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Assessing Sustainable Development Performance and Alternative Concepts in a Group of Developed Countries in Europe

Ocena realizacji zrównoważonego rozwoju i alternatywnych koncepcji w grupie krajów rozwiniętych w Europie

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Abstract
This study evaluates the progress of 31 countries, including EU member states, Norway, Iceland, Switzerland, and the United Kingdom (UK), towards the United Nations (UN) 2030 Agenda for Sustainable Development (SD) and its 17 Sustainable Development Goals (SDGs) over the period 2012–2020. The analysis employs indicators from the EU SDG indicator set, which monitors progress towards the SDGs within the EU context. The objective is to identify which sustainability concepts these countries gravitate towards as they advance towards the SDGs and specific indicators within the EU SDG set. The study assesses progress and alignment with the overarching concept of sustainable development as well as with more focused practical approaches, such as green economy/growth and circular economy, and more complex alternative concepts like degrowth and compassionate economy. The biclustering method is applied to uncover relationships between countries and indicators, resulting in clusters that combine five groups of countries with ten groups of indicators. These clusters exhibit varying degrees of progress across sustainable development, green economy/growth, circular economy, compassionate economy, and degrowth based on the indicator values. Norway, Switzerland, the Netherlands, and Sweden are identified as the top performers in overall sustainability. Notably, Switzerland and Norway show the greatest alignment with degrowth and compassionate economy concepts, while the Netherlands and Italy excel in circular economy and green economy/growth. The novelty of this article lies in the innovative application of the biclustering method combined with point-based evaluation of indicators within the SDG set, providing a unique perspective on the progress of these 31 European countries towards sustainability. Furthermore, the identification of countries' inclination towards specific sustainability concepts represents a key innovation in this work.

Key words: biclustering, circular economy, compassionate economy, degrowth, sustainability, wellbeing
JEL Classification: I15, I31, Q51

Streszczenie
W niniejszym badaniu oceniono postęp 31 krajów, w tym państw członkowskich UE, Norwegii, Islandii, Szwajcarii i Zjednoczonego Królestwa, w kierunku realizacji Agendy na rzecz Zrównoważonego Rozwoju 2030 Organizacji Narodów Zjednoczonych 2030 i jej 17 Celów Zrównoważonego Rozwoju (SDGs) w okresie 2012-2020. Analiza wykorzystuje wskaźniki z zestawu wskaźników SDG UE, który monitoruje postęp w kierunku SDGs w kontekście UE. Celem jest określenie, do których koncepcji zrównoważoności te kraje zmierzają w kontekście SDGs i konkretnych wskaźników w ramach zestawu SDG UE. Badanie ocenia postęp i zgodność z nadrzędną koncepcją zrównoważonego rozwoju, a także z bardziej ukierunkowanymi praktycznymi podejściami, takimi jak zielona gospodarka/wzrost i gospodarka o obiegu zamkniętym, a także bardziej złożonymi alternatywnymi koncepcjami, takimi jak postwzrost i gospodarka współczująca. Metoda biclusteringu jest stosowana w celu odkrycia

relacji między krajami i wskaźnikami, co skutkuje klastrami, które łączą pięć grup krajów z dziesięcioma grupami wskaźników. Te klastry wykazują różne stopnie postępu w zrównoważonym rozwoju, zielonej gospodarce/wzroście, gospodarce o obiegu zamkniętym, gospodarce współczującej i postwzroście na podstawie wartości wskaźników. Norwegia, Szwajcaria, Holandia i Szwecja są identyfikowane jako kraje o najlepszych wynikach w zakresie ogólnej zrównoważoności. Co ciekawe, Szwajcaria i Norwegia wykazują największe dopasowanie do koncepcji postwzrostu i gospodarki współczującej, podczas gdy Holandia i Włochy przodują w gospodarce o obiegu zamkniętym i zielonej gospodarce/wzroście. Nowością tego artykułu jest innowacyjne zastosowanie metody biclusteringu w połączeniu z punktową oceną wskaźników w ramach zestawu SDG, co zapewnia unikalną perspektywę postępu tych 31 europejskich krajów w kierunku zrównoważonego rozwoju. Kluczową innowację w tej pracy stanowi też identyfikacja skłonności krajów do określonych koncepcji zrównoważoności.

Słowa kluczowe: biclustering, gospodarka o obiegu zamkniętym, gospodarka współczująca, postwzrost, zrównoważoność, dobre samopoczucie

1. Introduction

Sustainable Development (SD) and sustainability are closely linked to the ambition of improving the quality of life for both current and future generations. According to the most widely cited definition from the World Commission on Environment and Development (WCED), SD is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. This definition involves two key concepts: the notion of needs, particularly focusing on the fundamental needs of the world's poor, and the limitations imposed by the state of technology and social organization on the environment's capacity to fulfil both present and future needs (WCED, 1987). Although the original concept of SD remains persuasive (Lorek and Spangenberg, 2014), various related and alternative concepts have emerged to address its inconsistencies. This research seeks to evaluate these alternative concepts in relation to SD and to propose a new, advanced methodology for analysing progress toward the SD agenda and these alternative frameworks.

The theoretical discussion (continued in subsection 2.1) must be contextualized within the recent SD Agenda. The most recent and comprehensive global policy framework for achieving SD is the UN Agenda 2030, which includes the Sustainable Development Goals (SDGs). Formulated by the UN in 2015 (UN, 2015), this agenda provides a global policy framework aimed at addressing the most pressing economic, social, and environmental challenges facing humanity (see Drastichová, 2022). It outlines 17 SDGs with 169 associated targets and 213 measurable indicators (which are subject to modification) designed to tackle economic, social, and environmental issues obstructing global progress toward SD (see Gue et al., 2020). Consequently, it serves as a worldwide policy framework for advancing SD. The EU and its member states have committed to implementing the 2030 Agenda, with the EU's response detailed in the 2016 European Commission Communication (European Commission, 2016).

Despite extensive research on SDGs and sustainability concepts, there are gaps in the study of country progress towards alternative SD concepts through a combination of sophisticated statistical and subjective methods. Additionally, there is a lack of empirical evidence regarding the development of countries towards sustainability, considering both SD philosophy and alternative concepts.

The aim of the paper is to identify which concepts the 31 countries in the sample favour in their pursuit of the SDGs and their progress toward selected indicators within the EU SDG indicator set. It evaluates progress and inclination towards the fundamental SD concept, as well as specific practical concepts such as green economy (GE)/growth (GG) and circular economy (CRE), and more complex alternative concepts like degrowth (DG) and compassionate economics (CEE). This has significant implications for future wellbeing, quality of life, and the survival of humanity. The method of biclustering is employed to uncover relationships between countries and indicators. The biclustering algorithm yields combinations of country and indicator partitions. This paper is structured as follows: Introduction (section 1); Materials and Methods (section 2); Results of the Analysis (section 3); and Conclusions (section 4).

2. Materials and methods

The works relevant to the analysis, which was carried out, are introduced in this section. Subsequently, the applied data and methods are described.

2.1. Literature review

This subsection provides the background for the analysis conducted in this paper and explains the methodology and indicators used. Since the original definition of Sustainable Development (SD) conceptualized by the World Commission on Environment and Development (WCED) in 1987, many scholars have proposed their own definitions. One of the two guiding principles of SD identified by the WCED is the concept of accepting limits (see section 1). This principle suggests that one way to achieve sustainability is by limiting the total amount of resources consumed by an economy. However, this principle was not a direct requirement of the original SD concept, leading to the development of related and alternative concepts.

The SD concept is often linked to the idea of decoupling economic activity from environmental harm, commonly referred to as decoupling (see, e.g., Wiedmann et al., 2015). Decoupling is viewed as an application of SD, aiming for economic growth without corresponding increases in resource use or environmental damage. Despite this goal, absolute decoupling – characterized by a reduction in resource use and ecosystem service consumption alongside economic growth – has not been achieved (see, e.g., O'Neill et al., 2018), and future trends remain uncertain. A significant factor contributing to this is the rebound effect, a term encompassing various mechanisms that diminish the potential energy savings from improvements in energy efficiency (Ruzzenenti et al., 2018). Notable analyses of this concept in EU countries, focusing on material consumption and greenhouse gas emissions, have been conducted by Drastichová (2016; 2017). The theoretical framework for this paper is based on the works of Drastichová (2022, 2023, 2024), which underpin the analysis presented here.

2.1.1. Scientific foundations and comparative analysis of concepts related to sustainable development

Sustainability (SD) remains a powerful concept based on its original definition, but its significance has often been diluted due to misrepresentation. The concept's inherent vagueness has led to various interpretations and definitions. In the realm of economics, mainstream Neoclassical Environmental Economics (NEE) is the primary approach for addressing environmental issues. However, due to the limitations of SD, alternative concepts have emerged that cater to different analytical levels or specific regions and communities. For example, Buen Vivir in Latin America, Ubuntu in Africa, and Ecological Swaraj in India present regional adaptations of sustainability (Drastichová, 2023; Beling et al., 2018; Kothari et al., 2014). On a global scale, Degrowth (DG) stands out as a significant alternative. Some concepts address the weaknesses of the Sustainable Development (SD) concept or seek to supplement it with additional insights. One such concept is the Human Development (HD) approach, which can be included in this category. Our perspective is that SD should be viewed as a path of change leading to a sustainable state. Consequently, certain sustainability concepts, defined by specific criteria, can be identified. Various approaches attempt to operationalize SD, though they often face similar criticisms as the SD concept itself. These include the Green Economy (GE), Green Growth (GG), Circular Economy (CRE), Sustainable Production and Consumption, and the broader concept of decoupling, which should be applied across these approaches. In contrast to these concepts, another group entirely rejects the current capitalist system. This is particularly evident in the Degrowth (DG) concept and other comprehensive models that often support the DG philosophy (specified below).

In recent times, the concept of HD, which is substantially related to SD from the perspective of quality of life, has gained interest. It is associated with the concept of SD, i.e. economic growth is not rejected. Within the HD notion, the emphasis on the human dimension (people and their opportunities and choices) (UNDP, 2022) is added to the focus on the economic, social dimensions, and environmental pillars of SD. An alternative view to some extent is provided by Beeks (2016) who summarized fourteen economic systems/concepts, which are regarded as alternative systems to the system of capitalism. They include environmental (EN), ecological (EC), circular (CR), green (GN), resilience (RE), complexity (CY), feminist (FE), compassionate (CE), caring (CG), degrowth (DG), steady-state (SE), no-growth (NH), ecosocialism (EM), and anarcho-ecosocialism (AEM) systems. The formation of these systems is related to the illusion that a sustainable society can be based on an economy with economic growth which also has significant effects on environmental services. We support a different approach to some extent but take this classification into account. In particular, the concepts applied in our work to complement that of SD are all included in Beeks (2016)'s analysis, apart from green growth (GG), but this is regarded as complementary to that of green economy (GE). As also indicated above, the first two concepts analysed by Beeks (2016), EN and EC, are the fundamental disciplines for the analysis of all the remaining concepts/systems.

Moreover, not all concepts from the remaining list can be viewed as alternatives to Sustainable Development (SD), particularly the Circular Economy (CRE), Green Economy (GE), and Resilience Economy (RE) concepts. GE and its complementary concept, Green Growth (GG), are more practical approaches that operationalize the ideas of sustainability and SD. On the other hand, alternative approaches include the No-Growth (NH), Steady-State (SE), and Degrowth (DG) economies from Beeks' (2016) list. Several practical alternatives to DG also reflect the cultural characteristics of smaller communities. Thus, the first group of concepts can be described as those related to SD. This group encompasses concepts based on various scientific disciplines, with some offering practical approaches (e.g., Circular Economy, Green Economy, Resilience Economy) and others reflected in the political strategies of organizations or countries (e.g., GE and GG). This group also includes alternative perspectives or critiques of SD and its aspects (e.g., NH, SE, and DG).

The remaining concepts from Beeks' (2016) list – such as Complexity (CY), Feminist (FE), Compassionate (CE), Caring (CG), Ecosocialism (EM), and Anarcho-Ecosocialism (AEM) – represent more comprehensive alternatives to capitalism. These concepts emphasize quality of life and wellbeing and are highly interconnected. The concepts applied in this work are described in greater detail, with a particular focus on Circular Economy from a theoretical perspective. The more practical concepts, including Circular Economy, Green Economy, and Green Growth, are contextualized with their theoretical underpinnings, as summarized in Beeks (2016).

Compassionate (CE) Economy traces its origins back to 1955 and is philosophically rooted in Buddhism, which led to its initial designation as *Buddhist economics* (Schumacher, 2011). CE economists argue that mainstream economics often fails to address critical issues due to its tendency to oversimplify the complex relationships between society, the environment, and the economy. In response, CE economics emphasizes these intricate relationships, including those pertaining to individual needs, and seeks to establish a foundation for social democracy akin to that in Nordic nations. This approach aligns closely with the philosophy of Sustainable Development (SD) and offers a model for economic systems that can bring about significant improvements to mainstream capitalism (Beeks, 2016). The concept is further elaborated in Drastichová (2024).

In terms of practical political strategies, inclusive Green Economy (GE) and Green Growth (GG) initiatives, which build upon the aforementioned concepts (see Drastichová, 2022), have gained prominence on national and global political agendas. The term *greening the economy* has re-emerged as a key issue in policy debates since the early 1970s and has become a widely recognized buzzword. GE and GG are often used interchangeably, encompassing a spectrum of ideas related to low-carbon development (Barbier, 2012), from narrowly focused eco-industries and environmentally friendly production to broader redefinitions of national or regional economies (e.g., World Bank and DRC, 2012; European Commission, 2010; OECD, 2009).

Within this spectrum, various policies aim to promote low-carbon economies, enhance efficiency and productivity, and often overlap. These policies advocate for decoupling resource use from economic growth and promoting dematerialization (UNEP, 2011a), valuing ecosystem services (Nellemann and Corcoran, 2010), and improving energy efficiency (IEA, 2012), all of which are driven by technological innovation. Similar to SD, the GE is a multidimensional concept that has been increasingly integrated into the policies of international and national institutions (see Drastichová, 2023, 2024). The United Nations Environment Programme (UNEP), a key promoter of the concept at the international level, launched the Green Economy Initiative in 2008 and called for a Global Green New Deal in 2009 (Barbier, 2012; Bowen et al., 2009; Georgeson et al., 2017). When the UN General Assembly convened the 2012 United Nations Conference on Sustainable Development (UNCSD) in 2009, it designated the GE as one of its two main focal areas. UNEP defines the GE as an economy that results in improved human well-being and social equity while significantly reducing environmental risks and ecological scarcities (UNEP, 2011b).

Green Growth (GG) can be seen as a political catchword introduced to address skepticism within the business sector toward environmental initiatives, despite their potential economic benefits. GG is central to the Green Economy (GE) concept (UNEP, 2011b). The Organisation for Economic Co-operation and Development (OECD) has adopted GG as a key overarching theme (OECD, 2011), though its implementation has been inconsistent (Lorek and Spangenberg, 2014). Colby (1989) defined GG as an approach focused on increasing the information intensity, community consciousness, and experiential quality of economic activities rather than their material and energy intensiveness. However, this term did not gain significant traction before the 2000s, similar to the GE concept.

In 2009, the OECD adopted the Green Growth Declaration (OECD, 2009) and, in 2011, published its Green Growth Strategy Package, which includes the widely cited report Towards Green Growth. In this report, GG is defined as a strategy that promotes economic growth and development while ensuring that natural assets continue to provide the resources and environmental services upon which our well-being depends (OECD, 2011). Capasso et al. (2019) reviewed 113 recent scientific articles on GG, summarizing that GG is often viewed as a key component in achieving SD by balancing environmental protection with economic growth.

The OECD positions GG as a policy pathway to achieving the United Nations Sustainable Development Goals (SDGs). The connections between GG and the SDGs are explicit, particularly concerning resource efficiency. GG is closely aligned with SDG 8: Decent Work and Economic Growth, specifically through green innovation (targets 8.2 and 8.4) (Imasiku et al., 2019). While Islam and Managi (2019) argue that GG is related to all UN SDGs, Merino-Saum et al. (2018) and Khoshnava et al. (2019) suggest that GG may not be fully equipped to advance SDGs focused on social issues, such as SDG 5 (Gender Equality) and SDG 10 (Reduced Inequality). The same critique applies to the GE concept; however, its potential to address social goals may be enhanced if a socially inclusive version of this strategy or model is implemented.

Both Green Economy (GE) and Green Growth (GG) concepts have faced substantial criticism from political authorities (Atkisson, 2013) and many developing countries (Bina, 2013). In our analysis, we interpret GE and GG primarily as political strategies that do not significantly incorporate alternative economic concepts or challenge the capitalist system to any meaningful extent. This perspective aligns with the views of Belmonte-Ureña and Plaza-Úbeda (2021) and Bina (2013).

Another practical concept for implementing SD is the Circular Economy (CRE), which aligns closely with the principles of biomimicry (see, e.g., Geisendorf and Pietrulla (2017)). The CRE approach involves eliminating waste, mimicking natural processes, internalizing externalities, and emulating a closed-loop cycle observed in nature. Unlike a linear consumption economy, a CRE is regenerative, focusing on recycling and reusing products rather than disposing of them (see Beeks (2016) for further details). Beeks (2016) also highlights that the recommendations of circular economy economics emphasize internalizing externalities through mechanisms such as taxes on goods and services with negative externalities and subsidies for those with positive externalities. This approach is closely related to Environmental Economics (EN).

