carbon intensity emissions	Business behavior	Antitakeover policy
Climate change	Community relations	Audit and control system
Control of environmental impacts	Corporate citizenship/philanthropy	Board diversity
Eco-design (financial green products and services)	Customer relationship management	Board structure
Eco efficiency	Customer and product responsibility	Brand management
Emissions	Diversity	Business ethics and fraud
Energy consumptions	Human capital development and training	Codes of conduct/compliance
Environmental policy	Human rights criteria	Corporate government functions and commitments
Environmental policy management	Labor management	Prevention of corruption and bribery
Environmental reporting	Local suppliers	Remuneration of members of the executive team
Environmental risk management	Market ethics	Respect of shareholders rights
Hazardous waste	Non-discrimination, promotion equality	Risk and crisis management
Materials recycled and reused	Privacy and data security	Transparency
Packaging	Protection of children	Vision and strategy
Pollution management/recourses	Exclusion of children labor	Antitrust policy
Protection of biodiversity	Quality of working conditions	Industry specific criteria
Raw material sourcing	Respect of trade unions	
Renewable energy consumption	Responsible investing	
Travel and transport impact	Rights of indigenous people	
Waste management reduction	Social reporting	
Water use and management	Stakeholder engagement	
Industry-specific criteria	Supply chain management	
	Talent attraction/retention	
	Work-life balance	
	Industry-specific criteria	

Source: own elaboration based on Escrig-Olmedo et al. (2019), p. 11–12 [63].

Analysis of the evolution of ESG criteria included in methodologies of rating agencies conducted by Escrig-Olmedo et al. (2019) showed the growing role and importance of environmental criteria since 2008 [64]. Tables 4–6 summarize the main changes in significance of ESG factors and the increasing role of non-financial factors in the decision-making process of financial institutions.

Table 4. The evolution of environmental factors incorporated into the decision-making process of financial institutions.

2008, the Leading Environmental Criteria	2018, the Leading Environmental Criteria
Environmental policy/management	Environmental policy/management
Emissions	Water use and management
Climate change	Protection of biodiversity

Source: own elaboration based on Escrig-Olmedo et al. (2019), p. 10–12 [63].

Table 5. The evolution of social factors incorporated into the decision-making process of financial institutions.

2008, the Leading Social Criteria	2018, the Leading Social Criteria
Human capital development and training	Labor management
Human rights	Human rights
Community relations	Quality working conditions
	Health and safety

Source: own elaboration based on Escrig-Olmedo et al. (2019), p. 10–12 [63].

Comparing 2008 to 2018, the increasing role of environmental policy/management, water use and management, and protection of biodiversity can be observed. In 2018, some new elements were included, such as emissions and waste management reduction. The reason is the agreement signed in Paris (United Nations Climate Change Conference, COP21, December 2015). In the case of social criteria, the definition of sustainable development goals is crucial, as the improvement of health and education and the reduction of inequalities are the main issues pointed out. The importance of new factors in the governance scope, such as corruption, bribery, and transparency issues, is the result of OECD reports and recommendations [65]. As the role of ESG finance and financial markets

grows, financial institutions (especially banks and rating agencies) start to incorporate ESG factors into their business practices and processes. This applies in particular to larger banks and banks with international operations [20]. Incorporating ESG factors by financial institutions and markets is not obligatory; therefore, the level of these actions varies depending on the financial institution and the market in which it operates [20,66]. Some institutions and markets did not implement any activities or incorporate ESG into their financial decisions and procedures (for example, small local financial institutions such as co-operative banks). Others fully implemented ESG and adjusted their decision systems and risk systems in terms of convergence with ESG (large international banks, for example, Societe Generale, Hongkong and Shanghai Banking Corporation-HSBC, and Credit Agricole, Triodos) [58]. Another group of markets and institutions only partly included non-financial factors in their business models (for example, the China Securities Regulatory Commission (CSRC) issued its Guidance for Supporting Green Bond Development) [67]. Bearing in mind the fact that financial institutions, markets, and financial architecture make up the financial system, and taking into account the different level of ESG implementation by markets and institutions, divisions of financial systems were created due to the coherence of sustainability principles. A typology of financial systems according to the response to sustainability requirements is presented in Figure 3. A sustainable financial system in the context of ESG is a system that addresses environmental, social, and governance (ESG) impacts of financial services and financial markets by supporting sustainable development and growth and sustainable economies. The degree of sustainability of a financial system is expressed by the number of ESG factors incorporated by the system. More ESG factors incorporated leads to a more sustainable financial system. A sustainable financial system and an unsustainable financial system are opposite cases. The first includes all ESG factors, while the second includes none or very few. A transforming financial system is an evolving one and, in this case, numerous options are possible according to our best knowledge, as shown below.

- The system may be more green-oriented (an advantage of the environmental factors incorporated), than socially and governance-oriented (for example, Chinese green bonds);
- The system may be more socially oriented (an advantage of the social factors incorporated) than environmentally and governance-oriented (for example, the microfinance market in India);
- The system may be more governance-oriented (an advantage of governance factors incorporated) than environmentally and socially oriented (e.g., Australia, United States of America (USA), United Kingdom (UK));
- The system may be partially ESG-oriented, where none of the ESG factors are represented fully.

Table 6. The evolution of governance factors incorporated into the decision-making process of financial institutions.

2008, the Leading Governance Criteria	2018, the Leading Governance Criteria
Corporate governance functions and committees	Corporate governance functions and committees
Board structure	Board structure
Remuneration/compensation policy	Remuneration/compensation policy
	Prevention of corruption, bribery issues, and transparency issues

Source: own elaboration based on Escrig-Olmedo et al. (2019), p. 10–12 [63].

Just as the understanding of the concept of sustainable finance changed, the paradigm of a balanced financial system changed, and its new shape is related to the effects of the global financial crisis [48]. Changes of the concept of sustainable finance that took place and were noted in the literature are presented in Figure 3. There is a visible departure from the system which did not take into account the factors of sustainability and ESG. Slow development meant that factors affecting classic sustainable development were taken into account, and the developed financial system included not only the

sustainability factor, but also ESG. The transforming financial system has two variations: Sustainable Financial System 1 and Sustainable Financial System 2, the characteristics of which are presented on Table 7. The target financial system, i.e., the sustainable financial system after transformation, can be characterized as the Sustainable Financial System 3, the characteristics of which are also presented on Table 7.

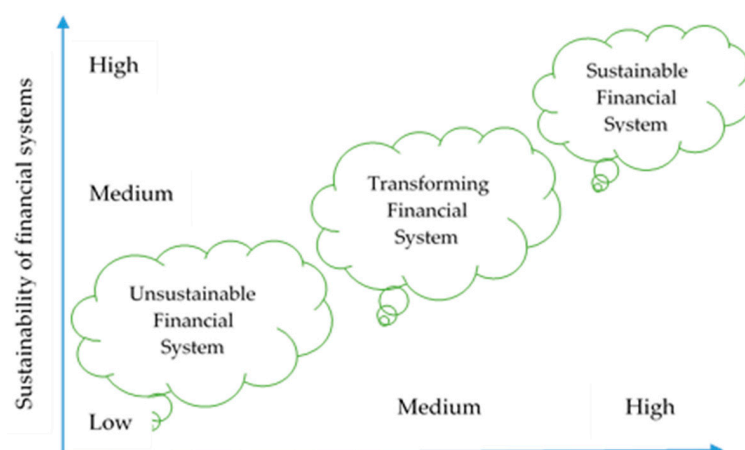


Figure 3. Typology of financial systems according to the degree of sustainability. Source: own elaboration.

The directions of evolution are shown in Tables 1 and 7, the changes in the paradigm are shown in total on the basis of the development of the approach to the financial system. The classic paradigm of stability was based on the basic pillar of the financial system—the market (private) financial system. An important aspect of the classical paradigm was monetary stability and the need to comply with the first two conditions. Stability analysis was conducted for a short-term horizon, and the group of stakeholders did not take into account social and environmental effects, but only economic ones. To sum up, the financial system was based on short-term maintenance of the efficient functioning of the financial system, achieving financial value (including profit), and its ability to facilitate and support effective functioning and efficiency of the economy.

Table 7. Framework for a sustainable financial system.