CRE is essentially a framework of ideas rooted in long-established economic and environmental paradigms, aiming to enhance resource efficiency to achieve a better balance between the economy, environment, and society (Ghisellini et al., 2016; Giampietro, 2019; Murray et al., 2017). According to Korhonen et al. (2018), the roots of CRE lie in Ecological Economics (EL), with its core idea linked to the macroeconomic potential of cyclical material flows, as discussed in Georgescu-Roegen's (1977) concept of *Matter matters, too*, or the fourth law of thermodynamics. However, CRE should be understood more as a model and strategy rather than a purely theoretical concept, and its practical implications for sustainability and SD remain ambiguously defined (Giampietro, 2019) (see Drastichová, 2023 for further discussion).

Although the term Circular Economy (CRE) is not explicitly mentioned in the targets of the Sustainable Development Goals (SDGs), its connection to SDG 12 is evident, particularly in target 12.5: *By 2030, substantially reduce waste generation through prevention, reduction, recycling, and reuse.* The core principles of CRE – consumption reduction, reuse, recovery, and recycling of materials and energy – align closely with this target (Blomsma et al., 2017; Zwiers et al., 2020). In this context, CRE is a key concept for decoupling economic growth from natural resource consumption (Oriekhova, 2019; Geisendorf and Pietrulla, 2017; Hazen et al., 2016). Several studies have explored the relevance of CRE to the SDGs. Schroeder et al. (2019) identify strong connections between CRE and SDG 6 (Clean Water and Sanitation), SDG 7 (Affordable and Clean Energy), SDG 8 (Decent Work and Economic Growth), SDG 12 (Responsible Consumption and Production), and SDG 15 (Life on Land). Moreover, CRE has the potential to create synergies across multiple SDGs, as it addresses critical issues such as promoting economic growth and job creation (SDG 8: Decent Work and Economic Growth), eliminating poverty (SDG 1: No Poverty), improving sustainable food production (SDG 2: Zero Hunger), and enhancing biodiversity protection both in the oceans (SDG 14: Life Below Water) and on land (SDG 15: Life on Land). In summary, the CRE concept represents a system that facilitates decoupling and is grounded in Sustainable Consumption and Production (SCP). It can be integrated within the frameworks of Green Economy (GE) or Green Growth (GG) and contributes to advancing economies toward Sustainable Development (SD). While CRE is an ambitious model, GG and GE are more pragmatic approaches, offering contingent policy prescriptions (Hamdouch and Depret, 2010). Both approaches share a comprehensive yet not fully articulated theoretical foundation.

Degrowth (DG) emerged as a paradigm that highlights the inherent tension between sustainability and economic growth, thereby complicating the Sustainable Development (SD) paradigm and its revival through the Green Economy (GE) concept (Kothari, Demaria, and Acosta, 2014; Dale et al., 2015). The concept of décroissance (degrowth) was first introduced by French philosopher André Gorz during a debate organized by Le Nouvel Observateur in Paris in 1972, following the publication of the Limits to Growth report (Meadows et al., 1972) (Demaria et al., 2013). Gorz used the term to question the compatibility of the capitalist system with the degrowth of material production and emphasized the need to reduce consumption while promoting values such as frugality, autonomy, and conviviality (Asara et al., 2015). The origins of DG can be traced back not only to Meadows et al. (1972) but also to Hardin (1968), who argued that continuous economic growth is unsustainable on a finite planet and must be curtailed to ensure human survival. The DG perspective, also known as survivalism, significantly influenced Ecological Economics (EL) and the work of its founder, Herman Daly, who proposed a steady-state economy as an alternative to continuous economic growth (as mentioned earlier). This perspective dominated environmental discourse until the concept of SD became more prominent in the 1990s (Dryzek, 1997). The relentless pursuit of GDP growth, rather than genuine well-being, has led to the issue of uneconomic growth, where the costs of growth exceed its benefits (Daly, 2007, 2013).

Critics of DG as a pathway to sustainability argue that a reduction in GDP does not necessarily lead to reduced energy consumption or lower emissions of pollutants, pointing out that the concept can be overly reductionist (Robra and Heikkurinen, 2019; Haberl et al., 2020). Furthermore, DG presents an ontological contradiction with the foundational premise of SD, which posits the possibility of environmentally benign growth achieved through decoupling economic activity from environmental degradation (Haberl et al., 2020). The World Commission on Environment and Development (WCED), in its Brundtland report (WCED, 1987), envisioned a future sustainable economy that would be much larger than it was at that time (Daly et al., 1993). DG challenges this vision by proposing an alternative perspective, in which economic growth is not inherently desirable, and organizations should prioritize social and environmental performance over purely economic outcomes within the capitalist system (Plaza-Úbeda et al., 2020). In conclusion, DG has evolved from an activist movement into a multidisciplinary academic paradigm, yet a comprehensive review of the peer-reviewed literature on DG is still lacking (Weiss and Cattaneo, 2017).

Due to the divergence in the interpretation of economic growth between the concepts of Degrowth (DG) and Sustainable Development (SD), DG is not referenced in any United Nations Sustainable Development Goals (SDG) documents or related topics. Robra and Heikkurinen (2019) argue that the assumptions underlying the

SDGs need to be revised to incorporate a DG perspective. Such revisions would necessitate abandoning the notion of SD as synonymous with balanced economic growth and challenging the Circular Economy (CRE) model, which presupposes the unlimited growth of production and consumption within cyclical flows (Barnosky et al., 2012). Robra and Heikkurinen (2019) attempt to bridge the DG concept with the UN SDGs, positing that considering economic growth alongside ecological sustainability is incompatible with DG. This is because the SDGs do not address the need to reduce consumption and production, a central tenet of DG. Additionally, several SDGs emphasize technological solutions, which DG proponents view as diverging from their core principles: technology plays a crucial role in SDG 12 (Responsible Consumption and Production) (Srnicek and Williams, 2015), SDG 7 (Affordable and Clean Energy) (Robra and Heikkurinen, 2019), and SDG 13 (Climate Action) (Heikkurinen, 2018). Conversely, certain SDGs align more closely with the DG concept, such as SDG 10 (Reduced Inequality), SDG 2 (Zero Hunger), and SDG 5 (Gender Equality).

To further clarify and specify these classifications, particularly in relation to the concepts analyzed in this work, it is essential to reference seminal contributions in the field. Dryzek (1998) categorized environmental discourses based on the extent to which they deviate from the discourse of industrialism, which is inherently committed to the growth of goods and the material well-being that results from such growth. The shift away from industrialism can be either reformist, involving adjustments and corrections within the existing economic system, or radical, involving a complete disruption or replacement of the economic system. Reformist discourses advocate for slow, gradual change, thereby encountering less resistance. In contrast, radical discourses propose dramatic changes but face strong opposition from established authorities. According to this classification, SD, GE/GG, and CRE are considered reformist discourses, while DG and certain aspects of the Circular Economy Economics (CEE) are viewed as radical discourses.

Another advanced and more practical concept, which embodies a Human Development (HD) approach and emphasizes quality of life, is the Economy for the Common Good (ECG). The ECG is an economic model where the primary goal is the common good, defined as a good life for all on a healthy planet. This model focuses on the true purpose of business, which is to meet human needs, rather than merely increasing monetary capital. The ECG is fully aligned with the principles of SD. To measure whether this goal is being achieved, the ECG suggests using alternative indicators beyond traditional monetary measures like GDP (for more information, see ECG, 2021). Thus, the ECG significantly reflects the characteristics of a compassionate (CE) economic system, potentially serving as a viable economic model for the future.

In summary, we adopt the following interpretation of the relationships among these concepts. Sustainability and Sustainable Development (SD) are foundational concepts, with sustainability encompassing a broader scope than SD. Both concepts are rooted in, or draw upon, the principles of Environmental (EN) and Ecological (EL) economics, though the dominance of one over the other depends on the specific approaches within the sustainability and SD frameworks. The boundaries between these concepts are not clearly defined. This ambiguity also extends to some of the other related concepts, which frequently draw from both EN and EL economics. However, concepts that present clearer alternatives to SD or the capitalist system tend to rely more heavily, if not exclusively, on EL economics. Given the broader scope of sustainability, alternative concepts that oppose SD can still focus on sustainability within their own frameworks. These alternative or more comprehensive/practical concepts, such as the steady-state economy, the compassionate economy (CEE), or the Economy for the Common Good (ECG), emphasize achieving high levels of quality of life, human development, happiness, life satisfaction, or similar values.

2.1.2. Connections between concepts and the current Global Sustainable Development Agenda

Conceptually, have made significant efforts to categorize the 17 Sustainable Development Goals (SDGs) to better understand their interconnectedness and to facilitate the transition towards sustainable development (SD). Costanza et al. (2016) classified SDGs into three groups based on their potential contributions to natural, economic, and social capital, focusing on how these classifications could enhance the measurement of sustainable well-being. In contrast, Kastrinos and Weber (2020) approached the SDGs with an eye towards structuring future research and innovation policy, organizing them into distinct yet overlapping groups that correspond to four major transitions: social needs, biosphere, innovation, and governance. Kolk and Kourula (2017) took a different approach by examining the role of multinational enterprises in contributing to SD through a corporate social responsibility lens, categorizing the SDGs into five groups: planet, people, prosperity, justice, and dignity. While these classifications share common dimensions – most notably the inclusion of natural capital (the planet) as a central category – they differ in how specific SDGs are grouped, reflecting the varying priorities and objectives of each framework.

Although these classifications can simplify analysis and guide policy in specific areas, they can also obscure important distinctions between the goals within the same category. This complexity highlights the need for a more detailed analysis of the contributions to each of the 17 SDGs. Given the intricate interrelationships among the various aspects and stakeholders involved in the SDGs, scientific research plays a crucial role in translating these global goals into actionable national and local agendas (Salvia et al., 2019). It is essential to investigate which existing or alternative conceptual approaches to SD can most effectively support the implementation of the SDGs and help humanity progress towards sustainable development. The existing literature lacks studies that thoroughly examine the contribution of specific concepts to each of the 17 Sustainable Development Goals (SDGs). The extent to which Sustainable Development (SD) concepts are applied by different countries is typically assessed using relevant indicators.

Belmonte-Ureña and Plaza-Úbeda (2021) examined three key approaches to Sustainable Development (SD) that directly connect the environment, development, and society: Circular Economy (CRE), Degrowth (DG), and Green Growth (GG). Using bibliometric techniques, they evaluated how recent academic research has contributed to the SD agenda, particularly in relation to the UN Sustainable Development Goals (SDGs). Their analysis included four concepts – CRE, DG, GG, and SDG Research (SDGR), which focuses specifically on the SDGs – each offering a unique perspective on balancing ecological and economic systems. The authors identified significant gaps in the academic literature, noting that many SDG priorities are insufficiently addressed. Despite this, they concluded that CRE, DG, GG, and SDGR have made substantial contributions to research related to the 17 UN SDGs. However, the impact of each concept varies across different SDGs. For instance, each concept tends to focus on one or two primary SDGs, particularly SDG 3 (Good Health and Well-being), SDG 12 (Responsible Consumption and Production), SDG 8 (Decent Work and Economic Growth), and SDG 13 (Climate Action). SDG 13 is consistently addressed by all four concepts, while SDGs like SDG 1 (No Poverty), SDG 5 (Gender Equality), SDG 14 (Life Below Water), and SDG 17 (Partnerships for the Goals) receive less attention. Notably, some SDGs, such as SDG 10 (Reduced Inequality), SDG 2 (Zero Hunger), and SDG 5 (Gender Equality), align more closely with the Degrowth concept.

Focusing on the CRE, DG, and GG concepts, Belmonte-Ureña and Plaza-Úbeda (2021) observed that the existing literature does not yet provide a clear understanding of how knowledge of each concept contributes to addressing the challenges embedded within the UN SDGs. None of the bibliometric studies on CRE, DG, and GG have systematically examined how these concepts enhance research on the UN SDGs. One of the few comparative studies available is by Haberl et al. (2020), who compared the relevance of academic literature on GG and DG concerning the reduction of natural resource use and greenhouse gas (GHG) emissions. Haberl et al. (2020) concluded that DG favors reducing resource use and GHG emissions over GDP growth, while GG emphasizes reducing resource use and GHG emissions without altering the growth trajectory.

According to Belmonte-Ureña and Plaza-Úbeda (2021), the persistent disparities in the academic research coverage of SDG priorities may hinder the successful implementation of the UN SD Agenda 2030. They also found that certain approaches are more likely to be adopted by specific stakeholders: CRE by businesses and GG by policymakers, as preferred pathways for contributing to the UN SDGs. Although the agenda promotes collaboration among countries, businesses, experts, and civil society, the reality is that each concept targets different audiences: CRE is designed for businesses, GG focuses on governments, SDGR emphasizes transnational collaboration and civil society, while DG is primarily of interest to the academic community. Future research should prioritize fostering collaboration, exploring synergies between SDGR, CRE, GG, and DG, and addressing the tensions between the theory-driven DG, policy-driven GG, and practitioner-driven CRE approaches.

2.1.3. Key considerations for final evaluation

Bina (2013) highlighted that the UNCSD (2012, Rio+20) was conceived during a period of significant concern for the global economy. The green economy was chosen as one of the conference's two central themes, building on existing literature on Green Economy (GE) and Green Growth (GG). Bina's study aimed to identify what defines and distinguishes the proposals in 24 sources on GE and to explore the significance of the greening agenda for Sustainable Development (SD) in the 21st century. The study examined the relationship between the global economic crisis and the rise of greening as a potential solution. Through systematic qualitative analysis, Bina identified three categories of discourse that explain the concept of greening: *almost business as usual*, *greening* and *all change.* These were analyzed in relation to Dryzek's classification of environmental discourse, revealing three interrelated patterns: (1) scarcity and limits, (2) means and ends, and (3) reductionism and unity. These patterns illustrate the implications of greening for SD, highlighting the economization and polarization of discourses, the persistent weak interpretation of SD, and the tension between fixing or shifting the dominant socioeconomic paradigms underlying its conceptualization.

In evaluating our work, we considered this perspective, categorizing approaches into three levels: (1) a tendency towards business as usual, (2) various levels of change still linked to economic growth and capitalism, often associated with the buzzword *greening* and (3) substantial changes most closely related to alternative concepts. These levels have significant implications not only for human well-being and quality of life but also for survival itself. From our research perspective, it is essential to integrate all the concepts and systems discussed. The future socio-economic-environmental system could take the form of a Circular Economy (CEE), which is why this concept was included in our analysis. The potential for synergies is considerable. The current international agenda, including the UN SD Agenda 2030 and the related SDGs, along with SDGR at the international level, should serve as the foundation for adopting national strategies. These strategies may take the form of GG, GE, or lean towards DG, Natural Harmony (NH), or a Sustainable Economy (SE). Businesses should adopt the relevant form of CRE, supported by institutional frameworks and infrastructure established at both international and national levels.

2.2. Data and methodology

This section outlines the background of the methodology, the indicators used, and the data sources.

2.2.1. Data

Eurostat coordinated the development of the EU SDG indicator set and has been monitoring progress towards the SDGs within the EU context. The indicators from this set serve as the data source for our analysis. They represent relevant SDGs in the EU context and reflect the application of the related or alternative concepts discussed earlier. The EU SDG indicator set comprises 101 indicators structured around the 17 SDGs. Each goal, except SDG 13, is associated with six indicators. Additionally, there are 31 multipurpose indicators that monitor more than one SDG. The indicators are grouped into sub-themes to highlight interlinkages and emphasize different aspects of each SDG.

Based on our review of relevant literature, we selected 28 indicators from the EU SDG indicator set that reflect crucial aspects of Sustainable Development (SD). Some of these indicators also address the additional concepts analyzed in this study, including Circular Economy (CRE), Circular Economy and Environment (CEE), Green Economy/Green Growth (GE/GG), and Degrowth (DG). All selected indicators are detailed in Table 1.

Table 1. The 28 indicators applied in the analysis, source: (Eurostat, 2022)

People at risk of income poverty after social transfers [SDG1] (PIP1); Percentage;	Share of renewable energy in gross final energy consumption by sector; [SDG7] (SRE7); Percentage;	Recycling rate of municipal waste [SDG11] (RR11); Percentage;
Area under organic farming [SDG02] (AOF2); Percentage;	Population unable to keep home adequately warm by poverty status [SDG7] (PUV7); Percentage;	Resource productivity [SDG12] (RP12); PPS per kilogram;
Healthy life years at birth; [SDG03] (HLY3); Year;	Real GDP per capita [SDG8] (GDP8); Chain linked volumes; Percentage change on previous period;	Raw material consumption [SDG12] (RMC12); Tonnes per capita;
Share of people with good or very good perceived health; [SDG03] (SPH3); Percentage; Age class: 16 years or over; Level: very good/good;	Employment rate [SDG8] (GDP8); Percentage of total population; Age class: 20-64 years;	Circular material use rate [SDG12] (CMU12); Percentage;
Life expectancy by age and sex [SDG03] (LE3); Year; Age class: less than 1 year;	Investment share of GDP by institutional sectors [SDG08] (ISP8); Total investment; Percentage;	Net GHG emissions [SDG13] (NG13); Tonnes per capita;
Self-reported unmet need for medical examination and care [SDG3] (SUN3); Percentage; Age class: 16 years or over;	Long-term unemployment rate [SDG8] (LU8); Percentage of population in the labour force; Age class: 15-74 years;	Population reporting occurrence of crime, violence or vandalism in their area by poverty status [SDG16] (PCV16); Percentage
Adult participation in learning by sex [SDG4] (APL4); Percentage; Age class: 25-64 years;	Gross domestic expenditure on R&D [SDG9] (ERD9); all sectors, percentage of GDP;	Corruption Perceptions Index [SDG16] (CPI16); Number;
Tertiary educational attainment by sex [SDG4] (TE4); Percentage; Age class: 25-34 years;	Adjusted gross disposable income of households per capita [SDG10] (AI10); Purchasing power standard (PPS, EU27 from 2020), per inhabit.	Share of environmental taxes in total tax revenues [SDG17] (ET17); Percentage of total revenues from taxes and social contributions (excluding imputed social contributions). Environmental tax revenues – from four types of taxes: energy taxes, transport taxes, pollution and resource taxes;
Inactive population due to caring responsibilities by sex [SDG5] (IPC5); Percentage of population outside the labour force, wanting to work; Age class: 20-64 years;	Income distribution [SDG10] (ID10); Ratio;	
Gender pay gap in unadjusted form [SDG5] (GPG5); Percentage;	Severe housing deprivation rate by poverty status [SDG11] (HD11); Percentage;	

Note 1: First, the official names of indicators are indicated; second, the SDG, to which the indicator belongs, is indicated in the brackets; third, the abbreviations are indicated in the parentheses. For the purpose of simpler orientation, the number of the reflected SDG is added to each abbreviation. Unit of measures or additional parameters of indicators are indicated after these abbreviations.

Note 2: Data are not available: PUV7: IS, UK (2019-20); HD11 and PCV16: IS, UK (2019-20), PL (2020); ET17: UK (all years); PIP1: IS, UK (2019-20); APL4, NG13, GDP8: UK (2020); AOF2: AT, UK (2020), IS (2012, 14, 16, 18); RMC12: IS, NO, UK (all the years) and the data for 2020, except for IT and LU; SRE7: CH (all the years), UK (2020); ISP8: BG (2018-20), IS (2016-20); UK (2020); LE3, TE4: UK (2019-20); GPG5: IE, UK (2019-20), EL (all the years except for 2014 and 2018), HR (2012, 2015); SUN3: IS, UK (2019-20), IT (2020); IPC5: DE, UK (2020), IS (2012, 17, 18); RP12: UK (2020); HLY3: SE (2012), FI (2013), IS, UK (2019-20); SPH3: IS, UK (2019-20); LU8: IS (2012, 16, 19), UK (all years); AI10: BG (2018-20), MT, RO (all the years), IS (2015-20), UK (2020); ER8: UK (all years); RR11: AT, EL, IT (2020), BG, UK, IC (2019-20), IR (2013-14).

The PIP1 indicator measures, in percentage, the proportion of individuals with an equivalised disposable income below the risk-of-poverty threshold, which is set at 60% of the national median equivalised disposable income after social transfers. This indicator is part of the multidimensional poverty index. The AOF2 indicator measures the share of the total utilised agricultural area occupied by organic farming (including both existing organically farmed areas and those in the process of conversion). Farming is recognized as organic if it complies with Council Regulation (EC) No 834/2007 (The Council of the European Union, 2007), which established a comprehensive framework for the organic production of crops and livestock, as well as for the labeling, processing, and marketing of organic products, and the regulation of organic product imports into the EU.

The SPH3 indicator is a subjective measure of how people assess their general health on a scale from very good to very bad. It is expressed as the share of the population aged 16 or over perceiving themselves to be in good or very good health. Indicators of perceived general health have been found to be good predictors of future healthcare use and mortality. Life expectancy (LE) at certain ages represents the mean number of years still to be lived by a person who has reached a certain exact age if subjected throughout the rest of his or her life to the current mortality conditions (age-specific probabilities of dying). It is one of the most frequently used health status indicators. The healthy life years (HLY3) indicator measures the number of remaining years a person of a specific age is expected to live without any severe or moderate health problems. The SUN3 indicator measures the share of the population aged 16 and over reporting unmet needs for medical care due to one or more reasons, including financial constraints, long waiting lists, or distance to healthcare facilities. These three categories are cumulated. The indicator reflects an individual's self-assessment of whether they needed a medical examination or treatment (excluding dental care) but did not receive or seek it. The data for this indicator is derived from the EU Statistics on Income and Living Conditions (EU-SILC). Since the indicator is based on self-reported data, it is influenced by respondents' subjective perceptions, social and cultural backgrounds, and the differing organization of healthcare services across regions. These factors should be taken into account when analyzing and interpreting the data. All four indicators are part of the SDG 3 topic (good health and well-being) in the EU SDG indicator set (see Drastichová and Filzmoser, 2021). While LE is no longer included as the main indicator, it remains a complementary one. Among the four indicators, LE3 clearly refers to the quantitative, objective aspects of life; HLY3 also indicates qualitative, objective aspects, while SPH3 and SUN3 reflect subjective aspects. LE3 does not differentiate whether the additional years of life gained through increased longevity are spent in good or poor health. Therefore, indicators of health expectancies, such as healthy life years (HLY), have been developed. HLY3 focuses on the quality of life spent in good health, rather than merely the quantity of life, as measured by LE3 (Eurostat, 2022). It was considered essential to include all three types of indicators in the analysis related to sustainable development and additional concepts.

The APL4 indicator measures the share of people aged 25 to 64 who reported receiving formal or non-formal education and training in the four weeks preceding the survey. The numerator represents those who participated in such learning activities, while the denominator consists of the total population in the same age group, excluding those who did not respond to the question about participation in education and training. This indicator typically refers to learning activities undertaken after the completion of initial education, encompassing both general and vocational formal and non-formal learning. The TE4 indicator measures the share of the population aged 25–34 who have successfully completed tertiary studies, such as those at a university or higher technical institution. This educational attainment is classified according to the International Standard Classification of Education (ISCED) 2011 levels 5-8 for data from 2014 onwards, and ISCED 1997 levels 5-6 for data up to 2013. Data for both the APL4 and TE4 indicators are sourced from the EU Labour Force Survey (EU-LFS). The IPC5 indicator encompasses individuals who are not working, are not actively seeking work, or are not available to work, and therefore, are classified as outside the labour force. This definition, used in the EU-LFS, aligns with the guidelines of the International Labour Organization (ILO). While there may be multiple reasons why someone is not seeking employment, only the primary reason is considered. Inactivity due to caring responsibilities includes reasons such as looking after children, incapacitated adults, or managing other family or personal responsibilities. The GPG5 indicator measures the gender pay gap, defined as the difference between the average gross hourly earnings of male-paid employees and female-paid employees, expressed as a percentage of the average gross hourly earnings of male-paid employees. The indicator is unadjusted, providing an overall picture of gender inequalities in terms of pay, and encompasses a broader concept than equal pay for equal work. This data includes all employees working in firms with ten or more employees, regardless of age or hours worked. The PUV7 indicator measures the share of the population unable to keep their homes adequately warm. Data for this indicator is collected as part of the EU-SILC to monitor the development of poverty and social inclusion within the EU. The values are self-reported through surveys. The SRE7 indicator measures the share of renewable energy consumption in gross final energy consumption, as defined by the Renewable Energy Directive (The European Parliament and the Council of the EU, 2009). Gross final energy consumption includes energy used by end consumers (final energy consumption), as well as grid losses and the self-consumption of power plants.

The GDP8 indicator represents the ratio of real GDP to the average population of a specific year. GDP measures the value of the total final output of goods and services produced by an economy within a certain period. It includes goods and services that have markets (or could have markets) as well as products produced by the general government and non-profit institutions. It serves as a measure of economic activity and is also used as a proxy for the development of a country's material living standards. However, GDP is a limited measure of economic welfare, as it does not account for most unpaid household work or the negative effects of economic activity, such as environmental degradation. The LU8 indicator measures the share of the economically active population aged 15 to 74 who have been unemployed for 12 months or more. The ERD9 indicator assesses gross domestic expenditure on R&D as a percentage of GDP. The ISP8 indicator represents gross fixed capital formation (GFCF) expressed as a percentage of GDP for the government, business, and household sectors (the total economy). GFCF includes resident producers' acquisitions less disposals of fixed assets, and certain additions to the value of non-produced assets realized by productive activity, such as land improvements. The AI10 indicator reflects the purchasing power of households and their ability to invest in goods and services or save for the future, accounting for taxes, social contributions, and monetary in-kind social benefits. It is calculated as the adjusted gross disposable income of households and non-profit institutions serving households, divided by the purchasing power parities of actual individual consumption of households and by the total resident population. The ID10 indicator measures income inequality by calculating the ratio of total income received by the 20% of the population with the highest income (the top quintile) to that received by the 20% with the lowest income (the bottom quintile). The HD11 indicator represents the percentage of the population living in dwellings that are overcrowded and exhibit at least one of the housing deprivation measures, such as a leaking roof, no bath or shower, no indoor toilet, or a dwelling considered too dark. It is a measure of poor housing amenities.

The RR11 indicator measures the tonnage recycled from municipal waste divided by the total municipal waste generated. Recycling includes material recycling, composting, and anaerobic digestion. Municipal waste consists mostly of household waste but may also include waste generated by small businesses and public institutions that are collected by the municipality. For areas not covered by a municipal waste collection scheme, the amount of waste generated is estimated. The CMU12 indicator measures the share of material recovered and fed back into the economy relative to overall material use. It is defined as the ratio of the circular use of materials to overall material use and reflects the involvement of Circular Economy (CRE) practices in a country. This is a crucial concept for shifting economies towards sustainable development (see, e.g., Kirchherr et al., 2017). Overall material use is the sum of aggregate domestic material consumption (DMC) and the circular use of materials. DMC is defined in economy-wide material flow accounts. CMU is estimated as the amount of waste recycled in domestic recovery plants minus imported waste for recovery, plus exported waste for recovery abroad. A higher CMU rate means that more secondary materials are substituting primary raw materials, thus reducing the environmental impact of extracting primary materials. RP12 is the ratio of GDP to DMC and was previously included in SDG12. Currently, RP is only a supplementary indicator for this goal, as the focus has shifted to RMC, CMU, or the use of waste in general. The RMC12 indicator represents the global demand for the extraction of materials (minerals, metal ores, biomass, and fossil energy materials) induced by the consumption of goods and services within a specific geographical area. Data include domestic extraction of materials, measured in tonnes of gross material, and imports and exports, measured by estimates of the raw material equivalents of the products traded (domestic and foreign extraction required to produce the traded products). RMC thus shows the amount of extraction needed to produce the goods demanded by final users in a given geographical area, irrespective of where in the world the material extraction occurred. Unlike DMC, which is used in CMU and RP, RMC12 is the material footprint indicator.

The NG13 indicator measures total national emissions, including international aviation, of the so-called Kyoto basket of greenhouse gases (GHGs), including carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), and F-gases (hydrofluorocarbons, perfluorocarbons, nitrogen trifluoride (NF3), and sulpfur hexafluoride (SF6)), from all sectors of GHG emission inventories, including international aviation and indirect CO2. The indicator is presented in two forms: net emissions including land use, land-use change, and forestry (LULUCF), as well as excluding LULUCF. These gases are integrated into a single indicator expressed in units of CO2 equivalents, using each gas's individual global warming potential (GWP). The PCV16 indicator shows the share of the population who reported that they face problems related to crime, violence, or vandalism in their local area. This perception is not necessarily based on personal experience. The CPI16 indicator is a composite index that combines surveys and assessments of corruption from 13 different sources to score and rank countries based on how corrupt their public sector is perceived to be, with a score of 0 representing a very high level of corruption and 100 representing a very clean country. The ET17 indicator measures the share of environmental taxes in total revenues from taxes and social contributions. Environmental taxes are those whose tax base is a physical unit (or a proxy for it) of something that has a proven, specific negative impact on the environment (Eurostat, 2022).

2.2.2. Methodology

We selected the method of biclustering because it allows to generate groups of countries combined with groups of indicators. Conventional clustering procedures would just partition either countries or indicators, but not both at the same time. In the first step, the data had to be prepared for the subsequent biclustering procedure. For some

countries, indicators, and years, there have been missing data (in total, about 3% of the values were missing). For biclustering, the R software package *biclustermd* (Li et al., 2020) was used, which internally can handle missings. However, since the data set consists of time series, we preferred to impute the missings outside of this algorithm by using kNN (k nearest neighbour) imputation, implemented as function kNN() in the R package *VIM* (Kowarik and Templ, 2016). This algorithm requires at least one complete observation (country), but for some indicators, several countries had not reported values for the whole period. For these countries and indicators, the imputation was first done for the data of every single year, thus based on the matrices with countries as observations and indicators for a specific year as variables. Then the kNN algorithm could be used for every single indicator.
The next important step in a clustering procedure is data standardization because the values of different indicators are on a different scale. However, it is not desirable to lose changes over time per indicator. Thus, centering and scaling are applied to the observation for every single indicator, but jointly for all years.
In contrast to classical clustering algorithms, biclustering simultaneously partitions the rows and columns of a data matrix according to some similarity measure. Here, the rows are the different countries, and the columns are the indicator/year combinations; thus, in total, 28*9=252 columns. There are various procedures to compute biclusters. Some procedures allow for an overlap of countries and indicators across different biclusters. The algorithm of Li et al. (2020) partitions both the countries and the indicators into non-overlapping groups. The bicluster solutions are different combinations of the country/indicator groups, and they are sorted according to their cluster homogeneity, reported in terms of a Mean Squared Error (MSE) from the cluster center. In practice, one has to cut at a certain number of biclusters, e.g., at a point where the MSE increases above a threshold.

3. Results

Section 3.1 presents the outcomes of the biclustering analysis. A detailed examination of these results in the context of the concepts introduced in subsection 2.1 is provided in Section 3.2. Section 3.3 offers a summary evaluation based on the entire analysis. Unless otherwise specified, any data presented in brackets represent average values over the entire period.

3.1. Results of Biclustering

The results of the biclustering analysis are summarized below, where the initial splits of countries and indicators are presented. These splits do not yet represent the individual clusters. We first assessed the homogeneity of different clusters based on the Mean Squared Error (MSE). The individual clusters were then reported, starting with the cluster that had the lowest MSE.
Table 2a shows the division of countries into groups (C groups), and Table 2b displays the division of indicators into groups (I groups). The combinations of C and I groups form specific clusters, which are listed in Table 4.

Table 2a. The groups of countries: The six C groups created, source: Author's calculations in the R statistical software

C group 1	**C group 2**	**C group 3**	**C group 4**	**C group 5**	**C group 6**
AT, DK, FI, IS, NO, SE, CH	BE, FR, DE, LU, NL, UK	BG, LV, RO	HR, EE, HU, LT, PL, PT, SK	CY, EL, IT, MT, ES	CZ, IE, SL

In addition to the six groups of countries presented in Table 2, ten groups of indicators were constructed, as shown in Table 2b.

Table 2b. The groups of indicators: The ten I groups created, source: Author's calculations in the R statistical software

C group 1	**C group 2**	**C group 3**	**C group 4**	**C group 5**	**C group 6**
AT, DK, FI, IS, NO, SE, CH	BE, FR, DE, LU, NL, UK	BG, LV, RO	HR, EE, HU, LT, PL, PT, SK	CY, EL, IT, MT, ES	CZ, IE, SL

We reported the first 40 clusters and displayed them in Table 4. The first cluster, which includes C group 2 and I group 5, has the lowest MSE. This cluster involves four different indicators: HD11, LU8, PUV7, and SUN3, for various years. As shown in Table 4, I group 5 appears in the first ten clusters three times, indicating that this group of indicators divides the sample into several highly homogeneous C groups. For the LU8 indicator, not all years from the monitored period are included. Cluster 2 involves C group 3 with the APL4 and ERD9 indicators for all years, forming I group 9. The MSE value gradually increases from cluster 1 to cluster 40.