Sustainable Financial System Typology	Balance between Pillars of Sustainable Financial System		The Occurrence of Basic Stability Conditions	Sustainability Pillars	Risk Factors	Horizon
	Public Financial System (PFS)	Market Financial System (MFS)				
Sustainable Financial System 1	PFS << MFS		1; 4	F	financial risk	Short term
Sustainable Financial System 2	PFS ≠ MFS; PFS → MFS		1; 3; 4	F + S	financial risk	Medium term
Sustainable Financial System 3	PFS = MFS = balance		1; 2; 3; 4	F + E + S + G = I	financial risk + ESG risk	Long term

Note: << lack of balance; → strives for balance; = close balance. 1—monetary stability; 2—the natural level of employment; 3—confidence in the operation of key financial institutions and markets; 4—no movements in the prices of financial and non-financial assets. F = financial value; S = social impact; E = environmental impact; G = governance; I = integrated value. PFS—public financial system; MFS—market financial system. Source: own elaboration.

To make a comprehensive assessment of the financial system, a discussion about the indicators/variables is necessary. Based on the literature review, the financial system is measured and assessed based on financial depth [45], financial development, financial vulnerability, financial soundness, financial fragility, and financial stability. The main definitions, measures, and studies referring to the mentioned categories are presented in Table 8.

Table 8. The methodology of assessment of financial systems.

Scope	Definition	Measurement	Source
Financial depth	Financial depth captures the financial sector relative to the economy. It is the size of banks, other financial institutions, and financial markets in a country, taken together and compared to a measure of economic output.	1/ Private credit to GDP; 2/ Total banking assets to GDP	Čihák et al., 2012; Demirgüç-Kunt et al., 2008, 2011; King, Levine, 1993; Levin, Zervos, 1998 [45,66–69]
Financial development	Financial development gives a measure of the level of financial system development. Market capitalization as a share of GDP captures the development of the capital markets, while the ratio of total credit to GDP provides information on the ability of credit institutions in carrying out their intermediation functions.	1/ Market capitalization to GDP 2/ Total credit to GDP 3/ Interest spread 4/ Herfindahl–Hirschmann index (HHI)	Verlis, 2010 [70]
Financial Vulnerability	The final indicator of financial vulnerability retains the ratio of “reserves to deposits” and “notes and coins to M2”, acting as an early warning indicator. Reserves as a share of deposits reflect the banking sector capacity to respond to severe deposit withdrawal, while notes and coins to M2 measures the liquidity preference of the economy. Thus, a high liquidity preference coupled with low reserves would signal increased vulnerability in the banking system.	1/ Inflation rate; 2/ General budget Deficit/surplus (%GDP) 3/ Current account deficit/surplus (%GDP) 4/ REER (change) 5/ Non-governmental credit/total credit 6/ Loans (%deposits) 7/ Deposits/M2 (“moving io”) (reserves/deposits)/ (note and coins/M2)	Verlis, 2010 [70]; Andrés-Alonso et al., 2015 [71]
Financial Soundness	The variables retained in the financial soundness measure the solvency of credit institutions in the financial system. “Non-performing loans to total loans” reflects the loan quality of banks, and their level of capitalization is measured by the “capital to assets” ratio.	1/ Non-performing loans/total loans 2/ Capital/assets 3/ Z-score 4/ Liquidity ratio	Babihuga, 2007 Verlis, 2010 [70,72]
Financial fragility	We think of financial fragility as meaning that small shocks can produce a large effect on the system. If it takes very large shocks to produce these effects, the financial system is robust rather than fragile.	1/ Share of credit to households for housing purchases in credit total issued to residents 2/ Loans issued to non-banks to deposits 3/ Ratio of total deposits to M2 (broad money)	Allen, Gale, 2004 [73]; Aspachs-Bracons et al., 2004 [74]
Financial stability	Financial stability is largely defined in terms of preconditions, and one such definition is that financial stability is said to exist when all financial risks are adequately identified, allocated, priced, and managed (Orr, 2006).	1/ Inflation level 2/ Ratio of state budget deficit to GDP 3/ Ratio of current account deficit to GDP 3/ Real effective exchange rate value increase or deterioration	Goodhart, 2006 [75]

Source: own elaboration, based on literature review.

Development of the sustainable financial system concept indicates a number of elements, approaches, and decision-making mechanisms. In particular, the literature review [1,46–49] indicates the following:

1. The performance of the financial system entails an evaluation of how well the financial system facilitates economic resource allocation, the saving and investment process, and ultimately economic growth. Stability can be included as a positive or negative effect of the real economy and the effects of its linkages to the financial system. Effects must be considered from the point of view of a long-term horizon [46,47].
2. Financial stability is a broad concept, encompassing the different aspects of the financial system, such as infrastructure, institution, and markets [46,49].
3. Financial stability not only implies that the financial system adequately fulfils a role in allocating resources, transforming and managing risk, mobilizing saving, and facilitating wealth

- accumulation and growth, but also, within this system, ensures that the system of payments through the economy functions smoothly. On the one hand, it ensures monetary stability and financial value, but, on the other hand, social impact is an important factor [1,46].
4. Financial stability requires the absence of financial crises and the ability of the financial system to limit and deal with the emergence of imbalances before they constitute a threat to stability. In the decisions taken, the aspect of governance becomes important. Decisions taken without regard for the environmental aspect and CSR are not positively evaluated by the society and stakeholder. The market and public finance system are beginning to take into account ESG risk in their decisions [46,47,49,76].
 5. Financial stability can be thought of as occurring along a continuum, reflecting different possible combinations of conditions of the financial system's constituent parts. Confidence in decisions and institutions is important. It is important for the stability of the financial system to preserve the balance between decisions, instruments, and actions taken by decision-makers within the market and public financial system (governance) [1,46,47,77].

Ambiguities in the definitions of financial system stability and paradigm development led to a lack of unambiguous methods for measuring the stability of this system.

Among the commonly used quantitative methods for financial stability assessment are three groups of methods: early warning systems, macro-stress testing, and financial stability indices. It is, however, essential to note that the approaches to the development of these measures changed over time. The evolution of the approaches is shown in Table 9.

Table 9. Development of using quantitative methods for financial stability assessment.

Authors	The Specificity (Direction) of Measuring the Stability of the Financial System
Calvo, Leiderman and Reinhart (1993), Eichengreen, Rose and Wyplosz (1996), Turner and Goldstein (1996), Frankel and Rose (1996), Demirguc-Kunt and Detragiache (1997) Kaminski and Reinhart (1999), Borio and Lowe (2002), Bussiere and Fratzscher (2008), Borio and Drehman (2009), and, Alessi and Detken (2009)	Early warning systems constructed from potential leading indicators to predict the probability of a financial crisis [78–87]
Jakubik and Slacik (2013)	Early warning systems used as a starting point or a complementary instrument [88]
Čihák, 2007; Schneider, Pühr and Hasan, 2011; Buncic and Melcky, 2012; Jakubik and Sutton, 2012	Stress testing used to estimate financial system resistance to adverse macroeconomic scenarios [89–92]
Hawkins and Klau (2000), Nelson and Perli (2005); Gray, Merton and Bodie (2007)	Financial indicators intended to encompass a broader definition of financial stability and to monitor market pressure, as well as external and banking system vulnerabilities [93–95]
Koong, Law and Ibrahim (2017) for Malaysia; Arzamasov and Penikas (2014) for Israel; Sere-Ejembi et al. (2014) for Nigeria; Jakubik and Slacik (2013) for nine selected countries in emerging Europe; Sales, Areosa and Areosa (2012) for Brazil; Albulescu (2013) and Islami et al. (2013) for euro area; Brave and Butters (2011) for the United States; Albulescu (2010) for Romania; Morales and Estrada (2010) for Colombia; Illing and Lui (2003) for Canada	Country-specific financial stability indices [96–104]
Loloh (2014)	Aggregated financial soundness indicator [105]
Kočišová K. and Stavárek (2015), Kočišová K. and Stavárek (2018)	Aggregated banking system stability index for 10 selected countries [106,107]
Illing and Lui (2003); van den End (2006)	Composite financial stability index [77,108]
Gadanecz et al. (2008), Oosterloo et al. (2007)	Indicators for monitoring and analyzing risks and threats to financial stability (they were named by banks as financial stability reports, FSRs) [109,110]
Dattels et al. (2010)	Financial stability map, used to assess the risks and conditions that affect financial stability [111]
Albulescu (2008); Cheang and Choy (2009); Morris (2010); Jordan and Smith (2014); Sere-Ejembi et al. (2014)	Ingle aggregate index to gauge the state of financial stability based on data from the external sector, monetary sector, balance of payments, capital market, foreign exchange market, and traditional FSIs [112,113]
Akosah et al. (2018)	Quarterly aggregate financial stability indicator (AFSI) using traditional FSIs, as well as peculiar indicators from the external sector, monetary and financial sector, balance of payments, foreign exchange, and capital markets [77]

Source: own elaboration based on References [77,105–107].