Table 3. The groups of indicators: The ten I groups created, source: Author's calculations in the R statistical software

I group 1: AI10.2015, AI10.2016, AI10.2017, AI10.2018, AI10.2019, AI10.2020, CPI16.2012, CPI16.2013, CPI16.2014, CPI16.2015, CPI16.2016, CPI16.2017, CPI16.2018, CPI16.2019, CPI16.2020, ER8.2012, ER8.2013, ER8.2014, ER8.2015, ER8.2016, ER8.2017, ER8.2018, ER8.2019, ER8.2020, RR11.2012, RR11.2013, RR11.2014, RR11.2015, RR11.2016, RR11.2017, RR11.2018, RR11.2019, RR11.2020, TE4.2016, TE4.2017, TE4.2018, TE4.2019, TE4.2020
I group 2: AOF2.2012, AOF2.2013, AOF2.2014, AOF2.2015, AOF2.2016, AOF2.2017, GDP8.2020, ISP8.2012, ISP8.2013, ISP8.2014, ISP8.2015, ISP8.2016, ISP8.2017, ISP8.2018, ISP8.2019, ISP8.2020, NG13.2012, NG13.2013, NG13.2014, NG13.2015, NG13.2016, NG13.2017, NG13.2018, NG13.2019, NG13.2020, RMC12.2020, SRE7.2012, SRE7.2013, SRE7.2014, SRE7.2015, SRE7.2016, SRE7.2017, SRE7.2018, SRE7.2019, SRE7.2020,
I group 3: ET17.2012, ET17.2013, ET17.2014, ET17.2015, ET17.2016, ET17.2017, ET17.2018, ET17.2019, PIP1.2012, PIP1.2013, PIP1.2014, PIP1.2015, PIP1.2016, PIP1.2017, PIP1.2018, PIP1.2019, PIP1.2020,
I group 4: PCV16.2012, PCV16.2013, PCV16.2014, PCV16.2015, PCV16.2016, PCV16.2017, PCV16.2018, PCV16.2019, PCV16.2020
I group 5: HD11.2012, HD11.2013, HD11.2014, HD11.2015, HD11.2016, HD11.2017, HD11.2018, HD11.2019, HD11.2020, LU8.2016, LU8.2017, LU8.2018, LU8.2019, LU8.2020, PUV7.2012, PUV7.2013, PUV7.2014, PUV7.2015, PUV7.2016, PUV7.2017, PUV7.2018, PUV7.2019, PUV7.2020, SUN3.2012, SUN3.2013, SUN3.2014, SUN3.2015, SUN3.2016, SUN3.2017, SUN3.2018, SUN3.2019, SUN3.2020
I group 6: AI10.2012, AI10.2013, AI10.2014, CMU12.2012, CMU12.2013, CMU12.2014, CMU12.2015, CMU12.2016, CMU12.2017, CMU12.2018, CMU12.2019, CMU12.2020, RP12.2012, RP12.2013, RP12.2014, RP12.2015, RP12.2016, RP12.2017, RP12.2018, RP12.2019, RP12.2020, TE4.2012,
I group 7: ET17.2020, ID10.2012, ID10.2013, ID10.2014, ID10.2015, ID10.2016, ID10.2017, ID10.2018, ID10.2019, ID10.2020, IPC5.2012, IPC5.2013, IPC5.2014, IPC5.2015, IPC5.2016, IPC5.2017, IPC5.2018, IPC5.2019, IPC5.2020, LU8.2012, LU8.2013, LU8.2014, LU8.2015
I group 8: AOF2.2018, AOF2.2019, AOF2.2020, GDP8.2012, GDP8.2013, GDP8.2014, GDP8.2015, GDP8.2016, GDP8.2017, GDP8.2018, GDP8.2019, GPG5.2012, GPG5.2013, GPG5.2014, GPG5.2015, GPG5.2016, GPG5.2017, GPG5.2018, GPG5.2019, GPG5.2020, RMC12.2012, RMC12.2013, RMC12.2014, RMC12.2015, RMC12.2016, RMC12.2017, RMC12.2018, RMC12.2019, TE4.2013, TE4.2014, TE4.2015,
I group 9: APL4.2012, APL4.2013, APL4.2014, APL4.2015, APL4.2016, APL4.2017, APL4.2018, APL4.2019, APL4.2020, ERD9.2012, ERD9.2013, ERD9.2014, ERD9.2015, ERD9.2016, ERD9.2017, ERD9.2018, ERD9.2019, ERD9.2020
I group 10: HLY3.2012, HLY3.2013, HLY3.2014, HLY3.2015, HLY3.2016, HLY3.2017, HLY3.2018, HLY3.2019, HLY3.2020, LE3.2012, LE3.2013, LE3.2014, LE3.2015, LE3.2016, LE3.2017, LE3.2018, LE3.2019, LE3.2020, SPH3.2012, SPH3.2013, SPH3.2014, SPH3.2015, SPH3.2016, SPH3.2017, SPH3.2018, SPH3.2019, SPH3.2020

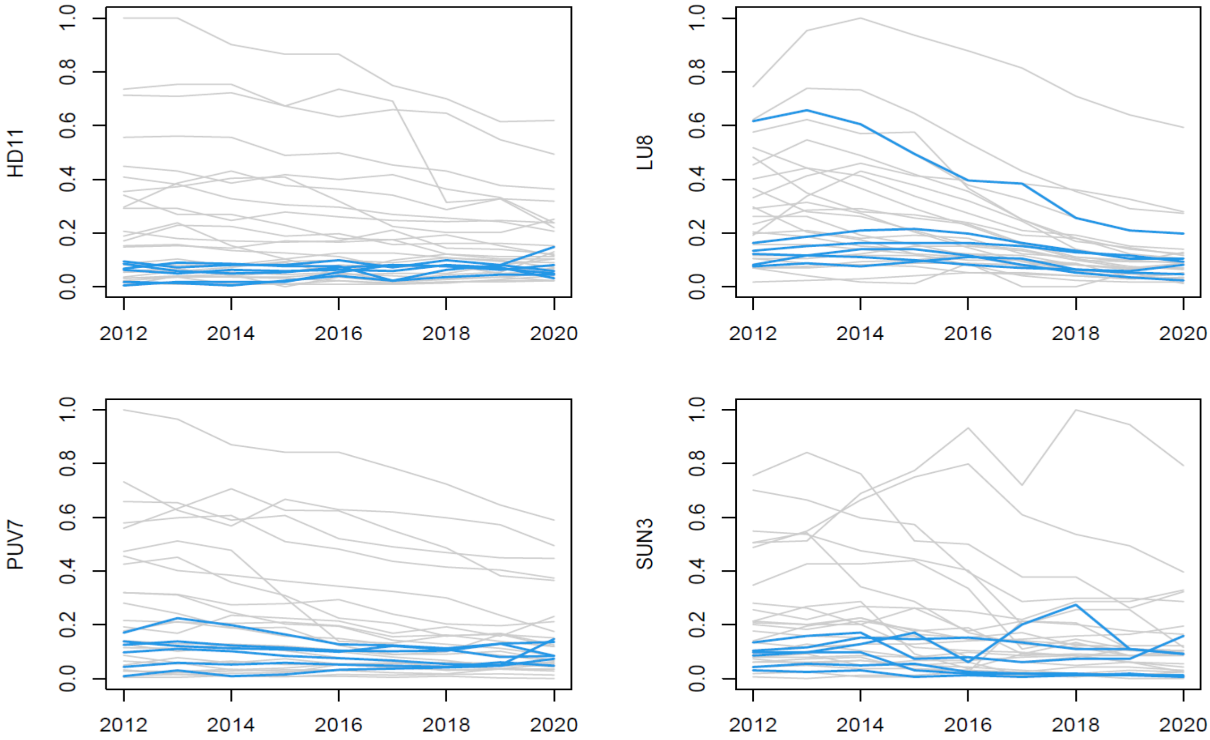
Note: The abbreviations of indicators from Table 1 were used, with the years of indicator data also included.

Table 4: The 40 reported clusters: Combinations of the C groups (Table 2) and the I groups (Table 3), source: Author's calculations in the R statistical software

Cluster 1: C group 2 (BE, FR, DE, LU, NL, UK)/I group 5; **Cluster 2:** C group 3 (BG, LV, RO): I group 9; **Cluster 3:** C group 1 (AT, DK, FI, IS, NO, SE, CH)/ I group 5; **Cluster 4:** C group 6 (CZ, IE, SL)/I group 5**; Cluster 5:** C group 6 (CZ, IE, SL)/ I group 4; **Cluster 6:** C group 5 (CY, EL, IT, MT, ES)/I group 9; **Cluster 7:** C group 2 (BE, FR, DE, LU, NL,UK)/I group 2; **Cluster 8:** C group 5 (CY, EL, IT, MT, ES)/: I group 2; **Cluster 9:** C group 2 (BE, FR, DE, LU, NL,UK))/I group 4; **Cluster 10:** C group 4 (HR, EE, HU, LT, PL, PT, SK) /I group 2
Cluster 11: C group 5/ I group 4; **Cluster 12:** C group 4/ I group 6; **Cluster 13:** C group 1/ I group 7; **Cluster 14:** C group 4/ I group 9; **Cluster 15:** C group 3/ I group 6; **Cluster 16:** group 3/ I group 2; **Cluster 17:** group 5/ I group 10; **Cluster 18:** group 4/ I group 4; **Cluster 19:** group 1/I group 3; **Cluster 20:** C group 6/ I group 6
Cluster 21: C group 6/ I group 9; **Cluster 22:** C group 3/ I group 3; **Cluster 23:** C group 2/ I group 1; **Cluster 24:** C group 2/ I group 10; **Cluster 25:** C group 1/ I group 4; **Cluster 26:** C group 6/ I group 2; **Cluster 27**: C group 1/ I group 8; **Cluster 28:** C group 2/ I group 7; **Cluster 29:** C group 1/ I group 1; **Cluster 30:** C group 4/I group 10; **Cluster 31:** C group 4/ I group 3; **Cluster 32:** C group 5/ I group 8; **Cluster 33:** C group 4/ I group 1; **Cluster 34:** C group 3/ I group 8; **Cluster 35:** C group 6/ I group 1; **Cluster 36**: C group 1/ I group 9; **Cluster 37:** C group 6/ I group 7; **Cluster 38:** C group 4/ I group 8; **Cluster 39:** C group 5/ I group 3; **Cluster 40:** C group 2/ I group 6

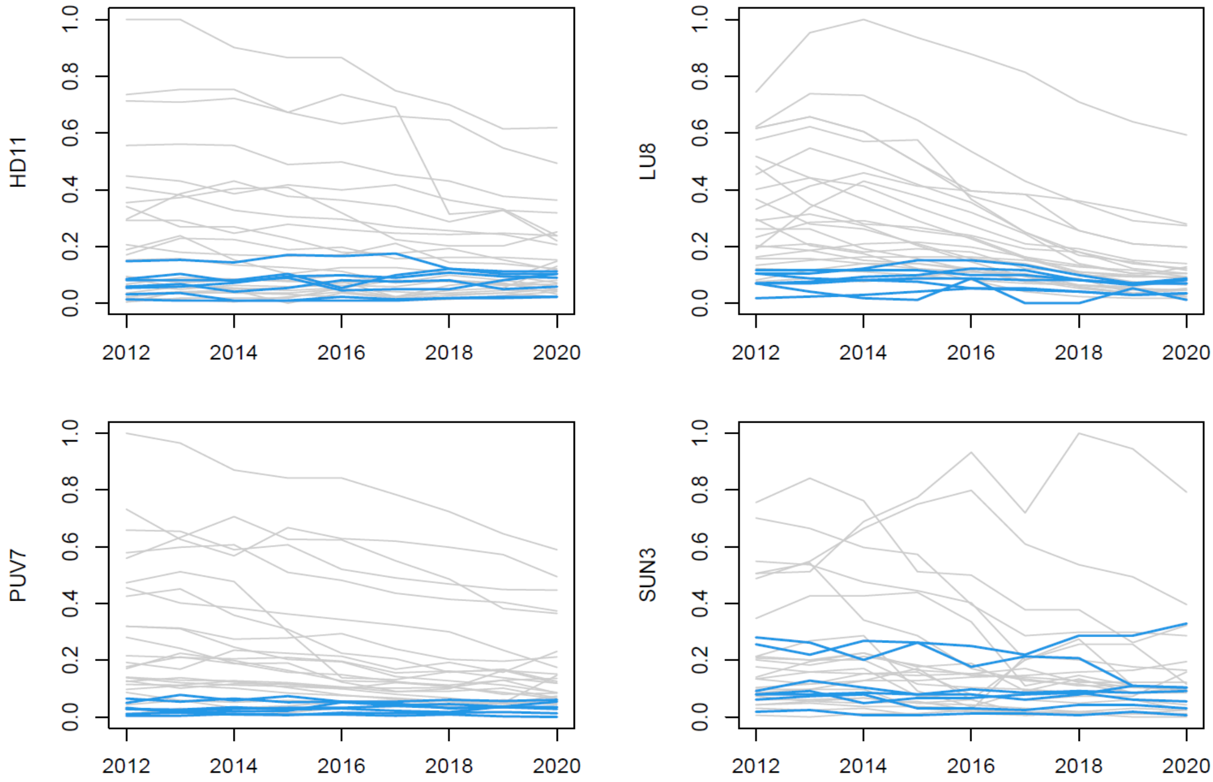
The I group 5 includes four indicators (see Table 3). The HD11 indicator showed low values across many countries in C groups 1 and 2. However, higher values were observed in some countries, particularly Austria, France, and, more recently, Denmark and Sweden, which experienced notable increases. The PUV7 values were generally low in C group 1 countries, although Denmark and Sweden had higher values in 2020 compared to the rest of the group. In C group 2, PUV7 values were higher in the UK, France, Belgium (especially in the more recent period), and, in the last year, also in Germany. For the LU8 indicator, both C groups often exhibited low values, with C group 1 countries showing some of the lowest values. In the more recent period, only Iceland, Denmark, and Norway had the lowest values in the sample. C group 2 displayed high variability in LU8 values, with most countries showing lower values, while Belgium and France had higher values. The LU8 indicator has been included since 2016, a time when higher variability was already apparent in C group 1. The SUN13 indicator showed more diverse values. Although lower values predominated in both groups, countries like Finland and Iceland in C group

Figure 1. Cluster 1: C group 2 (BE, FR, DE, LU, NL, UK) / I group 5, source: Author's calculations in the R statistical software



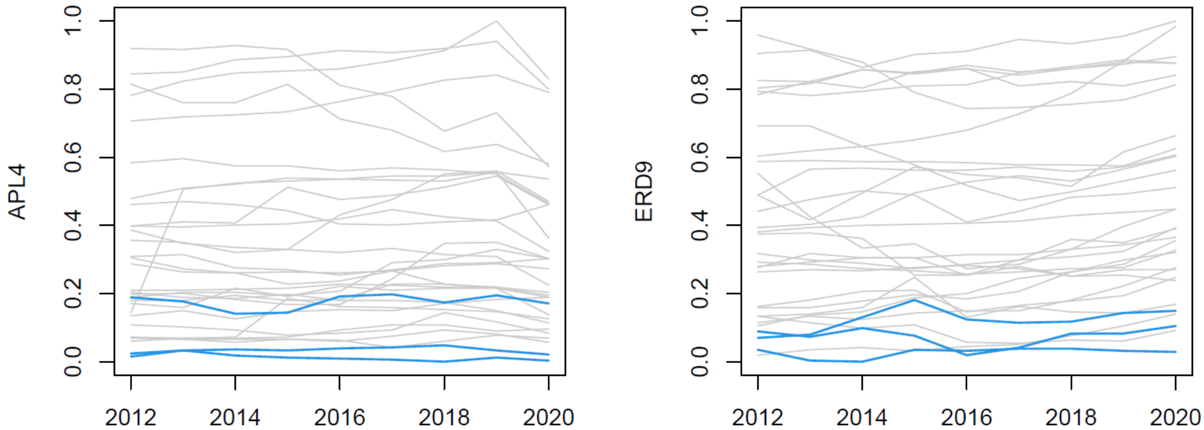
1 (both among the highest values in the sample) and France, the UK (especially from 2014), and Belgium in C group 2 exhibited higher values. In relative terms, recent data from 2020 indicated higher values in Denmark and Sweden (e.g., AT, CH, and NO had values below 1%; SE and DK had values of 1.5% and 1.7%, respectively; FI had 5.4%).

Figure 2: Cluster 3: C group 1 (AT, DK, FI, IS, NO, SE, CH) / I group 5, source: Author's calculations in the R statistical software



Overall, the indicators of severe housing deprivation (HD11), population unable to keep their home adequately warm (PUV7), long-term unemployment rate (LU8), and self-reported unmet need for medical examination and care (SUN3) generally show lower values, indicating that these groups have the best average results. However, specific countries performed poorly on certain indicators (see above and the analysis in subsection 3.2).
The indicators APL4 (adult participation in learning) and ERD9 (gross domestic expenditure on R&D) are the only indicators in C group 9, and they have been included for all years. Cluster 2, which combines C group 3 with I group 9, exhibited the lowest MSE among the top 40 clusters. However, the values for these countries are generally low, indicating poor performance in terms of sustainability and sustainable development (SD). Specifically, Latvia and Bulgaria had slightly higher values in APL4 and ERD9, respectively, but the other countries in this cluster had the lowest values in the sample. In contrast, the highest performance was observed in C groups 1 and 2. For APL4, C group 1 achieved the highest performance, followed by C group 2, though some countries in the latter group had lower performance. For ERD9, countries from both groups appear in the top rankings, with Luxembourg showing relatively lower performance.

Figure 3. Cluster 2: C group 3 (BG, LV, RO) / I group 9, Source: Author's calculations in the R statistical software



Although the first three clusters with the lowest MSE were described in detail, further analysis of various combinations of C groups and I groups, and thus clusters, is conducted in the next section to evaluate their alignment with particular (more practical, alternative, or comprehensive) concepts.

3.2. Assignment of countries (clusters) to the selected concepts

Initially, efforts were made to assign a score to each SDG indicator based on its contribution to each of the six selected concepts (see Table 5). However, this approach was found to be subjective in several cases, due to differing views on the relationships between the selected SDG indicators and concepts, or because these relationships are not yet fully understood. Instead of the original method of evaluating each SDG indicator's contribution to each concept, the assessment was shifted to evaluating the group of indicators – that is, the combinations of indicators present in the clusters – from this perspective. This evaluation is inherently more subjective, as the contribution of each combination of indicators to a particular concept can be challenging to determine. Additionally, some countries may not always have values for certain indicators that are comparable to others in their C group. Consequently, the final assessment encompasses a broader range of factors than what would be derived from Table 5 alone, incorporating various aspects when drawing conclusions. Table 6 supplements Table 5 by showing the combinations of indicator groups that best align with each concept. A '+' added next to the number of points in Table 5 indicates that the corresponding combination of indicators fits particularly well with the specified concept.

Table 5. Assignment of points (0 – 5+) to the indicators based on their relevance to the six concepts applied, source: Author's elaboration

	SD	GG	GE	CRE	DG	CEE		SD	GG	GE	CRE	DG	CEE
I group 1	5	4	4	4	4	5	I group 6	5	4	4	5	4	4
I group 2	5	**5+**	**5+**	**5+**	3	4	I group 7	5	4	1	1	4	5
I group 3	5	3	3	3	4	4	I group 8	**5+**	4	4	4	4	4
I group 4	5	0	1	0	2	5	I group 9	5	2	2	0	1	1
I group 5	5	1	1	1	5	5+	I group 10	5	0	0	0	3	**5+**

Note: A '+' behind the number of points indicates that the relevant combination of indicators most perfectly fits with the particular concept.

All indicators included in this analysis are part of the EU SDG indicator set, making them relevant to achieving the goals of the current global agenda for sustainable development (SD). These indicators are also specifically tailored for EU countries. Consequently, each group of indicators is assigned 5 points for their relevance to the SD concept. However, I group 8 (see Table 2) is particularly well-suited to the SD concept, as it includes indicators covering the economic, social, and environmental pillars of SD, though it does not include the institutional pillar. The combination of indicators in I groups 1 and 2 also aligns well with the SD concept and plays a crucial role in advancing toward SD. Despite this, all groups are relevant to progressing toward SD, even though not all are equally relevant to the other concepts. In the following part of this section, the ten I groups are analyzed in more detail in relation to the values achieved in the six C groups, as well as in relation to the six selected concepts.

Table 6. Assignment of points (0 – 5+) to the groups of indicators based on their relevance to the six concepts applied, source: Author's own elaboration

Concept	Group of indicators	Concept	Group of indicators	Concept	Group of indicators
SD	1 + 2 + 3 + 4 + 6 + 7 + 8 + 9 + 10	GE	2 + 6	DG	2 + 3 + 5+ 7 + 8
GG	2 + 6	CRE	2 + 6 + 8	CEE	2 + 3 + 4 + 5 + 7 + 10

I group 4, which includes only the PVC16 indicator across all the monitored years, reflects a subjective measure of safety, an important factor in quality of life (see more in Drastichová and Filzmoser (2021)). This indicator is significant for sustainable development (SD) in general, but it plays a crucial role in the Compassionate Economy (CEE). Throughout the analyzed years, Bulgaria, the Netherlands, and the UK consistently exhibited among the highest values for PVC16, while Iceland, Croatia, Norway, and Lithuania had some of the lowest values (with NL and UK; IS and NO; HR and LT being in common groups of countries). Clusters 5, 9, 11, 18, and 25 demonstrate similarities for I group 4, with the highest similarities typically seen in C group 5. In cluster 5, which involves C group 6, medium values predominated. During the period 2012–2017, Slovenia had the lowest values (e.g., 8.1% in 2012), while Czechia had the highest values until 2016 (e.g., 11.7% in 2016). Since 2017, Ireland has shown the highest values, while Czechia has had the lowest values since 2018 (e.g., 6.1% in 2020). The average values for these two countries are around the sample average, with Slovenia's average being slightly lower. In C group 2, which forms cluster 9 with this indicator group, values are among the highest (except for Germany in the first and last years and Luxembourg in 2013, all in relative terms). Germany and Luxembourg often exhibit the lowest values (with the lowest average values, respectively), while the UK and the Netherlands frequently exhibit the highest values (with the highest average values, respectively). The values in these two clusters, which show the highest similarities, suggest relatively poorer outcomes concerning quality of life, SD, and the Compassionate Economy (CEE). In contrast, cluster 25, where countries have the lowest similarities in C group 1, includes several high-performing countries. Apart from three countries with higher values in certain years – Sweden (especially from 2016 onwards), Switzerland (especially until 2017), and Austria (especially 2014–17), which have higher average values in that order – the remaining Northern countries show low values, with Iceland having the lowest average value in the sample. Although C group 3 was not included in the first 40 clusters, Bulgaria consistently had the highest values, even though these decreased significantly over the monitored period. Latvia and Romania also saw significant decreases from high values, with lower values in the most recent period (e.g., 5.3% in 2020 for Latvia, the sixth lowest in the sample). C group 4, which includes the new member countries and one Southern country (Portugal), forming cluster 9, is notable for its prevailing very low values (especially since 2015). In contrast, cluster 11, which contains the remaining Southern countries (I group 5), generally shows higher values, particularly in the more recent period.

The internalizing of externalities by means of ecological taxes is encouraged by GE/GG, CE, CEE, and also non-growth economics (e.g., ecological tax reform in the form of imposing tax on a base that is to be reduced, such as pollution and resource depletion, as a way of internalizing externalities and raising revenues, as well as subsidies to discourage negative and encourage positive externalities). It is generally supported by neoclassical environmental economics (NEE) and, therefore, also anchored within the SD concept (Beeks, 2016). More generally, such a form of taxation can play a role in all the concepts analysed, in both those based on NEE, or the system of capitalism (supporting economic growth), including GE/GG, CE, and SD in general, and alternative systems, including DG and the more comprehensive system of CEE. Since DG economists support anti-consumerism, social equity across the globe, and the limiting of human impact on natural systems (Martínez-Alier et al., 2010), group 3 also seems relevant to DG. Concerning the ET17 indicator included, the preferred form of taxation (or more generally, economic instruments of environmental policy) can differ between the concepts. Nevertheless, the aim of sustaining ecosystems to maintain life on the planet is crucial. Since the highest similarities are associated with cluster 19 and subsequently with clusters 22, 31, and 39, these similarities are generally low. The I group 3 was not explicitly assigned to GE, GG, and CE (see Table 6), since the ET17 indicator is grouped with PIP1, which substantially reflects the social dimension. However, all aspects are considered to derive final conclusions. Cluster 19 is a combination of the I group 3 and the C group 1. In most C group 1 countries, the ET17 values are low (which might seem surprising in these highly developed countries), as are the PIP values. Nevertheless, since relative values are used, in welfare states, the shares of other taxes, including income tax, can be higher in comparison to these taxes. The major exception for ET17 is Denmark, although its values significantly decreased (but are still the highest in this group, followed by Finland in each year; the remaining countries have significantly lower values). For the PIP1 indicator, the higher values are typical of Sweden, Switzerland (slightly lower, except for 2012), and also Austria. On the contrary, in cluster 22 containing C group 3, the ET17 values are high, especially in Latvia and Bulgaria (the highest and the third highest average value in the sample, respectively; in the last two years, the values of Bulgaria surpassed the highest values in the sample achieved by Latvia). The values in Romania have been relatively high in the last two years (although only a slight increase occurred; the ET17 values decreased in 24 countries over the monitored period). On the contrary, these countries have among the highest PIP1 values in the sample. Romania had the highest values until 2019, and in the last monitored year, it was surpassed by Bulgaria (the highest average values: RO, BG, and LV, respectively).

I group 2 contains crucial indicators of the environmental dimension of SD, including those that reflect resource productivity, quality of agricultural and energy production, aspects of the global problem of climate change (GHG emissions), as well as the overall product of the economy and investment. This group was therefore assigned as crucial to all the concepts included (see Table 5 and learn more about the relationships between the concepts and SDG indicators in Belmonte-Ureña and Plaza-Úbeda, 2021). All the indicators included in this group, which reflect the environmental dimension of sustainability, are also important for CEE. Most notably, regarding the SRE7 indicator, Schumacher (2011) emphasized that an economy reliant on non-renewable resources, or one that does not distinguish between renewable and non-renewable resources, is both exploitative and parasitic. Additionally, the aspects related to climate change and the NG13 indicator are matters of significant concern. The clusters created with this I group include clusters 7, 8, 10, 16, and 26. Thus, this I group plays a crucial role both due to its composition, involving key indicators relevant to all the concepts, and due to the relatively high similarities that appear in the relevant C groups when compared to the remaining I groups. The AOF values (included in this I group until 2017) are the highest in Austria in each year (over 20% since 2015 and consistently increasing except for 2013), followed by Sweden and Estonia (until 2016, after which they interchange their positions), Czechia, and Switzerland until 2015. Their order interchanges in the following years, also involving Italy and Latvia, all of which had the highest average values. Estonia and Austria also achieved the highest increases over the monitored period. The values are the lowest in smaller economies such as Malta, Iceland (below 1%), Ireland (over 1%), two C group 3 countries (BG, RO), and other countries from all the groups, including the UK (over 2% since 2015, with over 3% until 2014), the Netherlands, Hungary, Luxembourg, Poland, Cyprus, and Norway. Hence, it is difficult to assess the tendency towards the concepts for the entire C group based on this indicator. However, it emerges from the analysis that the highest number of C group 1 countries have higher values. In I group 2, only RMC12 and GDP growth rates (GDP8) in 2020 are included, with the values for the second indicator differing significantly from previous years. Except for Ireland, a drop occurred in the remaining countries. The highest drops in 2020 were typical of the C group 5 countries, and the lowest ones occurred in the C group 1 countries (except for IS and AT). However, no significant similarities are visible in the C group 2 countries (the highest drops in France, followed by Belgium) and C group 4 countries (the highest drops: PT, HR; the lowest drops: LT, PL). In C group 3, the similarities are higher, with all countries decreasing below 3%. In C group 6, the similarities are low, with higher drops in Czechia (-5.8%) and Slovenia (-4.9%). For RMC12, only the values for Luxembourg (high) and Italy (low) are available, and hence, this indicator is evaluated in terms of I group 8.

For the NG13 indicator, the similarities are most visible in C group 2 (relatively high values) and in C group 4 (relatively low values), as expected based on the analysis. The main exceptions are France (with lower values) in C group 2, and Estonia (among the highest values) and Poland (with higher values) in C group 4. C group 5 should also display higher similarities, but the values vary more significantly, with the highest values predominantly in Cyprus (among the highest in the sample, especially in the more recent period), followed by Greece, while the remaining three countries show lower values. The highest values are generally typical of almost all small economies, except for Malta, which had among the lowest values (though higher values were seen until 2014; for the entire sample, the highest average values were in IS, LU, IR, EE, CZ, NL; the lowest average values were in SE, RO, LT, HR, LV). For the ISP8 indicator, the values are among the lowest for C group 5. However, Malta exhibited significantly higher values in 2015 and 2016 (with a sharp increase in 2015). The values are predominantly high in C group 1 (with lower values in IS and DK). C group 6 had a wide variation of values. Ireland showed the highest increase in the sample, achieving among the highest values since 2015 and the highest since 2016. Czechia also maintained high values throughout the period. Consequently, the differences were particularly pronounced until 2014, when the remaining two countries had lower values, which continued to be the case for Slovenia throughout the entire period. In C groups 3 and 4, the differences were also notable (EE: among the highest values in the sample, the highest until 2014; PT: among the lowest; PL: among the lowest since 2016). In C group 3, Bulgaria had lower values, but Romania had among the highest values in the sample until 2015. However, the highest drop in the sample occurred in this country. In Latvia, which had among the highest values until 2014, the fifth highest decrease was observed.

The clearest division of countries into particular C clusters is evident for the SRE7 indicator, with C group 2 showing among the lowest values but with higher values in Germany and France (both above 13% in 2012 and above 19% in 2020). The highest values are typical of C group 1 (the absolutely highest values: IS (over 70% and in 2020 even 83.725%); NO (over 60% and since 2017 over 70%); SE (49.403% in 2012, then over 50%, 60.124% in 2020); the lowest values in this group: DK (25.465% in 2012, then increasing over 30% from 2015, with a maximum in 2019 (37.02%) and in 2020: 31.681%)). In C group 5, the values are rather medium (IT, ES, and EL, with increases in all of them to values over 21% (EL, ES) and 20% (IT)) and lower (CY: the third highest increase in the sample; MT: the second lowest average value in the sample, but with a significant increase from 2.862% in 2012 to 10.714% in 2020). In C group 4, four countries have higher values (PT, EE, HR, and LT) and three countries have lower values (PL, SK, and HU). In C group 3, the values are higher in Latvia and lower in Romania and Bulgaria, with values close to one C group 6 country, i.e., Slovenia (2012: 21.551; 2020: 25%). The remaining two C group 6 countries, Czechia and Ireland (the lowest values in this group), have even lower values and are not similar to one another. Thus, the similarities in this group are among the lowest. Since this indicator is crucial for all the concepts analyzed and is of particular interest due to the current energy crisis, C group 1 is evaluated as the best and C group 2 as the worst performing group, while individual differences are considered. It is an interesting result since both groups contain the more and most developed countries.

I group 8 is included in clusters 27, 32, 34, and 38. Therefore, C group 1, which is part of cluster 27, should exhibit the highest similarities, but overall, these similarities are lower. The other clusters include C groups 5, 3, and 4. For the TE4 indicator, three values are included (2013–2015). During this period, the values in C group 1 are particularly high in Norway (consistently high each year), Sweden, and Switzerland, with slightly lower values in Denmark. High performance is thus typical of most C group 1 and C group 2 countries, with notable exceptions in Germany and Austria, although Austria achieved the highest increase in the sample. This indicator generally shows lower values in some C group 4 countries, with the main exceptions being Lithuania and Poland, although Poland's values are relatively lower. Additionally, two C group 3 countries – Bulgaria and Romania – also display low values.

Across various C groups, several countries exhibit either high or low TE4 values. The countries with the highest average values are Cyprus (CY), Ireland (IE), Lithuania (LT), and Luxembourg (LU), with these countries interchanging their positions over the period. Conversely, the lowest TE4 values in the sample were found in Romania (RO), Italy (IT), Hungary (HU), Bulgaria (BG), and Czechia (CZ), with values ranging from 24.9% in Romania to 33% in Czechia in 2020. Due to these variations, C groups 3 and 6 display high dissimilarities, with Bulgaria, Romania, and Czechia showing among the lowest values, while Ireland exhibits among the highest, and Slovenia and Latvia have medium values following significant increases. Germany's values are relatively low, while Austria's values have been higher since 2014, having previously been among the lowest. This shift could affect the assignment of particular years to these groups for this indicator. Countries from C group 1 have become more similar to each other since 2014, while C group 2 shows increasing dissimilarity, particularly as Germany becomes more distinct from the rest of the group, which generally exhibits high values. This is reflected in C group 1 being included in cluster 27, which has the lowest number in the order, while C group 2 does not appear in the first 40 clusters for this I group.

RMC12 is a crucial indicator, reflecting the level of dematerialization of economies, making it essential for all concepts and the future of humanity. C group 1 countries again exhibit the highest values and the greatest similarities, with Switzerland showing the lowest values (around 17 t per capita) and Finland the highest in the sample (over 30 t and 29.5 t in 2019). Data for Norway (NO) and Iceland (IS) are not available. In C group 2, which also includes developed countries, significant dissimilarities exist, with the Netherlands (NL) showing the lowest values in the sample (over 7 t, 8.224 t in 2012) and Luxembourg the highest (the second-highest average value in the sample at 29.5301 t), surpassing Finland in 2015 and 2017. Lower values generally prevail in some C group 5 and 4 countries, although there are many exceptions, including Cyprus (CY), which recorded 21.071 t in 2012 and 23.159 t in 2019, Malta (MT) with values above 17 t per capita in the last two years after a significant increase in 2018, and Estonia (EE) with the third-highest average value in the sample at 26.4 t. Higher values are also observed in Lithuania, Poland, and Portugal (PT). In C group 3, lower values are typical in Latvia, while higher values are observed in the other two countries. Among C group 6 countries, there have been notable changes, with Ireland experiencing a significant increase, Czechia a slight increase, and Slovenia a decrease in value (2012: Czechia and Slovenia above 15 t, Ireland 14.462 t per capita; 2019: Ireland 24.133 t, Czechia 17.547 t, Slovenia 15.358 t per capita). Therefore, it can be concluded that for this indicator, not only the stage of development but also structural features, natural endowment, and various other aspects of the economy are crucial.

The highest GDP growth rates (GDP8) are typical of the C group 3 and 4 countries, with exceptions such as Portugal and Croatia until 2014. However, the situation changed significantly in 2020 due to the pandemic. In that year, most C group 1 countries, except for Austria and Iceland, experienced among the lowest decreases, alongside Lithuania (which had the lowest decrease at -0.2%) and Poland (-2.1%) from C group 4. The values of GDP8 in this year, representing an extraordinary development, are assigned to I group 2. Although many decreases also occurred in 2012 in C group 1, 3, and 4, the situation was less serious again (slight drops only in Finland, Sweden, and Denmark; positive growth rates in Lithuania, Estonia, Poland, and Slovakia; decreases in all three C group 6 countries and C group 5 countries, except for Malta). Predominantly lower GDP growth rates were exhibited by C group 1 countries, reflecting their high level of development, with Iceland as an exception. However, the growth rates in smaller economies tend to be more variable, a trend that applies to all of them.