The measures of public stability of the financial system should be considered both in terms of value (objective evaluation) from the macroeconomic point of view (which was sanctioned by the development of various approaches; see Table 3) and qualitative assessment (see Özesmi et al., 2004) [114]. In addition, their essence and significance should be recognized, and the impact of other external factors determining stability should be assessed. Thus, combining a quantitative approach with a qualitative approach allows searching for dependencies between determinants shaping the stability of the financial system. In this way, one can determine which factors have a particularly high impact on the stability of the financial system, taking into account not only direct but also indirect impacts. This approach allows, therefore, a deeper and multifaceted examination of the stability of the financial system. Studying the relationships between factors representing different areas is particularly important when designing multidimensional systems, including a sustainable finance system. In this type of system, we deal with various conditions, which must be studied. That is why it is so important to structure the problem and determine the relationships between various factors before the proper assessment of these systems. This type of study is also presented in the paper. This results in the division of the research presented in the work into two parts. The first concerns the structuring of the research problem; the second assesses the degree of sustainability of the examined financial systems.

3. Research Methodology

3.1. A Cognitive Map as a Tool for Designing a Sustainable Financial System

According to the information presented in the work, it was assumed that the research methodology should include two stages. The first was related to supporting the identification of criteria that are most important for the design of sustainable financial systems. Their purpose was also to determine the ESG factors that affect the level of sustainability of financial systems and to identify ESG factors incorporated by financial institutions into the decision-making process. For this purpose, a fuzzy cognitive map (FCM) was used. The collective map elaborated on the basis of the opinions of experts participating in the study was built using the software FCMapper_bugfix_27.1.2016. It should be noted that the use of the map for this purpose not only allows for the simple identification of the most important criteria, but also for the identification of their relationship with a sustainable financial system. A cognitive map, commonly known as a map of associations, is a solution that was used for the first time in the humanities. The basis for its creation involves causal dependencies (associations) of a complex nature. Similar to econometric models, the influence of a set of explanatory factors on the variable explanation is examined here, while the dependence between conditions of the studied phenomenon is primarily sought. This allows answering the question as to which conditions (in the work referred to as criteria) have a particularly large impact on the examined phenomenon, taking into account not only direct but also indirect impacts. In the literature review, this tool was used in modeling processes and diagnosing various types of phenomena, including knowledge representation and management [115,116], political and social fields [117,118], engineering and technology management [119,120], modeling [120–122], agriculture and ecological modeling and management [121–123], and prediction [124,125], as well as medical decision support and classification tasks [126,127]. A holistic conception, including the use of cognitive maps, may be used to study the criteria that are most important for the design of sustainable financial systems [128,129]. The main incentive that leads to further research and development of the cognitive map is the wide recognition of the cognitive map as a promising modeling and simulation methodology with remarkable characteristics, such as abstraction, flexibility, adaptability, and fuzziness [130].

It is worth noting that, in the literature on the subject, two basic approaches were used to build a cognitive map, as shown below.

- a) Econometrics, within which mathematical relations were modeled;
- b) Experts, mainly using the Delphi method and relatively simple calculation procedures.

A common part of both approaches was as follows:

1. Determining the list of initial criteria explaining the studied phenomenon;
2. Selection of the criteria of the greatest importance for the target model of dependency research being created;
3. Development of a correlation matrix between the considered criteria.

Cognitive maps, based on expert methods, can be obtained in four ways: (1) from questionnaires; (2) by extraction from written text; (3) by drawing from data that show causal relationships; (4) through interviews with people who draw them directly [131]. The theoretical course of the cognitive map determination procedure is described in the literature. In simplified terms, the procedure for determining a cognitive map is as follows [132–135]:

The first stage (I) of the study is to prepare an interview questionnaire. This stage can be based on an approach in the subject literature, such as patterns from other studies, test results obtained, and approaches used by other researchers.

The second stage (II) of the work includes the selection of experts appropriate for the research, because the idea of the study is based on Delphi methods (experts) with regard to the regularity and appropriateness for determining the scope of the study. The purpose of the Delphi method is to combine the questionnaire with the interview. This allows the identification of key cause-and-effect relationships and the prediction of changes in their intensity. The researcher is obliged to analyze both measurable variables and non-measurable phenomena.

The third stage (III) is to organize the list of conditions in order to remove ambiguities and repetitions and to standardize the terminology.

The fourth stage (IV) allows the experts to establish cause-and-effect relationships with an indication of their nature for each relationship. This version of the map is the starting point for assessing the strength of each influence, firstly using the verbal scale and then in the form of a numerical scale.

The results of the adopted procedure were as follows:

- A cognitive matrix, presenting average assessments of compound intensity, having a significance higher than average;
- A cognitive factor map.

To analyze the FCM, the density and type of variables presented on the map can be taken into account. The density (clustering coefficient) of a fuzzy cognitive map (D) is an index of connectivity, which shows the degree of connection or sparseness of the maps [114]. This clustering coefficient can be calculated based on the following equations:

$$D = \frac{C}{N(N-1)}, \quad (1)$$

$$D = \frac{C}{N^2}. \quad (2)$$

According to the first of these equations, the number of connections is divided by the maximum number of connections possible between N variables [114]. The second equation is adopted when the variables have a causal effect on themselves. If the density of a map is high, then a large number of causal relationships among the variables is observed. The next main point of the analyses is a description of the type of variables presented on the map. Diagnosis of this type is very important because it shows how the variables act in relation to the other variables and facilitates an understanding of map structure. On the map, three types of variables can be presented: transmitter variables (forcing functions, givens, tails), receiver variables (utility variables, ends, heads), and ordinary variables (means) [114]. These variables are defined by their outdegree ($od(v_i)$) and indegree ($id(v_i)$).

The outdegree is the row sum of the absolute values of a variable in the adjacency matrix. It shows the cumulative strengths of connections (aij) exiting the variable and can be calculated as follows [114]:

$$od(v_i) = \sum_{k=1}^N \bar{a}_{ik}. \quad (3)$$

The indegree is the column sum of the absolute values of a variable. It shows the cumulative strength of variables entering the variable. It can be calculated based on the following equation [114]:

$$id(v_i) = \sum_{k=1}^N \bar{a}_{ki}. \quad (4)$$

Transmitter variables have a positive outdegree, $od(v_i)$, and zero indegree, $id(v_i)$. Receiver variables have a positive indegree, $id(v_i)$, and zero outdegree, $od(v_i)$. Ordinary variables have both a non-zero indegree and outdegree [114]. The total number of receiver variables can be considered an index of its complexity. If the FCM considers many outcomes and implications that are a result of the system, many receiver variables are represented on the map [114,121]. On the other hand, a large number of transmitter variables describe the “flatness” of a cognitive map where causal arguments are not well elaborated [120]. Different maps can be compared in terms of their complexity using the ratio of the number of receiver (R) to transmitter variables (T)–(R/T). In more complex maps, these ratios are larger due to their large number of utility outcomes defined on the maps.

The centrality (immediate domain, total degree ($td(v_i)$)) [114,121] of a variable is the summation of its indegree (in-arrows) and outdegree (out-arrows) [114], as shown in Equation (5).

$$c_i = td(v_i) = od(v_i) + id(v_i). \quad (5)$$

The cognitive map provides an image and systematization of the knowledge of the impact factors and allows them to be used in management and decision-making.

3.2. Data Collection Procedure

In the study, the results of which are presented in this work, the second approach was used to build a cognitive map. Six experts (financial directors) representing the banking sector, the enterprise sector, and local government units were invited to participate in the study. This group comprised financial directors of the largest financial institutions operating in Poland, who all had between 20 and 30 years of experience in the field.