As regards the remaining indicators, they both reflect the social dimension. For the GPG5 indicator, the values are medium or higher in C group 1 countries, with the lowest ones in two Northern countries (the lowest/highest value in this group in each year: Sweden (2013-2020), Norway (2012)/Austria (each year); Switzerland and Finland – also relatively high values; Iceland – high especially until 2017, with a significant drop over the monitored period). Hence, the similarities are low. There are even higher dissimilarities in the remaining groups. In C group 2, the lowest values were in Luxembourg (the lowest in the sample since 2015; the lowest average value in 2020: 0.7%), followed by Belgium (2012/2020: 8.3/5.3%). The highest values were in Germany (among the highest in the sample; 2012: 22.7; 2020: 18.3%), followed by the UK (with a higher value than in Germany in 2017). In C group 4, Estonia had among the highest values (the highest value in the sample, except for 2020, when it was surpassed by Latvia with 22.3 and 21.1% in 2020, respectively), and Poland among the lowest (the fifth average value in the sample of 6.9%). In C group 3, Romania had the lowest values, and Latvia the highest, except for 2012 when Bulgaria had the highest values. After the highest increase over the monitored period (7.4 percentage points), Latvia reached the highest value in 2020. In C group 6, there are significant dissimilarities, with the highest values in Czechia (2012/2020: 22.5/16.4%) and the lowest in Slovenia (the lowest value in the sample in 2012: 4.5%; the third-lowest value in 2020: 3.1%). In C group 5, the values are predominantly lower, and the similarities are higher, with the lowest values in Italy each year (2020: 4.2%) and the highest in Spain or Malta. Since the variances in the groups are high, even more visible than C group countries are individual countries that have high both TE4 and GPG5 values (the UK), low both values (Italy, Malta, Romania), high GPG5 and low TE4 (Austria, Czechia), or higher TE4 and low GPG5 values (Sweden, Luxembourg, Belgium, Ireland, Poland, Cyprus). The last group is then the best-performing, and the last but one is the worst-performing group. Although C group 1 countries predominantly have higher values of both indicators, and C group 5 countries have lower values, there are many exceptions. It may be concluded that a high level of tertiary education does not automatically mean equal work opportunities for men and women, and the most developed C group 1 does not exhibit high performance as a whole in the combination of these indicators. C group 1 also has higher values of AOF12, although the values are more diverse again. The values of the GDP8 indicator are diverse, and lower values prevail, except for 2020, which was assigned to I group 2. C group 1 countries exhibiting high performance in many variables predominantly show lower GDP growth rates since they are highly developed, except for Iceland.

I group 10 is fully related to the social dimension, particularly to aspects of health and, therefore, to the quality of life to the highest extent. It is of crucial importance for CEE but also for SD in general. As explained in subsection 2.2.1, this group consists of three indicators related to health status and quality of healthcare: one objective quantitative indicator (LE3), one objective qualitative indicator (HLY3), and one subjective indicator (SPH3) (see also Table 3). As also indicated, all three indicators are included in the SDG 3 topic of the EU SDG indicator set (see more in Drastichová and Filzmoser, 2021). Three clusters combining the C groups with I group 10 include cluster 17 (C group 5), cluster 24 (C group 2), and cluster 30 (C group 4) (see Table 4). A clear grouping of countries according to the C groups is visible for the LE indicator, with relatively high values in C group 1 (except for Denmark; in 2020, Austria had the lowest value in this group since Denmark exhibited a high and Austria a very low rise over the monitored period) and C group 5 (the lowest values in Greece each year). C group 4 countries show relatively low values (with the highest values in Portugal each year, closer to C group 5 countries in this indicator) and the lowest ones in Lithuania (2019: Hungary), and two C group 6 countries (Czechia and Slovenia; those of Ireland are higher – the fourth highest value in 2020 of 82.6, following Norway, Switzerland, and Iceland). The lowest values are in C group 3 countries (along with Lithuania) and diverse values in C group 2 countries (the highest/lowest: France, Luxembourg (2015-16)/Germany, Belgium (2012, 2020)).

For HLY3, the grouping is not that visible. All C group 5 countries have high/lower values (the highest/lowest average value: Malta/Cyprus; Malta: the highest or second-highest value in the sample, following Sweden; Italy: the lowest values in 2012–15; Greece has the lowest values in 2016–17; and Cyprus has the lowest values in subsequent years). In C group 1, only Norway, Iceland (the second-highest average value), and Sweden (the highest values since 2018, over 72 years) have among the highest values in the sample (Iceland: in 2017 and 2018, the values are lower, and in the following years, they are not available). Finland and Austria had among the lowest values in the sample, and in the majority of the years, Denmark and Switzerland had low values as well, while significant decreases occurred in the monitored period. It took place in almost all these countries, except for Sweden and Finland (a relatively high and low increase, respectively), while Iceland experienced the highest drop in the sample. Relatively low/high values are also typical of C group 4/2, respectively (the highest/lowest values in C group 4 are: Poland (each year), Portugal (2012–13), Hungary (since 2017)/Slovakia, Estonia). However, in C group 2, the results are not straightforward. Although the average values are close to one another (the highest/lowest: Belgium/Netherlands), there are high variances of values in particular years, as well as significant changes between them (Germany: the lowest values in 2012–14, the highest values in the remaining years (the second-highest increase in the sample); the lowest values in Luxembourg (2016–17), Netherlands in the remaining years; high values also in the UK (until 2017), Belgium, France). In C groups 3 and 6, great dissimilarities exist (the lowest value in the sample: Latvia; lower values: Slovenia, Romania; medium values: Czechia; high values: Bulgaria; among the highest values in the sample: Ireland). However, Slovenia achieved the highest increase in the sample and surpassed Czechia in 2020, while the value in Ireland slightly declined, resulting in higher similarities. For SPH3, the highest values are in C group 1 (with lower values in Finland, but also Austria (the lowest values in 2015–16) and Denmark (in a relative expression, especially since 2017)), and the lowest in C group 4 (the lowest value in the sample: Lithuania (except for 2013: Latvia); Slovakia – the highest values in the group). Dissimilarities are visible in C groups 3 and 6 again (Bulgaria, Romania – higher values (higher in Romania), Czechia, and Slovenia—lower values), while Ireland has the highest values in the sample each year and Latvia the second-lowest (2013: the lowest). Achieving a high increase, Slovenia surpassed Bulgaria in 2020. Higher differences are also present in C group 2, with the Benelux countries and the UK predominantly having higher values (the highest: Netherlands), and France and Germany around or below the average (Germany: the lowest value in this group, only in the last two years: the values above the average of the sample). C group 5 also contains countries with predominantly high values, except for Italy, apart from 2017, when it exhibited a high value (the highest value: Cyprus, but in the last two years: Greece (the lowest value in 2017)).

Since some SDGs are closer to DG, such as SDG 10 (reduced inequality), SDG 2 (zero hunger), and SDG 5 (gender equality), as analyzed by Belmonte-Ureña and Plaza-Úbeda (2021), I group 7 should be significantly related to the concept of DG while assessing the presence of the LU8 indicator carefully. It is also taken into account that the ET17 indicator supports the environmental dimension of SD, which has certainly played a crucial role in this concept as well, although this instrument of environmental policy does not have to be assessed as a crucial tool by all its proponents. Hence, I group 7, containing crucial indicators of the economic and social dimension, is of great importance not only for the SD concept but even more for both DG and CE economies. The level of inequality in income (ID10) is key to these concepts; LU8 complements IPC5. A high value of IPC5 can reduce LU8. As explained in subsection 2.1, both DG and CEE concepts deal with these issues and criticize current labor market systems, while care work should be valued more. Those carrying out this work are predominantly regarded as an inactive population. Along with these indicators, ET17 in 2020 is included. It helps reduce the environmental burden (analyzed above, in terms of I group 3, where the remaining years are included). Three clusters combining the C groups with I group 7 include cluster 13 (C group 1), cluster 28 (C group 2), and cluster 37 (C group 6) (see Table 4).

Although the division of values for ET17 in 2020 among the C group countries did not change significantly compared to 2019 in terms of order, the values decreased in almost all the countries relative to the previous year (except for Latvia, Bulgaria, Lithuania, and Norway). The most significant drop occurred in Estonia (2.37 percentage points), where the country's position worsened the most. The highest drop occurred in Estonia (2.37 p.p.), and this country worsened its position to the highest extent. For the LU8 indicator, the lowest values are typically found in C group 1, followed by C group 2, which are the two C groups with the highest similarities in the clusters. However, this trend is more pronounced in the first part of the period included in this I group (see Table 3). Since 2016, Czechia and several C group 4 countries have had some of the lowest values. The highest values are typical of C group 5 (Greece – each year having the highest values and the only country exceeding 10% each year), followed by Spain or Italy (with Italy surpassing Spain since 2018). Malta has had the lowest value in this group (and among the lowest values in the sample since 2019), except in 2012, when Cyprus had the lowest value (its values decreased, but its ranking in the sample also deteriorated). Higher values are also typical for C group 4 (Slovakia, Croatia, Portugal; Lithuania also has higher values in the sample; Poland – until 2014). Dissimilarities within this group increased as values in all countries dropped significantly. Since 2015, Estonia, Hungary, and Poland have moved towards values that are among the lowest in the sample. Values in C group 3 are medium or high and are also dissimilar in some years (Romania has the lowest values each year; Bulgaria and Latvia have high values and are closer to each other, with Bulgaria having lower values than Latvia only in 2012; these countries have been among the highest values in the sample, especially since 2018). The most dissimilar values are found in C group 6, with high values in Ireland in the first part of the period, especially until 2015, when the values are included. Ireland experienced the second-largest decrease in the sample (following Croatia). Slovenia also maintained high values over the whole period, while Czechia had the lowest (or second lowest) value in the sample in 2019/2020 (0.6%) after a decrease of 2.4 percentage points over the monitored period. In C group 1, values were generally low, and similarities were higher until 2015, the last year this indicator is included in this group. In the overall ranking, some countries have shown lower performance since 2016 (Austria, Finland, Sweden – since 2017; Switzerland – since 2018; Sweden had the highest value in this group in 2020 (1.8%), followed by Austria (1.7%)). France and Belgium are the C group 2 countries with the highest LU8 values each year, and their rankings have also worsened since 2015.

For the ID10 indicator, low values prevail in C group 1 again; they are predominantly low or medium in C groups 2 and 6 (low: Slovenia, Czechia, both of which improved their rankings over the monitored period, although the decreases were very slight (lower than 0.2) and in 2020, they had the second and third lowest values in the sample;

medium: Ireland, but after a high decrease, among the lowest values in the recent period as well). The highest values are found in C group 3 and Lithuania (especially since 2015), as well as in Spain, Greece, and Italy (especially since 2016). High values generally prevail in C groups 5 and 4, with some exceptions in both groups. Slovakia had among the lowest values, and after a higher decrease over the monitored period, it had the lowest value in the sample in 2020 (3.03). Lower values also prevailed in Hungary, and among C group 5 countries, they were the lowest in Malta (values were around or over 4 in both countries, lower in Malta until 2019).

For IPC5, the lowest values prevail in C group 1, particularly in the Northern countries, which often have similar values. Sweden consistently achieved the lowest value each year (between 4.3% (2018) and 6.1% (2017)). However, two countries in this group that are not Northern had higher values. Switzerland had the highest values, which were also relatively high in the overall sample (between 32% (2012) and 26% (2018), though there was a significant drop). Austria had lower values (between 18% (2012) and 15.2% (2017)), but these were still relatively high compared to the Northern countries, where the highest value was seen in Iceland in 2020 (11.3%). In C group 3, the values are among the highest in Latvia (also among the highest in the sample: over 30% each year, reaching 38.2% after a significant increase over the monitored period). Bulgaria and Romania had lower and similar values, often lower in Bulgaria (except for 2014 and 2019). Both countries had the same value of 14.5% in 2020 after a significant increase (similarly to Latvia; the lowest values were: Bulgaria: 6.6% (2012), Romania: 6.6% (2014)). The values in C group 2 are very diverse (lowest values: Netherlands each year, followed by Belgium in 2012-13 and 2015-17, or France in the remaining years; highest values in three countries: United Kingdom, with the highest value each year, followed by Luxembourg in 2012 (35.2%), but with the highest drop in the sample, or Germany in 2015-16 and 2018-19). The values in C group 5 are also diverse (Malta had the highest values in the sample until 2016, then the second to fourth highest, following Poland in 2017, Cyprus and Poland in 2018 and 2020, and also Croatia in 2019; Cyprus and Greece had among the highest values (Cyprus had the highest value in the sample in 2020: 54.2% (the maximum during the monitored period); Italy and Spain had lower and more similar values (except for 2015-18, when Italy's values were significantly lower)). Higher variance is also typical of C group 4, with predominantly higher values compared to C group 2 (lowest values: Portugal each year, followed by Hungary or Lithuania in 2016-18, Poland, Slovakia, and Croatia with the highest, fourth, or fifth highest average value in the sample). Lower values prevail in the first three and higher in the second three countries of I group 4 (Estonia is often in the middle of this group). The values are medium or higher in C group 6 (highest in Ireland except for 2013-14 and 2020 when Czechia took the lead, lowest in Slovenia each year). The difference between the highest and lowest values in this group increased from 5 pp. in 2012 to 14 pp. in 2014, and due to a significant increase in Slovenia in 2016, it narrowed to only 3.8 pp. in that year. However, it increased again, reaching 12 pp. in 2020 (with the highest value in Czechia in 2020 at 34.9%, the second highest increase in the sample, 15.6 pp., following Cyprus with 18.9 pp.).

This indicator plays a crucial role in DG and CE economies, as such work should be highly valued. Although assessing the specific benefits or pay for these workers in each country is beyond the scope of this paper, based on the definition of this indicator, which is population outside the labor force and wanting to work, higher values should, at least from a subjective perspective, be perceived as a negative phenomenon. The overall system should be improved to align more closely with the features of the CEE or other alternative concepts that emphasize people's well-being and happiness.

I group 1 has a diverse construction, involving all the economic, social, environmental, and institutional dimensions of SD. It holds importance for all concepts since crucial indicators for particular dimensions and key indicators for individual concepts are included. RR11 plays a key role in the CR, GG, and GE concepts. The most crucial aspect of this group in its overall construction is its significance for the SD concept, as it is debatable whether some of the indicators align with some of the remaining concepts, such as CEE and DG, which do not support employment in its traditional meaning. Four clusters combining the C groups with I group 1 involve cluster 23 (C group 2), cluster 29 (C group 1), cluster 33 (C group 4), and cluster 35 (C group 6) (see Table 4). The AI10 indicator has crucial socio-economic effects, and besides SD, it can have great importance for the CEE. The lowest values were found in C group 3 (Bulgaria: the lowest values in the sample until 2017; Latvia: the second-fourth lowest value in the sample), followed by C group 4 (Croatia: the lowest values in the sample since 2018; Portugal: the highest (until 2018) or the second-highest value in this group, following Lithuania (2019–20)); medium values in C group 5 (but Greece's values are among the lowest), and C group 6 (Ireland: the highest values each year; Czechia and Slovakia are lower, closer to one another). Higher values prevail in C groups 2 and 1 (Luxembourg: the highest values each year, surpassing 30 thousand (2020: the maximum in the sample of 34,710), followed by Switzerland, Germany, Norway, and then Austria, Netherlands, Belgium, and France. On average, there are different orders in different years. Then, the remaining C group 1 and 2 countries follow, with the average order being Sweden, Finland, Denmark, and the UK. Italy and Ireland follow next, and Iceland has only the values from the first two years available.

For the CPI16 indicator, representing the crucial institutional dimension, the division is quite clear, with the highest values in C group 1, followed by C group 2 and Ireland from C group 6, while Czechia and Slovenia from this group have lower values, especially Czechia (close to the lowest values in the sample; Slovenia had higher values).

Austria had the lowest values from these two groups, while in 2020, it was Iceland that had the second-lowest values in C group 1 in the other years. Most of the C group 3, 5, and 4 countries have low values, especially Bulgaria, Greece, Romania, Italy, Croatia, Hungary, Slovakia, Latvia, Malta, Lithuania, Poland, Cyprus, and Spain (the order of the lowest average values, but, moreover, Czechia follows Slovakia and Slovenia has the same average value as Poland). The values are most diverse in C group 4, with the highest values in Estonia (on average, following C group 1, 2 countries, and Ireland, while exceeding France). Portugal and Poland also have around medium values (often slightly lower), while since 2019, Lithuania has surpassed Poland. The values of the TE4 indicator have already been described, as part of the values (2013–2015) are assigned to I group 8 and, moreover, the value of 2012 to cluster 6. There are no significant differences between the values of these two periods. However, in 2016–18, Romania, followed by Italy, Hungary, and Germany, had the lowest values, and in 2019–20, the first three countries were followed by Czechia and Bulgaria (in different orders), and then Germany. All these countries, along with Croatia and Slovakia (which are slightly better in the overall order since 2016), also had low values in previous years, with the lowest values in Italy in the sample (2012–2015) and very low values in Austria (2012–13). Cyprus had the highest values in the sample, except for 2013 and 2015 when it was second (following Ireland and Lithuania, respectively), and 2020 when it was third (following Luxembourg and Ireland). These four countries had the four highest values each year. For the ER8 indicator, the highest values prevail in C group 1, although they are lower in Austria and Finland, especially in the most recent years. Finland had the lowest values each year, except for 2020, when Austria had the lowest value at 74.8%. The highest values were seen in Iceland, followed by Switzerland until 2019. In 2020, Switzerland had the highest value at 83%, followed by Iceland at 82.3%. Greece had the lowest values in the sample each year, followed by Romania until 2016, and then by Italy, while Romania had the third-lowest value. Along with Croatia and Spain, these countries had the lowest values each year. Bulgaria also had among the lowest values, but improvement is visible from 2019 onwards. The remaining C group 3 country, Latvia, had higher values. As indicated, in C group 5, the lowest values prevailed, although Malta and Cyprus also had higher values, especially Malta, which has been significantly increasing since 2017. The remaining C groups had diverse values, with the highest prevailing in two C group 2 countries, the Netherlands and Germany, and one C group 6 country, Czechia. The values are lower in Slovenia and Ireland, with higher values in 2014-2016, and one C group 4 country, Estonia, while Lithuania had the second-highest values in this group until 2019. Hungary has had higher values since 2014 and exceeded Lithuania in 2020. Low values were also found in Poland and Belgium, along with Portugal and Slovakia, with higher increases and values around the average in the recent period, although slightly lower in Poland. For the RR11 indicators, the situation is slightly similar. The highest values are achieved by the majority of the C group 1 and C group 2 countries, with the highest average values in the sample observed in Germany, Austria, Belgium, the Netherlands, and Switzerland. Lower values are seen especially in Iceland, Finland, and Norway during 2016-2019. The lowest values are found in the majority of C group 5, C group 4, and C group 3 countries, with the lowest average values in the sample observed in Malta, Romania, Cyprus, Greece, Croatia, Slovakia, and Estonia. However, Slovakia and Poland had the highest increases in the sample and recently slightly higher values. Portugal, Hungary, and Estonia had higher values in some years, but recently their values were among the lowest in the sample. Lithuania has had high values since 2016, showing a significant increase. The values are diverse in C group 6, with Slovenia showing the highest values in this group and among the highest values in the sample since 2015, except for 2014 when Ireland had the highest value. Czechia had the lowest values in this group each year.

I group 6 occurs in cluster 12 (C group 4), cluster 15 (C group 3), cluster 20 (C group 6), and cluster 40 (C group 2). It contains the remaining values of TE4 (2012) and AI10 (2012–2014) and two crucial indicators for CRE, which are CMU12 and RP12, both involved in the SDG12 topic. This group is, to some extent, similar to I group 1, but the institutional dimension and the socioeconomic aspects of employment are not involved. It is most crucial for CRE since two SDG12 indicators are included and, in this way, also for GG and GE. However, there are additional socioeconomic aspects that are not directly related to CRE. Then, it is crucial for the SD concept in general, but it is also of higher importance for CEE. For the TE4 indicator in 2012, the only extraordinary result is that of Austria, which had the second/third lowest value in 2012/2013, and the highest increase over the monitored period For the CMU12 indicator, the highest values are typical of C group 2, and from C group 1, where the values are available, the highest values are in Austria since 2014 and in Finland until then. Finland had the highest drop in the sample, while Austria had one of the highest increases. Sweden and Denmark had values below the average, except for Denmark in 2014 and Finland since 2014. Low CMU12 values are typical of several C group 5 countries, particularly Greece and Cyprus. Malta shows higher values, Spain shows even higher values, and Italy has the highest values in this group, which are among the highest in the sample. In C group 4, low values are also observed, except for Poland and Estonia. In recent years, Hungary's values have increased, while those of Poland have decreased. In the remaining two groups, the values are very diverse. Slovenia and Czechia show high values, which are close to each other, especially since 2017. Czechia had higher values than Slovenia only in 2018 and 2020 (in 2020: Czechia at 13.4% and Slovenia at 12.3%). Ireland has some of the lowest values in the sample (1.8% in 2020). Romania is also among the lowest, with 1.3% in 2020, the lowest in the sample, and a decrease over the monitored period. Bulgaria also has low values, but with a slight increase, surpassing Romania in all years except the first two. Latvia had the lowest value in the sample in 2012 (1.3%) but has since shown an increase, reaching 4.2% in 2020, though it remains among the lower values in the sample. Many similarities can be found with the division of the C groups for the second SDG12 indicator, RP12. The highest values prevail in C group 2, while those in C group 1 are highly diverse. Nevertheless, Switzerland had the highest value in the sample, except for the last two years, when it was surpassed by the Netherlands. Countries such as Switzerland, the Netherlands, the UK, Luxembourg, and Italy consistently show the highest average values each year. As indicated, along with the best-performing C group 1 and 2 countries, three C group 5 countries – Italy, followed by Spain and Malta – also have high values. Cyprus and Greece, on the other hand, have low values in most years, though they remain above 1 kg per capita each year. Bulgaria and Romania had some of the lowest values in the sample (below 0.9 kg each year), but values in Latvia were higher, exceeding 1.3 kg each year. Similar to C group 3, there is a high diversity in C group 4, with very low values observed in Estonia (below 0.9 kg, except for 2019 when it reached 0.914 kg). Croatia and Slovakia exhibited higher values, as did Hungary, particularly at the beginning of the monitored period, although Hungary also recorded the largest drop in the sample. Lower values were observed in the remaining three countries: Lithuania, Poland, and Portugal. In C group 6, the values are also diverse, though less so for this indicator. Values are consistently the lowest in Czechia and the highest in Ireland, except for 2013, when Slovenia had the highest value. In 2020, Ireland recorded 2.78 kg, Slovenia 2.027 kg, and Czechia 1.887 kg. Overall, the structure of the last two indicators is consistent across the C groups: the highest values are found in C group 2, while the lowest values are typically observed in C group 3, with Bulgaria and Romania showing the lowest performance for both indicators. The remaining groups display more diverse values. In C group 4, the values tend to be lower overall; however, Slovakia and Croatia stand out as the countries with the highest performance when both indicators are considered together. Conversely, Estonia presents a contrasting picture, with very low performance in RP12 and among the highest values in CMU12. The reverse is true for Ireland, while the other two countries in C group 6 exhibit more moderate results. In C group 5, Cyprus and Greece have poor results for the combination of these indicators, whereas the other three countries perform better, with particularly high values for RP12. Italy is notable for being among the highest performers in both indicators. The Netherlands emerges as the best-performing country for this combination of indicators.

I group 9 encompasses the entire time series for two indicators: APL4 and ERD9, reflecting more specific socio-economic aspects. This I group was chosen as a crucial group for SD because gross domestic expenditure on R&D does not play a critical role for both DG and CEE. It has higher importance for CRE, GE, and GG, but the type of investment needs further specification. On the other hand, adult participation does not play a primary role in the other three concepts but can influence DG and CEE, with specifics required It occurs in cluster 2 with C group 3, in cluster 6 with C group 5, in cluster 21 with C group 6, and in cluster 36 with C group 1. The division into the C groups is similar for these two indicators. Low values are observed in C group 3. For APL4, Romania is followed by Bulgaria, with both having the lowest values in the sample, and Latvia showing slightly higher values. For ERD9, Bulgaria has the highest values in this group (only in 2012 – slightly higher in Latvia), but all three countries remain among the lowest in the sample. Several countries in C groups 4 and 5 also exhibit low values. The values are diverse for C group 6, with higher values observed in Slovenia and Czechia, and lower values in Ireland. For both indicators, Slovenia initially had the highest values, but since 2018, Ireland has surpassed both countries in APL4 following a significant increase. In C group 4, the values are more varied, but lower values generally prevail. There are also similarities in the composition of the two indicators. For ERD9, higher values are seen in Estonia, Portugal, and Hungary, while the lowest values are found in Croatia and Slovakia (2016, 2018-2020). For APL4, the lowest values are also in Croatia and Slovakia (2016, 2020), as well as in Hungary (2012). Estonia has high values, ranking among the highest in the sample in the recent period (average: 15.17%), and Portugal has the second highest values in this group (average: 9.967%).

In summary, low values prevail in Slovakia and Croatia, while higher values are seen in Estonia and Portugal for both indicators. Hungary shows higher values for ERD9 but lower values for the remaining countries in both indicators. However, a significant increase in ERD9 was noted in Croatia and Poland. Estonia experienced the second-highest increase in APL4, leading to values that are among the highest in the sample in the recent period, grouping it with the best-performing countries of C groups 1 and 2. C group 5 is highly diverse, with low and medium values prevailing for both indicators. In ERD9, Cyprus is characterized by among the lowest values in the sample, with slightly higher values observed in Malta. However, since 2018, Malta has exhibited lower values, making it the second lowest in the sample. Greece, also among the lowest, has shown the second highest increase in the sample. Since 2018, Greece has held the second highest value in this group, surpassing Spain, which had the highest values in 2012 but was among the highest in subsequent years. In the remaining years, Italy reported the highest values. In APL4, Greece displays the lowest value, followed by Cyprus, indicating a decline. In 2012, 2013, and 2015, Italy showed higher values, reflecting an increase. Spain and Malta also exhibited higher values, with Malta demonstrating higher values in the more recent period following substantial initial increases In C group 1, the highest values prevail. In ERD9, Sweden has the highest average values, followed by Switzerland, Finland, and Austria, with Germany and Denmark following. Slightly lower values are observed in Iceland and Norway, which remained below 2% until 2014 and 2015, respectively. In APL4, Switzerland shows the highest average values in the sample (30.422%), followed by Sweden, Denmark, Finland, Iceland, and Norway. The best-performing countries from C group 2, 1, and 4 – such as the Netherlands, France, Luxembourg, the UK, and Estonia – follow, with Austria coming after them, though it is the least performing country in C group 1, with an average value of 14.36%. C group 2 is more diverse, with a greater number of countries exhibiting high values. In ERD9, Germany consistently ranks as the best-performing country each year, except in 2020, when it was surpassed by Belgium with a value of 3.48%. Belgium, followed by France and the Netherlands, maintained high values each year, exceeding 2%, except in 2012 when the Netherlands recorded 1.92%. Luxembourg had the lowest values in this group, with an average of 1.255%, while the UK had the second-lowest values, with 2% each year, except for 2012 when it was 1.58%. In APL4, the Netherlands consistently showed the highest value each year, except in 2014, when it was surpassed by France, which experienced the highest increase in the sample. Belgium and Germany recorded the lowest average values, with 7.522% and 8.1%, respectively.

I group 5 includes the entire time series of three indicators, with one additional indicator, LU8, included from 2016 onwards. This group presents a particularly interesting structure of subjective social (PUV7 and SUN3), objective social (HD11), and socio-economic (LU8) indicators. For all these indicators, lower values are desirable. The aspects of quality of life – or even happiness – such as housing, health, and employment, are most relevant in this group. Consequently, this group is more aligned with the alternative concepts of DG and CEE rather than the SD concept, where objective indicators still play a significant role. The earlier values of LU8 are included in I group 7, and those values are also analyzed within that group. As noted, since 2016, the value of Czechia has significantly dropped, with similarly lower values observed in some C group 4 countries (Estonia, Hungary, and Poland). They are also lower in Ireland (particularly in the last few years). For this indicator, the values dropped in almost all countries, apart from those with the lowest average values, i.e., Switzerland (no change), Luxembourg, Austria, and Norway (which saw the highest increase of 0.3 pp.). As a result, rankings shifted significantly depending on these declines. Similarly, between 2015 and 2016, all the increases occurred in the C groups 1 and 2 countries, in the following order: Austria, Luxembourg, and Norway; with no change in Switzerland, France, and Finland. Similar to the values of the LU8 indicator, low values for the remaining indicators also prevail in C groups 1 and 2, though with varying levels of variability. This trend is most evident with the PUV7 indicator, where the lowest values are found in most C group 1 countries. The highest values were observed in Denmark and Austria until 2017, and then primarily in Denmark and Sweden. Low values are also observed in several C group 2 countries, with Luxembourg recording the lowest values, though it also saw the highest increase in the sample – from 0.6% in 2012 to 3.6% in 2020. The Netherlands and Estonia from C group 4 also displayed low values. The highest values prevail in the UK and, more recently, in Germany after a significant increase in 2020. In C group 6, medium values are predominant, with Ireland recording the highest values and Slovenia the lowest, until 2014 and then again in 2019. In 2020, Czechia had the fifth-lowest value in the sample, following directly after the best-performing C group 1 countries, and also had the lowest average value in C group 6. Additionally, Sweden and Denmark recorded higher values. High values are found in C group 3, with Bulgaria showing the highest values in the sample, in C group 5, where Malta had the lowest values in this group from 2016 to 2018 and in 2020, and Spain in the remaining years. Several C group 4 countries also recorded high values, particularly Lithuania, which had the second-highest average value in the sample, and Portugal, which had higher values than Lithuania only in 2014. Slovakia exhibited lower values except in 2019, and since 2019, Poland has also shown lower values.

For the SUN3 and HD11 indicators, the division is less obvious than for the previous two indicators in this I group. Although many of the C group 1 and 2 countries have low values, additional countries with low values can also be found, particularly in C groups 5 and 6. For SUN13, Austria consistently ranks among the lowest values in the sample each year, with the lowest average value overall, followed by the Netherlands, Spain, Luxembourg, Malta, Czechia, and Germany. After these countries, three C group 1 countries follow: Switzerland, Norway, and Denmark. Finland and Iceland, on the other hand, have higher values, surpassing all the C group 2 countries in most years. For HD11, Austria has the highest average value in C group 1, followed by Denmark, which recorded a higher value than Austria only in 2018. The C group 3 countries exhibit high values for both indicators. For HD11, Romania consistently has the highest value in the sample each year, followed by Latvia and Bulgaria, although Hungary surpassed these two countries until 2017 (and in 2015, Hungary surpassed Bulgaria alone). For SUN13, Latvia and Romania are among the highest values in the sample, while Bulgaria had high values until 2014. Afterward, a significant drop occurred, and since 2016, Bulgaria has recorded lower values than some C group 1 and 2 countries. Similar trends are observed in some C group 4 countries, particularly for HD11, where Hungary leads, followed by Poland and Lithuania, which have the highest average values. Conversely, Estonia shows the lowest values due to decreases in recent years. For SUN13, Hungary has recorded lower values in the more recent period due to declines, while Estonia has the highest average value in the sample. In C group 5, the values for SUN3 are diverse. Spain and Malta have low values, while other countries have high values. Cyprus, however, experienced a significant drop and has been among the lowest values in the sample since 2019, with lower values since 2016. Greece consistently shows among the highest values in the sample each year. For HD11, Malta, Cyprus, and Spain have low values, although Spain had the highest increase in the sample and recorded higher values in 2020. In contrast, Italy and Greece have shown high values each year.

In C group 6, the differences are pronounced. For SUN13, Slovenia had the lowest value in the sample in 2012–13 but saw a significant increase and has been among the highest values in the sample since 2017. Czechia has consistently had low values each year, and since 2017, its values have been lower than Slovenia's. Ireland has had high values, close to Slovenia's but slightly lower since 2017. For HD11, Ireland has recorded the lowest values, also among the lowest in the sample. Czechia has higher values, and Slovenia has the highest, although both have seen significant decreases.
To sum up, as a group, C groups 1 and 2 can be evaluated as closer to the CEE and DG concepts, while the opposite is predominantly true for C groups 3 and 5, with several exceptions. In C group 5, Malta mainly stands out as an exception. Switzerland and Norway can be evaluated as the best-performing countries.