The basis for the selection of criteria of the highest importance for the target model was a list of starting criteria developed on the basis of the literature review (already presented in Table 3), which are taken into account by financial institutions (in particular, credit rating agencies) in the context of meeting sustainable development requirements. These criteria were assigned to three areas: environmental, social, and governance. Experts were asked to evaluate a total of 62 factors, of which 21 represented the environmental scope, 25 the social scope, and 16 the governance scope. The factors were determined based on a review of the literature, taking into account the ESG factors included in the methodology of sustainable rating agencies (see Table 3). The experts participating in the study assessed the impact of these criteria on both the proposed commercial financial system and the public financial system. The public system is defined as the state-controlled system, which is non-profit-oriented, and the commercial system is a system consisting of financial institutions (banking and financial market system), which is profit-oriented and not state-controlled. The paper presents the results concerning the first of these systems.

The task of the experts participating in the study was to determine both the strength of the impact of these criteria on the planned system of sustainable finances and an indication of the direction of this impact (positive versus negative influence). Thus, the experts participating in the study were

able to make their assessments using a five-point Likert scale, where 1 represented the smallest influence, but positive for the studied phenomenon, and 5 represented the largest impact, also positive. The criteria were also assigned conversely; the criterion that was assigned the value of -1 had the least negative impact on the planned system of balanced finances, and -5 represented the largest negative impact.

The result of this stage of the research was a list of the most important criteria from the point of view of the designed system of sustainable finance. Only the criteria for which the average calculated on the basis of the absolute values of the awarded points was the highest were selected for the next stage. The results of this stage of the study were presented to the experts for verification. Finally, a list of key criteria in each of the analyzed areas was obtained, as presented in Table 10.

Table 10. The main ESG factors incorporated by financial institutions into the decision-making process selected during the study.

Environment	Social	Governance
Control of environmental impacts (C1)	Customer relationship management (C6)	Business ethics and fraud (C17)
Hazardous waste (C2)	Customer and product responsibility (C7)	Corporate government functions and commitments (C18)
Travel and transport impact (C3)	Human capital development and training (C8)	Prevention of corruption and bribery (C19)
Waste management reduction (C4)	Human rights criteria (C9)	Remuneration of members of the executive team (C20)
Water use and management (C5)	Labor management (C10)	Respect of shareholders rights (C21)
	Local suppliers (C11)	Risk and crisis management (C22)
	Market ethics (C12)	Transparency (C23)
	Non-discrimination, promotion equality (C13)	
	Privacy and data security (C14)	
	Protection of children (C15)	
	Exclusion of children labor (C16)	

Source: own elaboration based on Escrig-Olmedo et al. (2019), p. 11–12 [36].

3.3. Study Results and Discussion

After the identification of the main factors affecting the commercial financial system, each stakeholder was asked to describe the existence and type of the causal relationships among these factors and, then, the strength of the causal relationships that may exist between these factors. This phase was implemented on an 11-grade scale, numbered from -5 to $+5$, to describe any kind of relationship between two factors, both positive and negative (see Table 11).

Table 11. Interpretation of experts' strength connections among concepts to crisp weights in the range $[-1,1]$.

Strength Connection by Experts	Sign and Strength of Relationship (Linguistic Weight)	Interpreted Crisp Weight
-5	Negatively very strong	-1
-4	Negatively strong	-0.8
-3	Negatively medium	-0.6
-2	Negatively weak	-0.4
-1	Negatively very weak	-0.2
0	Zero	0
1	Positively very weak	0.2
2	Positively weak	0.4
3	Positively medium	0.6
4	Positively strong	0.8
5	Positively very strong	1

Source: own elaboration.

Based on the indicators selected for the study, a correlation matrix was developed. To analyze a cognitive map, the number of variables (N) and the number of connections (C) in the map can be counted. The vector of C -objects values and the matrix of influences W taking place between objects in the fuzzy cognitive map for the first of these areas (environmental area) can be presented as follows:

$$C = \begin{bmatrix} C_1 \\ C_2 \\ C_3 \\ C_4 \\ C_5 \end{bmatrix} \quad (1) \quad W = \begin{bmatrix} 0 & -W_{12} & -W_{13} & -W_{14} & 0 \\ -W_{21} & 0 & 0 & 0 & 0 \\ -W_{31} & 0 & 0 & 0 & 0 \\ 0 & -W_{42} & 0 & 0 & 0 \\ W_{51} & 0 & 0 & 0 & 0 \end{bmatrix}. \quad (6)$$

The relationships identified between variables belonging to different areas became the basis for FCM collective reconciliation, which is presented in Figure 4. The map presents mutual relationships and directions of influence between particular variables according to the relationships between the 23 variables selected for the study. The collective FCM (consisting of 23 concepts and an average of 58 relationships among concepts) was, thus, obtained (see Figure 4). The FCM was developed in the Pajek (software <http://vlado.fmf.unilj.si/pub/networks/pajek/> based on the calculations made in the software FCMapper_bugfix_27.1.2016).

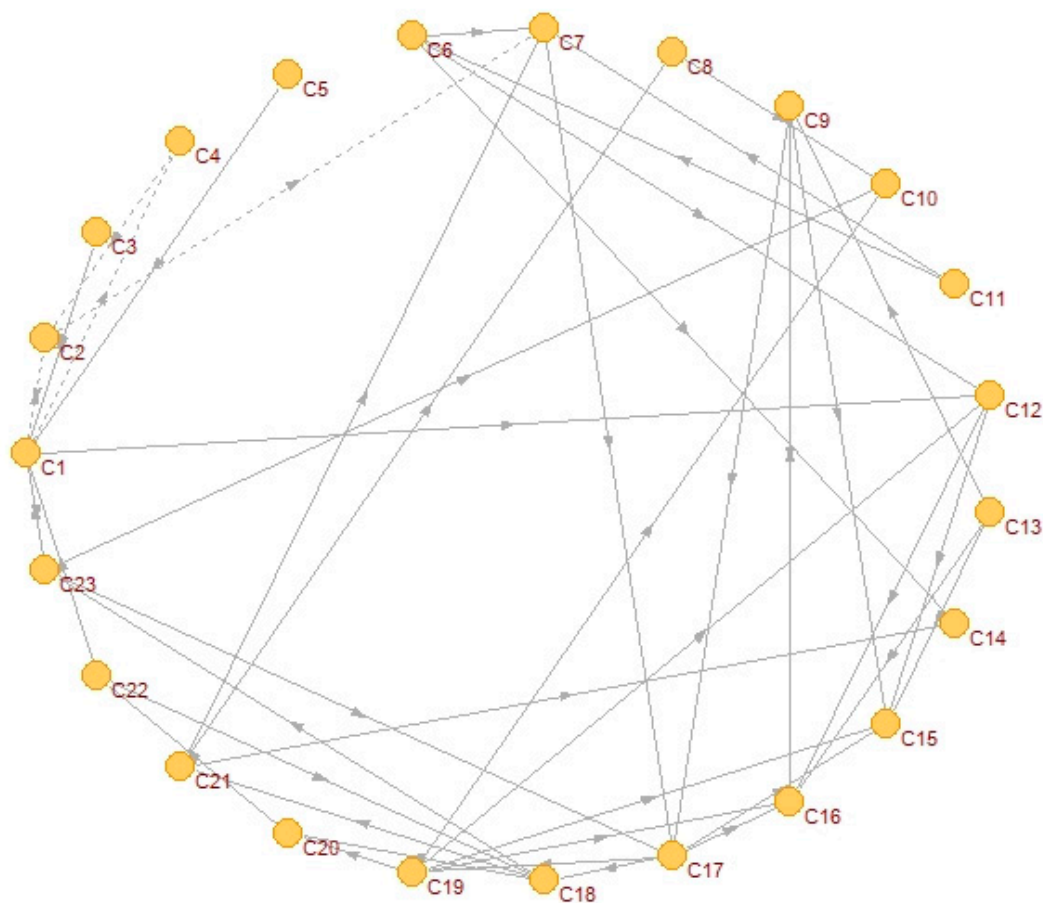


Figure 4. The collective fuzzy cognitive map (FCM) describing ESG factors. Source: own elaboration.

Amongst other findings, the maps show the following:

1. In the case of the environment area (C_1 – C_5), one can see that the most important variable is C_1 (control of environmental impacts), which is clearly associated with other variables. However, only with variables C_3 and C_5 is this relationship positive (solid line); with other variables, these relationships are negative (dashed line).

2. In the social area (C6–C16), there are only positive relationships between variables, and there are many different connections between the studied variables. Only two variables (C8 and C10) are separated individually, which means that, in the opinion of experts, only human capital development and training (C8) positively affects (and quite strongly) labor management (C10).
3. In the governance area, the links are only positive (C17–C23), but the large number of associations of the corporate government functions and commitments variable (C18) with the remaining variables draws attention.
4. In general, taking into account all three areas studied, positively linked connections (positively affecting the system of sustainable finances) prevail; in addition, most are very strong connections.
5. Positively marked relationships occur mainly between variables in social areas (e.g., C6 and C7, C6 and C14, C11 and C6, and C12 and C15) and governance (e.g., C17 and C18, C18 and C20, and C20 and C22).
6. Negative relationships can be observed between factors belonging to the environmental area. Strong relationships of this kind (−1) occur, for example, between the variables C1 and C2, C1 and C4, C1 and C3, and C4 and C2.
7. Relationships between variables belonging to different areas were also observed. Strong relationships combine, for example, C9 and C7 (social) variables with the variable C17 (governance) and C1 (environmental), as well as the C12 (social) variable.

When summarizing the research results, it should be noted that the most represented factors are factors from the social and governance groups. The group of environmental factors was narrowed down to five factors from the 21 accepted at the beginning of the study. In the group of environmental variables, the leading role and influence was attributed to the control of environmental impacts factor. The leading role of environmental factor C1 is not surprising, because the occurrence of this factor mitigates the risk created by other environmental factors. If an organization controls the environmental impact of its activities, it means that the control is complete and applies to all areas related to environmental risk. The environmental risk has two dimensions; it is a risk inscribed in a given specificity of activity on a permanent basis and, therefore, has a sectoral risk dimension. For example, it strongly concerns the mining industry or agriculture. Climate change and natural disasters are particularly felt for agriculture. However, this is not the only type of activity exposed to this type of risk; other examples are construction, tourism, etc. The second type of environmental risk is transitory and concerns mainly legal, reputational, or technological risk initiated by the negative impact on the environment [135].

The study showed a key role of the social factor in the decisions of financial institutions, which is confirmed by the social context of sustainable finance accentuated in the new paradigm of finance. Social risk is defined as the broadest category with the fastest development potential. Among the risk factors are sub-categories such as consumer rights, health risk, human rights, employee rights, security risks, strikes, and protests. From the point of view of the organization, social risk is the risk associated with the interaction among the company, stakeholders, and the broadly understood society, whose behaviors, priorities, and expectations evolve. In particular, the analysis of this type of risk concerns key personnel, the reputation of the company as an employer, the management of human resources, and sensitivity to the effects of long-term phenomena determined by social risk, such as strikes or protests. This risk also applies to evolving social preferences and purchasing behaviors influenced by social media and the transforming economy. In this group of risks, conflicts and terrorist attacks are mentioned. Social inclusion strictly associated with social risk has economic consequences, increasing the efficiency of state-implemented socio-economic policy, increasing productivity, and affecting the level of the economy and the state of public finances [135].

Governance risk is, in turn, the type of risk whose impact was strongly revealed during the 2008 crisis. The governance factor is one of the most strongly monitored by financial institutions since 2008. When analyzing governance risk, attention is paid to the following factors: effectiveness, stability, predictability of policies and strategies, institutional (including social) responsibility, and transparency,

which has a direct impact on creditworthiness. Transparent and responsible institutions strengthen the stability and predictability of political institutions and the framework for the political state. Transparency also affects the quality of information, which is extremely important in the conduct of monetary policy and assessment by central banks. Therefore, governance risk can significantly affect the independence of the central bank's operations and decision-making. In turn, from the perspective of the assessment of the commercial sector and entities such as financial institutions or enterprises, it is important to assess the effectiveness of these institutions, in terms of the board's activities, its composition, transparency and supervisory aspects, and quality of control and risk management. Timely reporting of the organization's results, based on the high quality of financial statements, is crucial for stakeholders interested in the development perspectives of the organization. Non-financial reporting is an important element of this process, because it shows a number of threats and the possibilities of overcoming them (including in the context of taxation). Providing independent, prestigious auditors is the premise of high-quality internal control [12].

The research confirmed that experts making financial decisions are aware of ESG risk and the factors that create the risk. Experts are also aware of the consequences of ESG factors and their impact on finance. Experts admitted that, in their financial decisions, they take into account the significance and impact of ESG factors on finance; however, as the study shows, the most numerous social and governance factors are represented in the financial decisions. In the group of social factors, it is possible to group factors selected by experts as significant and to highlight a group of factors concerning relationships with customers (C6, C7, C12, C14), suppliers (C11), human rights (C9, C13, C15, C16), and the labor market (C8, C10). Financial institutions use information to determine if entities with which they expect to co-operate respect human rights and employee rights, act ethically, and ensure privacy policy, thus either deciding to co-operate, or opting out if these criteria are not met, or undertaking conditional co-operation after fulfilling certain criteria. Information about fulfilling or not fulfilling social criteria may result in differentiation of co-operation conditions, e.g., scope, costs, and products. Similarly, in the sphere of governance, financial institutions draw attention to whether entities co-operating with them implement risk management and crisis management standards (C22), whether they act transparently and ethically (C17, C23), whether they implement safeguards against fraud and corruption (C19) or respect the rights of stakeholders (C21), and whether they have a remuneration policy and how it is implemented (C20). All these factors are taken into account in decisions regarding co-operation and building a long-term risk strategy for financial institutions. In the sphere of environmental factors outside the control of the environment, experts demonstrated the key role of the impact of transport on the environment, and waste and water management. The sectors for which these factors are of strategic importance are assessed in relation to the measures taken to eliminate the negative impact of these factors on the environment. In the absence of such activities by financial institutions, such entities receive lower ratings. This applies both to agency ratings and to internal ratings of other financial institutions, mainly banks. More and more often, financial institutions decide to terminate co-operation or to not co-operate with entities operating in a so-called dirty business.

3.4. Data Collection and Description of the PROMETHEE Method

In the first part of the study, using cognitive maps confirmed the occurrence of relationships between various factors that make up the overall system of sustainable finances. This system can also be described taking into account such features as C1, financial depth; C2, financial development; C3, financial vulnerability; C4, financial soundness; C5, financial stability; and C6, financial sustainability. This means that, after examining the relationships between equal factors affecting the possibility of creating a system of sustainable finances, we moved to the second part of the study, in which we determined the current level of this stability, taking into account both traditionally applied assessment criteria and new criteria referring to the balance of assessed systems. Based on multiple-criteria decision analysis (MCDA) using the PROMETHEE method, 23 OECD countries that respect the

Equator Principles were ranked according to seven groups of criteria presented and described in the paper (financial depth, development, vulnerability, soundness, fragility, stability, and sustainability), defined based on the literature review for financial system assessment. Table 12 presents a detailed list of criteria and sub-criteria analyzed in the work.

Table 12. List of criteria and sub-criteria.

Criterion	Sub-Criterion
C1. Financial depth	C1.1 Bank capital (max) C1.2 Domestic credit to private sector % of GDP (max) C1.3 Bank assets, % of GDP (max) C1.4 Bank credit to the private sector as % of GDP (max)
C2. Financial development	C2.1 Stock market capitalization to GDP (max) C2.2 Bank concentration: % of bank assets held by top three (max)
C3. Financial vulnerability	C3.1 Total government debt/GDP (%) (min)
C4. Financial soundness	C4.1 Bank Z-score (min) C4.2 Bank non-performing loans in % of total gross loans (%) (min)
C5. Financial stability	C5.1 Real GDP per capita (max)
C6. Financial sustainability	C6.1 Using social concept of business responsibility—CSR (where 1 = yes, and 0 = no), (max) C6.2 Taking into account, when selecting or assessing the customer, realization of the CSR concept (where 2 = this is the most important criterion, 1 = yes, but it is not the most important criterion, and 0 = no), (max) C6.3 Incorporating ESG risk in the decision-making process (where 2 = yes, 1 = partially, and 0 = no), (max)

Source: own elaboration, where min means that the lower the value is, the better the assessed object is, and max means that the higher the value is, the better the object is rated.

The basis of the PROMETHEE method used in the work involves the so-called thresholds of equivalence and preferences, on the basis of which comparisons of the two analyzed variants are made (in this case, 23 countries), taking into account the analyzed criteria (in this study, a total of 13 different criteria assigned to six areas were analyzed). The process of comparing variants takes place through negative and positive preference flows that allow the determination of the degree of overstepping of a given variant over others and the extent of yielding to other variants. This is the basis for determining optimal decision alternatives that can be presented in partial (PROMETHEE I) or complete (PROMETHEE II) order. The PROMETHEE method application process involves several stages [135,136], as shown below.

1. Stage 1. Defining the set of criteria K for the surveyed countries V and developing the coefficients of importance for individual criteria (in this study, it was assumed that all analyzed criteria are equally important; hence, $V = 1$).
2. Stage 2. Defining the function and preference thresholds. In this work, linear and V-shaped functions were adopted for criteria C1.1–C5.1 and C6.1–C6.3, respectively. Thresholds of incomparability (indistinguishability) of Q and preference of P were also defined for each criterion.

3. Stage 3. Comparison of individual variants in pairs. The first step is to calculate the multi-criteria preference index π , using the following equation:

$$\pi(a, b) = \sum_{j=1}^k w_j \times P_j(a, b), \quad (7)$$

where $w_j > 0$ is the normalized weight assigned to the K_j criterion (the more important f_j is, the greater w_j is), and $P_j(a, b)$ is the value of the preference function for the K_j criterion when variant a is compared with variant b . The index, whose value is between 0 and 1, indicates how much option a is preferred to option b , taking into account the criteria and standardized weights. Therefore, $\pi(a, b) \approx 0$ means that there is a weak advantage of variant a over b , and $\pi(a, b) \approx 1$ means that there is a strong advantage of variant a over b .

4. Stage 4. Calculating the ranking using negative and positive preference flows using the Visual PROMETHE computer software. Preference flows were calculated to consolidate the results of comparisons of variants in pairs and to order all variants in the ranking from the best to the worst.

The complete ranking of the attractiveness of financial systems is presented in Table 13 and Figure 5. Table 13 also includes preference flow values calculated on the basis of pairwise comparisons of individual criteria. This made it possible to determine the order (ranking) of financial systems, taking into account assessments made for all criteria. There are three types of preference flows as follows [136]:

- 1) Φ^+ (Φ^+), positive flow: it indicates to what extent the financial system of a given country is preferred over other financial systems. Its value is the strength of the financial system (a). The higher the value of $\Phi^+(a)$ is, the better the position of the financial system (a) is.

$$\varphi^+(a) = \frac{1}{n-1} \sum_{b \neq a} \pi(a, b). \quad (8)$$

- 2) Φ^- (Φ^-), negative flow: it indicates to what extent financial systems are preferred over the financial system (a). Its value is the weakness of the financial system (a). The lower the value of $\Phi^-(a)$ is, the better the position financial system (a) is.

$$\varphi^-(a) = \frac{1}{n-1} \sum_{b \neq a} \pi(b, a). \quad (9)$$

- 3) Φ (Φ): net flow: $\Phi(a) = \Phi^+(a) - \Phi^-(a)$; net preference flow is the difference between positive and negative flow. Thus, it takes into account the strengths and weaknesses of a given financial system, which are expressed by means of one indicator. The higher the $\Phi(a)$ value is, the better the financial system position (a) is.

$$\varphi(a) = \varphi^+(a) - \varphi^-(a). \quad (10)$$

3.5. Study Results and Discussion in the Area of Sustainable Financial Systems Ranking

There are two types of rankings: partial ranking (PROMETHEE I), which contains negative (Φ^-) and positive flows (Φ^+) and complete ranking (PROMETHEE II), showing net flows (Φ). Table 13 presents the results of the computer simulation carried out for 21 European Union countries belonging to the OECD, as well as for Canada and the USA (also OECD members). The lack of all OECD countries in the ranking is dictated by the availability of data allowing their inclusion in the ranking. The presence of Canada in the ranking is connected to the economic similarities and differences in the financial systems of USA and Canada [137], which can yield interesting observations.

Table 13. Full and partial ranking of selected OECD (Organization for Economic Cooperation and Development) countries according to the PROMETHEE (Preference Ranking Organization Method of Enrichment Evaluation) method.

Group	Rank	Country	Net Preference Flow (ϕ)	Positive Flow ($\phi+$)	Negative Flow ($\phi-$)
I	1	Denmark	0.3939	0.4446	0.0507
	2	Sweden	0.3373	0.3780	0.0407
	3	Norway	0.2959	0.3463	0.0504
	4	Netherlands	0.2697	0.3118	0.0421
II	5	Canada	0.1749	0.2572	0.0823
	6	Finland	0.1612	0.2235	0.0623
	7	United Kingdom	0.1437	0.2336	0.0899
	8	Estonia	0.0985	0.2191	0.1206
	9	United States of America	0.0445	0.2783	0.2338
	10	Ireland	0.0173	0.1935	0.1763
	11	Spain	0.0107	0.1440	0.1333
	12	France	−0.0129	0.1260	0.1389
	13	Germany	−0.0487	0.1074	0.1561
III	14	Belgium	−0.0577	0.0990	0.1567
	15	Austria	−0.0677	0.1002	0.1679
	16	Greece	−0.1906	0.1421	0.3326
	17	Portugal	−0.1911	0.1064	0.2975
	18	Slovakia	−0.1993	0.0942	0.2935
IV	19	Latvia	−0.2031	0.1028	0.3059
	20	Italy	−0.2208	0.0731	0.2939
	21	Slovenia	−0.2276	0.0639	0.2915
	22	Poland	−0.2520	0.0714	0.3234
	23	Hungary	−0.2761	0.0589	0.3349

Source: own elaboration with application of the Visual PROMETHEE software.

Based on the obtained net preference flows, the analyzed countries can be divided into four groups. Three Scandinavian countries were assigned to the first group characterized by the highest positive net flows (ϕ): Denmark, Sweden, and Norway, as well as the Netherlands. High positive net flow values indicate that, in these countries, the positive flows ($\phi+$) significantly exceed the negative flows ($\phi-$), which should be associated with high stability of these systems, resilience to crisis, permanent policy pursued toward the social pillar, and special attention given to the sustainability factor. This is confirmed by studies on the stability of economies and the financial system after the crisis of Scandinavian countries [138,139].

The second group, also with positive net flows, but lower than in the previous group, comprised seven countries: Canada, Finland, the United Kingdom, Estonia, USA, Ireland, and Spain. While participation in this group by Canada, Finland, the United Kingdom, and USA is understandable (due to economic stability, local leadership, and strong efforts to stabilize the financial system after the crisis), Estonia's presence can be explained by the effects of the stabilization program [140]. Ireland

and Spain are countries that learned their lesson from previous problems and destabilization of the financial system [141,142].

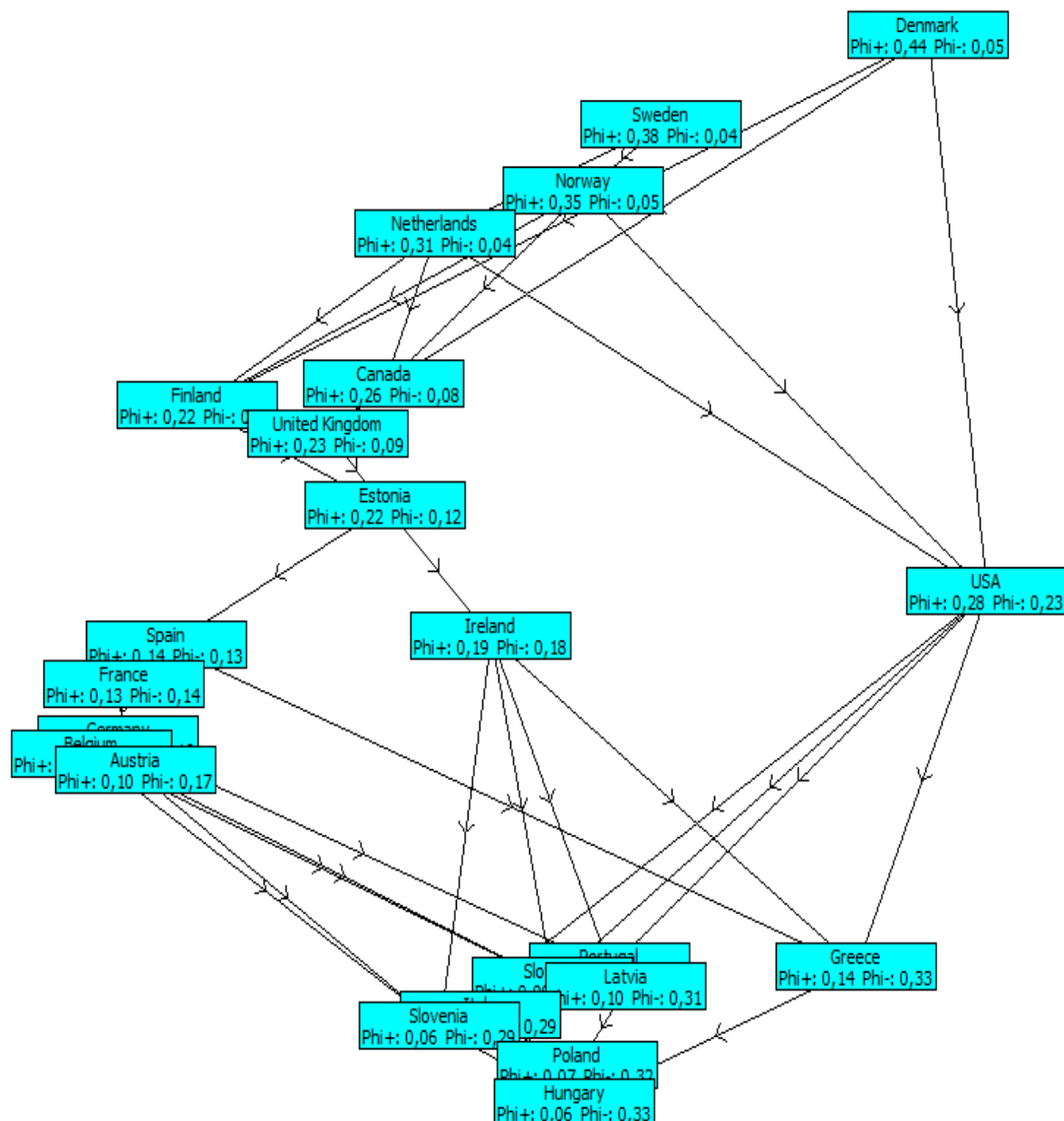


Figure 5. PROMETHEE (Preference Ranking Organization Method of Enrichment Evaluation) ranking as a network. Source: own elaboration in software Visual PROMETHEE.

The third and fourth groups were created by countries whose net flows were negative. This demonstrates the weakness of these financial systems and the need to implement a strong policy to increase their stability. Countries classified into these groups have more negative than positive flows. The third group comprised France, Germany, Belgium, Austria, Greece, Portugal, and Slovakia. In this case, two groups of countries require comment. The first group involves France, Germany, Belgium, and Austria. Financial systems are not strong in these countries. The problems of these financial systems can be seen in the financial crisis and the slow implementation of stabilization measures. It was these countries that were most affected by the financial crisis and that made the greatest effort to implement the rules stabilizing the financial system. The problems of stability in the European area are confirmed by official (government) analyses, and this is indicated in the

literature [143]. Greece and Portugal were affected by both the financial crisis and internal crises that had a severe impact on their financial systems [144].

The fourth group had by far the lowest net flows for the whole surveyed group of countries and comprised five countries: Latvia, Italy, Slovenia, Poland, and Hungary. While Hungary, Poland, and Slovenia belong to post-communist countries, Hungary and Poland always led the way in rapid adaptation changes [145,146]. The problems of these countries can be seen even in political changes, with the emergence of a nationalist trend that is not conducive to strengthening sustainability. Italy's problem is related to the large impact of the financial crisis on the country's financial system.

The results of the ranking can also be presented in the form of a network (Figure 5), which allows visualization of the distance between individual countries and indicates the direction of preference flow. The information presented in this figure shows, for example, that Denmark and Sweden, despite being classified into one (the best) group, are not related, which means that there is no relationship between them. A similar situation in this group also applies to the Netherlands and Norway. It is also worth paying attention to the numerous connections of various countries with the USA, including as many as three out of four countries qualified in the highest group (except Sweden).

The PROMETHEE method used in the work also allowed for more detailed analysis of the results obtained, e.g., in the perspective of the analyzed areas separately for each considered country. Figures 6 and 7 present country profiles by area for two countries: Denmark (highest classified in the built ranking) and Hungary (taking last place). The analysis of results from this perspective allowed identification of the strongest and weakest areas among the respondents. In Denmark, the strongest areas include from the first area (financial depth) C1.3, i.e., bank assets and percentage of GDP, and from the last area (financial sustainability) C6.1, i.e., using the social concept of business responsibility CSR (where 1 = yes, and 0 = no). It is worth noting the negative results of this country obtained under the other criteria qualified for the first area: C1.1 (bank capital), C1.2 (domestic credit to a private sector, % of GDP), and C1.4 (bank credit to a private sector, % of GDP), as well as within the area describing financial soundness: criterion C4.1 (Z-score bank). These were the only criteria for this country that received negative values. However, in the case of Hungary, they were the only areas in which the country achieved positive values.

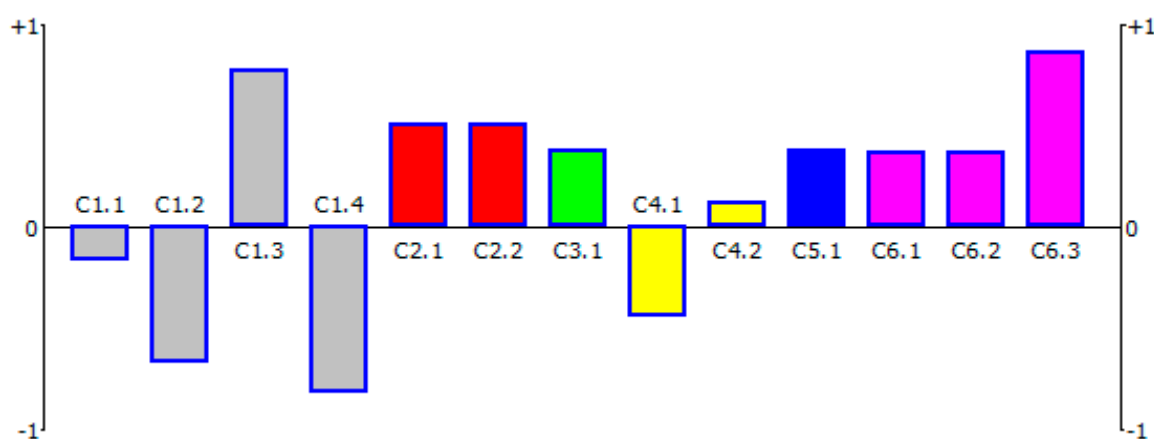


Figure 6. Profile of Denmark according to the analyzed areas. Source: own elaboration in software Visual PROMETHEE

In the second stage, based on multiple-criteria decision analysis (MCDA) using the PROMETHEE method, 23 OECD countries that respect the Equator Principles were ranked according to seven groups of criteria presented and described in the paper (financial depth, development, vulnerability, soundness, fragility, stability, and sustainability), defined based on the literature review for financial system assessment. The indicated criteria characterized ESG factors, which are presented in Table 10, for which the collective FCM describing ESG factors was built. The research shows that the selected

ESG factors in Table 12 affect the financial systems of all OECD countries analyzed, but with varying degrees of strength. The best risk of ESG factors is limited in countries such as Denmark, Sweden, Norway, and the Netherlands. ESG factors most strongly affect the following countries: Greece, Hungary, Poland, Slovenia, Latvia, and Italy. Thus, it can be pointed out that the study shows that limiting the risk of ESG factors strengthens the financial systems of countries, while, in countries such as Greece, Hungary, Poland, Slovenia, Latvia, and Italy, there is a strong impact of ESG factor risk and, therefore, their financial systems are in the last, weakest group of classified financial systems.

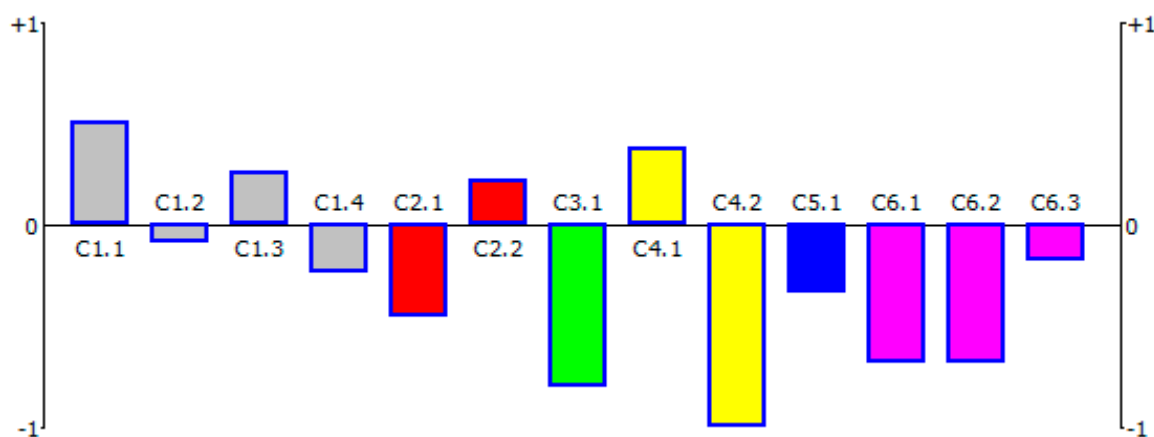


Figure 7. Profile of Hungary according to the analyzed areas. Source: own elaboration in software Visual PROMETHEE

Our analysis shows that, in the Scandinavian countries, the position of the financial system in the ranking is significantly affected by the environmental factor. In addition, the stability of financial systems is stimulated by the policies of the governments of these countries, whose instruments not only support stability, but are also strongly correlated with sustainable development and high public awareness (social factor). In post-transformation countries, differences are visible due to the lack of decisive government policies and having no impact on the social factor. The countries of the Visegrad group, excluding Poland, show a slower pace of adjustment of their financial systems, and yet Poland deviates significantly from them. Poland is a country with one of the strongest ESG risks, and a poorly developed social awareness of the environmental factor. Therefore, the impact of ESG patterns and the weak position of the system are highlighted.

4. Conclusions

Financial institutions, when determining the financial and non-financial criteria for assessing the risk of transactions, select entities by excluding those that do not meet the requirements specified by them from the availability of financial services. In turn, entities fulfilling the criteria, depending on the assessment of the level of transaction risk, conditioned by the degree of implementation of the criteria, are differentiated by financial institutions in terms of terms of service (including price, range of services, level of monitoring, legal repayment security, etc.). Criteria for assessing the risk of transactions change under the influence of economic changes. This is particularly evident in the conditions of “greening” the economy and social inclusion. These two phenomena referring to the environmental and social pillars of sustainable development strongly weigh on the necessity of extending the risk assessment criteria by financial institutions to encompass ESG risk (environmental, social, governance). The demand for extending the risk assessment methodology with ESG components is emphasized by the Environmental Program Financial Initiative, and the state of implementation of this postulate by financial institutions, depending on the country and institutions, remains at different levels of advancement.

The purpose of the article was to examine the factors of ESG taken into account in financial decisions by financial institutions and the impact on sustainability of financial systems. Non-financial

factors, the so-called ESG factors, which correspond with the three pillars of sustainable development—economic, environmental, and social—were analyzed. The article assumes that the inclusion of ESG factors in the decision-making processes of financial institutions results in a more sustainable financial system. A study carried out using a fuzzy cognitive map showed that financial decision-makers are aware of the risks of ESG and the impact of ESG risk on finance. The most numerous groups of factors included in financial decisions were the social and governance groups. There was no difference between the indications of experts representing the so-called green banks in relation to commercial banks. Experts representing financial institutions agreed on the factors having the greatest impact on risk assessment and customer rating, pointing to the leading role of variable C1 (control of environmental impacts). In the social area, in the opinion of experts, only human capital development and training (C8) positively affected (and quite strongly) labor management (C10). In the governance area, the links were only positive, but with a large number of associations with the corporate government functions and commitments variable (C18). Based on the cognitive map, it was possible to formulate basic research problems in the field of variable relationships affecting the system of sustainable financial systems. At this point, however, it should be noted that the identified research problems resulted from a proper exploration of the interviewed experts and should not be generalized. The tool used in the form of cognitive maps is not a perfect tool; although it is a source of unambiguous solutions, it can be the basis for further research.

The second stage of the research consisted of assessing the financial systems of OECD countries based on multiple-criteria decision analysis (MCDA) using the PROMETHEE method, resulting in a ranking of financial systems of individual countries. A total of 23 OECD countries that respect the Equator Principles were ranked according to seven groups of criteria (financial depth, development, vulnerability, soundness, fragility, stability, and sustainability). In the study, a total of 13 different criteria assigned to six areas were analyzed. Based on the net preference flows, the analyzed countries were divided into four groups. Three Scandinavian countries were assigned to the first group characterized by the highest positive net flows (ϕ): Denmark, Sweden, and Norway, as well as the Netherlands. The second group, also with positive net flows but lower than in the previous group, comprised seven countries: Canada, Finland, the United Kingdom, Estonia, USA, Ireland, and Spain. The third and fourth groups were created by countries whose net flows were negative. The third group comprised France, Germany, Belgium, Austria, Greece, Portugal, and Slovakia. The fourth group, with the lowest net flows for the whole surveyed group of countries, comprised five countries: Latvia, Italy, Slovenia, Poland, and Hungary. The first and last ranking places were Denmark and Hungary, respectively. In Denmark, the strongest areas were financial depth, C1.3 (bank assets, % of GDP and financial sustainability), and C6.1 (using social concept of business responsibility—CSR (where 1 = yes, and 0 = no)). The negative results of Denmark were for C1.1 (bank capital), C1.2 (domestic credit to a private sector, % of GDP), and C1.4 (bank credit to a private sector, % of GDP), as well as, within the area describing financial soundness, for C4.1 (Z-score bank). These were the only criteria for Denmark that received negative values. Conversely, the criteria that received negative values for Denmark were the only criteria with positive values for Hungary.

To the best of the authors' knowledge, the article is the first of its kind to attempt to evaluate financial systems taking into account sustainability criteria. This is also the first article assessing the validity of ESG criteria taken into account in the financial decisions of financial institutions. The originality of the research consists of including sustainability criteria in the analysis of the financial systems. The article fills a gap in the literature regarding the assessment of financial systems in terms of their sustainability. Until now, the subject of ranking and classification of financial systems was not done in the literature depending on the degree of their sustainability. In this approach, the study has original theoretical and methodological scientific value and may constitute a contribution to further expanded research in this field. The evaluation of the sustainability of financial systems using the PROMETHEE method presented in this article can be an interesting methodological and cognitive contribution to research into sustainable finance. Nonetheless, the research itself is limited and is a

kind of methodological proposal that can be developed in future, with more detailed analyses. Such an expansion could be in comparative studies, in which foreigners from other European countries can also be involved as experts, and the public and market pillars of the financial system can be subject to comparison. In addition, research using the proposed methodological approach can be conducted in two directions including (1) a detailed, comprehensive assessment of smaller regions (located within one larger area) aimed at determining their position (since not all European Union (EU) countries are the same due to the fact that, after the 2004 political transformation, countries such as Poland, Slovakia, Latvia, Hungary, Greece, Italy, and Portugal had significant EU accession), and (2) a detailed assessment of the areas in terms of individual criteria. Clearly, the spatial scope of research can also be extended to other non-European countries. The results of such analyses can also be useful for practical purposes. They not only determine the competitive position of individual areas, but also indicate their strengths and weaknesses (in relative terms, of course). Our research is individual (it was conducted for the first time), which is why we see the need to compare financial systems in later years and, on this basis, to conduct analyses that will allow the determination of the causes (i.e., factors) of ranking changes. However, the article also focuses on the way in which problems are identified and the prospect of their occurrence in other financial institutions. This is important in promoting a holistic approach to sustainable financial systems and identifying factors and relationships between them.

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