3.3. Summary evaluation of performance in relation to the applied concepts and discussion

Regarding the overall evaluation of the performance of the C groups and individual countries, the number of points assigned to I groups for their relevance to specific concepts was used. For the concept of SD, all groups are relevant, with Group 8 being particularly significant. Therefore, the groups and countries that generally perform well across all I groups, especially in I Group 8, can be seen as those moving closer to SD. For the concepts of GG, GE, and CRE, I Group 2 was the most relevant, with I Group 6 also playing a crucial role in CRE. For DG, I Group 5 was evaluated as the most relevant, while this group, along with I Groups 1, 4, and 7, is essential for moving towards CEE. The highest relevance for this concept was identified in I Groups 5 and 10.
Regarding I group 7, C group 1 countries generally show low values across all indicators. Although lower values for LU8 and ID10 indicate better performance, the interpretation of environmental taxes (ET17) is less clear. Except for Denmark and Finland – more significantly in recent years – these countries have relatively low shares of environmental taxes. This is not contrary to the principles of DG and CEE, as welfare states may rely more on other types of taxes. Lower values for IPC5 are also seen as positive due to the construction method of this indicator. I group 10 focuses on health-related indicators of the SDG3 topic, both qualitative and quantitative, and is crucial for quality of life and CEE. The performance of the C group 1 countries is also high in this I group, with some exceptions. Notable exceptions include Austria, Finland, and Denmark for both HLY3 and SPH3, and Switzerland for HLY3. Denmark, Austria, and Finland exhibited lower performance in LE3. Both Norway and Switzerland had among the highest performances, although Switzerland's performance was initially lower for HLY3 but improved slightly after a significant drop in 2013 Moreover, Switzerland has the highest LE and among the highest SPH3 values in the sample. I group 1 represents an appropriate and important combination for moving closer to both SD and CEE simultaneously. For the indicators included, higher values denote higher performance, predominantly achieved by C group 1 and C group 2 countries. Poor performance is often typical of the C group 3 and C group 4 countries, and for some indicators, the C group 5 countries. The C group 6 countries predominantly show medium values. For ER8, low performance was also seen in some C group 2 countries (Belgium, France, Luxembourg), and for TE4 (included from 2016), Germany and Czechia also showed lower performance. In contrast, Cyprus achieved higher performance for TE4 and Malta for ER8. The highest performance of C group 1 and C group 2 is clearly evident for AI10, CPI16, and RR11 (along with Slovenia). Regarding I group 4, which reflects self-perceived safety and is crucial for CEE, the majority of C group 1 and C group 4 countries show high performance. However, C group 2 and C group 5 countries generally demonstrate lower performance. In C group 1, the most significant exception is Sweden and Switzerland in the early years. Estonia experienced a notable drop in PCV16 values, moving from among the highest values initially to among the lowest in 2020.
I group 2 involves a higher number of indicators from all the dimensions of sustainability, making this group particularly important for SD, GE, GG, and CRE. Additionally, the NG13 and SRE7 indicators are crucial for DG and CEE. For the NG13 indicator, lower values are prevalent in the C group 3 and 4 countries, while higher values are observed in the C group 2 countries, including two C group 6 countries (notably Ireland and Czechia). However, there are exceptions: France shows lower values, Estonia and Poland exhibit high values, and values in I group 1 and 5 are diverse. Iceland recorded the highest values in the sample, Cyprus also achieved high values, but Malta had the lowest values, particularly in the most recent period. This highlights that small countries can achieve remarkable conditions. In contrast, Sweden, another C group 1 country, has the lowest values in the sample, while Norway and Switzerland also have relatively low values. For the environmental indicator SRE7, C group 1 countries, Latvia, and four C group 4 countries (Portugal, Croatia, Estonia, Lithuania) exhibit the highest performance, with medium values in Slovenia, Romania, and Bulgaria. Lower values are generally found in other groups and countries, including C group 2, where only France and Germany show higher values, but still relatively low in the sample. The pandemic significantly altered GDP growth rates, but C group 1 countries experienced the smallest drops (except Iceland and Austria), indicating higher resilience. Norway had the lowest decrease, reinforcing its status as a top-performing country.
In I group 5, which is crucial for DG and CEE and includes key socioeconomic aspects of quality of life, high performance is observed in C groups 1 and 2, while C groups 3 and 5 generally show low performance. The performance in C groups 4 and 6 varies by specific indicators. Notable exceptions include high performance in HD11 achieved by Ireland, Malta, Cyprus, Spain (except for 2020), and Czechia since 2017. The remaining C

group 5 countries and Slovenia generally had low performance, although Slovenia showed significant improvement in the recent period. For PUV7, the distinction is clearer: lower values and high performance are found in C groups 1 and 2, along with Estonia, while higher values are seen in C groups 3 and 5, including Lithuania and Portugal. The remaining C group 4 countries had slightly lower values. Among C group 2 countries, higher values are notable, especially in the UK, with slightly lower values in Belgium and France. Germany experienced a significant increase in 2020, surpassing France. Conversely, medium values in C group 6 decreased, with Czechia recording some of the lowest values in the sample in 2020, even lower than Sweden and Denmark from C group 1. For LU8 and SUN3, where low values are typical in C groups 1 and 2, Czechia also falls into this category, especially for LU8. For SUN3, Slovenia had even lower values until 2016, with an increase thereafter, but Czechia has maintained among the lowest values in the sample since 2017. Ireland generally had high values for both indicators. For LU8, high values are seen in C group 5, except for Malta and Cyprus in 2012. Similarly, SUN3 shows low values in Spain and Cyprus since 2015. Despite poor performance overall in C group 3, Romania achieved a lower long-term unemployment rate (LU8), and Bulgaria showed higher performance in SUN3 since 2017. In C group 4, Poland, Hungary, and Estonia had lower LU8 values, while Hungary has had lower SUN3 values since 2017.

Due to the inclusion of the PIP10 indicator, I group 3 is significant not only for SD but also for CEE and DG. The ET17 indicator, included in almost all the years (except for 2020), supports achieving goals across all previously analyzed concepts. The distributions of the C groups and several countries align for these two indicators. Low values for both PIP10 and ET17 are prevalent in C groups 1 and 2, while the highest values for both indicators are found in C group 3. In C groups 4 and 5, both indicators predominantly show high values (except for Slovakia, Hungary, and, in the most recent period, Poland for PIP10). The values in C group 6 are very diverse. For PIP10, Czechia records some of the lowest values in the sample, alongside Iceland. Slovenia exhibits high shares of taxes and a low poverty index (the most desirable result), while Ireland shows higher values at the beginning of the period, which have recently decreased, approaching Czechia's levels after significant declines.

In I group 9, which is primarily important for SD but also supplementary to other concepts, C group 1 shows the highest average performance for both indicators included (reflecting adult participation in learning and expenditure on R&D), followed by C group 2. C group 3 generally shows the lowest values (with slightly higher values in Latvia for APL4), while C group 4 also shows low values, particularly for APL4, and several C group 5 countries (notably Malta and Cyprus for ERD9, and Greece, Italy, and Cyprus for APL4). Switzerland and Norway are leading in applying the concepts of DG and CEE. Regarding I group 7, both countries also recorded low values for the ET17 indicator, which was not deemed negative. Switzerland had higher values for IPC5 and ID10, the highest in C group 1, whereas Norway had among the lowest values. Norway's performance is particularly notable due to its more equal income distribution, making it the best-performing country. Additionally, Norway has a significantly lower poverty index (PIP1) in I group 3, which ranks among the lowest values in the sample. This is crucial for both SD and DG/CEE.

C group 2 is especially close to CRE, but also to GG/GE, focusing on the CMU12 and RP12 indicators in I group 6. However, values for CMU12 are missing in three C group 1 countries (Switzerland, Norway, and Iceland). Except for Austria since 2013 and Finland in 2012, the remaining values are lower. For RP12, despite Switzerland having the highest values in the sample, C group 1 generally shows low values, particularly in Finland, Sweden, and Denmark (for most years), with higher values in Austria, Norway, and recently Iceland (Iceland showed the second-highest increase in the sample from very low values to 2.375 kg per capita; Norway showed prevailing stagnation with 1.76 kg per capita in both 2012 and 2020). RP12 values are also high in three C group 5 countries: Italy, followed by Spain and Malta, with lower values in Greece and Cyprus (their order interchanges). This pattern for C group 5 is also observed for CMU12, with Italy showing significantly higher values, Spain and Malta closer to each other, and Cyprus having weaker performance. C group 3 shows weak performance in both indicators, with Latvia having the highest values in both (except for CMU12 in 2012, where it had the lowest values). In C group 6, values are generally medium or high, but Ireland recorded among the lowest values for CMU12, whereas its RP12 values have recently been among the highest in the sample. C group 4 shows varied performance in both indicators (CMU12: Estonia, Poland, and recently Hungary have higher values; RP12: Croatia, Slovakia, and also Hungary in the first two years; with prevailing low values in the remaining countries). The RR11 indicator from I group 1 is also crucial for the CRE concept. I group 2, Slovenia, and most of I group 1 demonstrate high performance. Lower performance is seen in C groups 3, 4, 5, and Czechia (with diverse results in C group 6), but high values are observed in Lithuania (especially since 2015) and Italy.

The performance in RMC12, a crucial indicator of the environmental dimension of sustainability, mainly included in I group 8, is notably higher for the C group 2 countries as a whole. Specifically, the Netherlands stands out with the lowest values in the sample, while Belgium and France also show low values, though Luxembourg has among the highest values in the sample. In C group 5, lower and medium values prevailed. Conversely, the highest values are observed in the C group 1 countries (for which data are available), although Switzerland shows the lowest values within this group. Some countries from the remaining C groups exhibit high values, such as Estonia, with higher values also seen in Romania, Bulgaria, Cyprus, Lithuania, Poland, and Ireland in the recent period after a significant increase. This indicator also reflects the production structure of these economies, which depends on their natural endowments among other factors. Considering the combination of these four indicators, the Netherlands and Italy emerge as among the best-performing countries in CRE and GE/GG. The Netherlands consistently showed the lowest values in the sample for RMC12 (except in 2014, when it recorded the second-lowest), the highest CMU12 each year, and among the highest RP12 values (the highest in the last two years), along with high RR11 values. However, some weak areas that are crucial for CRE and GE/GG – and indeed for all the remaining concepts and the survival of humanity – include a low share of renewable resources (SRE7), organic farming (AOF2), and among the highest GHG emissions per capita (NG13) from C group 2. Italy, on the other hand, had good results in all seven indicators. Sweden presents a different profile, with among the highest values for AOF2, the lowest NG13 values in the sample, and among the highest shares of renewables (SRE7). However, Sweden also has higher RMC12 values and lower CMU12 and RP12 values, though its RR11 was relatively high except in the last year, when it fell below the average level. Despite their differing conditions and natural endowments, these countries show significant variance in their paths toward sustainability. It's also important to note that both the Netherlands and Italy have achieved very good results in crucial social indicators for moving closer towards CEE, particularly those included in C groups 5, 7, and 10, though some deficiencies remain. A notable deficiency is poor performance in I group 4, specifically in the PCV16 indicator, where the Netherlands, Sweden, and, to a lesser extent, Switzerland show weak results (Switzerland currently has lower values and recorded the third-highest drop in the sample). Additionally, HLY3 showed poor performance for Sweden and Switzerland (with a significant drop in Switzerland since 2012). Regarding the crucial institutional aspect, all four countries had among the best results in the CPI16 indicator. However, Italy stands out with CPI16 values slightly below the average, and deficiencies persist in other socioeconomic indicators, such as those included in I groups 1 or 3, despite HLY3 and LE3 having among the highest values. Therefore, a shift towards CRE and GE/GG is evident, but not towards CEE (DG), according to several indicators.

Switzerland also had among the highest performances in Group 9, with Norway showing slightly lower values. This places Norway closer to the SD path in both supplementary and deeper aspects. Regarding the crucial I group for DG and particularly CEE, which is I group 5, Norway had better results overall. For the PUV7 indicator, Switzerland achieved lower values (with Norway only showing similar low values in 2014–15), but the difference between This is also the case for the SUN3 indicator, where the difference between the countries' values is also marginal. Norway had lower values for both LU8 and HDI11. Additionally, Norway's RR11 values were lower, while Switzerland's were among the highest in the sample. Similarly, Switzerland's RP12 values were the highest in the sample until 2018, after which they were slightly surpassed by the Netherlands. Norway's values for this indicator were below the sample's average. These findings suggest that Norway is closer to moving towards DG and CEE when compared to CRE. Alongside the Netherlands and Sweden, Norway and Switzerland can be considered the highest-performing countries in sustainability overall. This conclusion aligns with the results of Drastichová et al. (2023). Furthermore, Switzerland had lower GHG emissions per capita, whereas Norway's values were around the medium range (below average) for most of the sample, except for the first two years, when they were lower than in Switzerland. Norway had the second-highest share of renewables in the sample, following Iceland, which, on the contrary, had the highest GHG values per capita in the sample. Their performance in socio-economic indicators was often very high, with notable indicators including HLY3 (for Sweden and Norway), PIP1 and LU8 (for Norway and the Netherlands), SUN3 (for the Netherlands and Switzerland), LE3 (for Norway, Switzerland, and Sweden), ID10 (for Norway, Sweden, and the Netherlands), and AI10 (for Switzerland, Norway, and the Netherlands). These countries also performed well in SPH3, APL4, TE4, and ER8.

In contrast, Cyprus demonstrated poor performance in key indicators related to CRE and GE/GG, including RP12, CMU12, RR11, SRE7, AOF2, as well as relatively high values in RMC12 and NG13. Despite considering the specific conditions of a smaller economy, Malta showed better results in at least some indicators, even though its performance in RR11, SRE7, and AOF2 was lower. However, Malta had lower GHG emissions and RMC12 values. Although Cyprus was evaluated as having weak performance in relation to CRE and GE/GG, it did achieve better results in other areas, particularly in social aspects and socio-economic indicators, such as TE4 (among the highest values in the sample), HD11, SPH3, SUN3, LE3, and GPG5, but it had poor performance in PUV7 and APL4.

Many countries in C groups 3, 4, and 5 had poor performance in sustainability overall, while C group 6 countries often had diverse results, showing progress towards higher sustainability in some areas but not consistently across all areas. Although C groups 1 and 2 include the most developed countries, they showed poorer performance in several areas of sustainability, which also corresponds with their higher level of development. Overall, C group 3 can be evaluated as the worst-performing group, with weak performance in several social indicators, such as HD11 and PUV7. Greece was the worst-performing country in socio-economic aspects, with high values in PUV7 and HD11, the highest long-term unemployment rate (LU8), and the lowest employment rate (ER8). However, Greece did achieve good results in qualitative health status indicators, such as HLY and SPH3.

The results of this analysis should be considered in the context of the deeper characteristics of the concepts to which the analyzed indicators were assigned. DG economists advocate for social and global justice and sustainability (Beeks, 2016). Similar to CE economists, they emphasize the need to reduce high consumption levels and shift towards local and self-sufficient economies (Kallis, 2011). They stress the importance of social equity and argue that wealth redistribution is necessary across the globe to alleviate poverty in developing nations and reduce economies in developed ones. DG economists also propose that global wealth disparities and other human injustices can be addressed through global wealth redistribution methods (Piketty, 2014). Additionally, they suggest that working hours should be reduced worldwide to no more than 21 hours per week, with guarantees for workers' health, safety, and economic security (Raventós, 2007). This concept is not without controversy, particularly when it suggests that the future economy should not rely on consumption and economic growth but fails to fully address wealth disparity and long working hours. The contribution of both theoretical and practical concepts to Agenda 2030, the recent global SD agenda, should be further investigated.

The implications of this research for lower analytical levels are also crucial. Although countries may lean towards different analyzed (and additional) concepts and their practical application on their path towards sustainability, they must pay attention to crucial aspects of development. A compassionate economy should serve as a model for the future socio-economic-environmental system (Schumacher, 2011), recognizing that the potential for individual countries to achieve this can vary. Efforts must be made to move closer to such a system at all levels of the economy. While degrowth may seem unrealistic for many countries in the near future, a higher level of dematerialization should begin with the application of green economy and green growth concepts, combined with circular economy practices. This transition also requires significant changes at lower levels, including regional, organizational, and household levels, and requires awareness from every individual. Structural reforms are necessary, particularly for countries identified as having low performance across most areas and indicators, which should prioritize the accelerated implementation of these reforms. Although no precise guideline exists, our detailed analysis has identified performance in various aspects related to sustainability, and countries achieving high performance in most areas can lead the way for others.

4. Conclusions

The aim of this paper was to identify which concepts the 31 countries in the sample lean towards in their pursuit of the Sustainable Development Goals (SDGs) and their progress based on a selected group of indicators from the EU SDG indicator set. The analysis assessed the progress and inclination towards the fundamental concept of sustainable development, as well as towards more specific practical concepts like green economy/growth and circular economy, and more complex alternative concepts such as degrowth and compassionate economics. Using the biclustering method, we examined the relationships between countries and indicators, resulting in a combination of five groups of countries (C groups) and 10 groups of indicators (I groups). We identified the relationships of the specific I groups to the analyzed concepts and reported the first 40 clusters.

Key findings of this study include the following: all ten constructed indicator (I) groups are relevant to the sustainable development (SD) concept, with specific groups also being pertinent to one or more additional concepts based on the points assigned to them. The most suitable groups of indicators were matched to each concept, allowing us to evaluate the progress of the C groups, which consist of countries with similar features, as well as the progress of individual countries. Certain groups of indicators hold particular significance, and countries should strive for high performance across these indicators. I group 6 is especially crucial for the circular economy since it includes two SDG12 indicators, making it equally important for the green economy and green growth. It also incorporates additional socioeconomic aspects related to sustainability in general, although not directly tied to the circular economy.

Countries with lower values in raw material consumption (RMC12) and GHG emissions (NG13), combined with higher values in circular material use rate (CMU12), resource productivity (RP12), recycling rate of municipal waste (RR11), and share of renewable energy (SRE7), are positively evaluated from an environmental sustainability perspective, representing fundamental requirements across all included concepts. This combination is vital for ensuring the survival of humanity and overall sustainability. The structure of the RP12 and CMU12 indicators, which are the foundation of the circular economy, is consistent across country groups: C group 2 (Belgium, France, Germany, Luxembourg, Netherlands, United Kingdom) shows the highest values, while C group 3 (Bulgaria, Latvia, Romania) shows the lowest performance, particularly in Bulgaria and Romania. In C group 4 (Croatia, Estonia, Hungary, Lithuania, Poland, Portugal, Slovakia), values tend to be lower. The Netherlands is the best-performing country for this combination of indicators. The combination of these two indicators with RMC12, RR11, and SRE7 most strongly reflects the shift towards a circular economy. Consequently, the Netherlands and Italy can be seen as making significant strides towards this practical concept, advancing environmental sustainability. Their results can serve as a model for other countries in the sample. This is evaluated as a positive change (level 2).

Other important aspects were identified through the construction of indicator groups. I group 5 encompasses critical subjective social indicators (population unable to keep home adequately warm (PUV7) and self-reported unmet need for medical examination and care (SUN3)), objective social indicators (severe housing deprivation rate (HD11)), and socio-economic indicators (long-term unemployment rate (LU8), included from 2016 onward), where low values are desirable. This group is most closely aligned with the alternative concepts of degrowth and compassionate economy rather than with the traditional sustainable development concept, which still values objective indicators. The highest performance was observed in C group 1 (Austria, Denmark, Finland, Iceland, Norway, Sweden, Switzerland), followed by C group 2 (Belgium, France, Germany, Luxembourg, Netherlands, United Kingdom), with lower performance in C groups 3 (Bulgaria, Latvia, Romania) and 5 (Cyprus, Greece, Italy, Malta, Spain). Performance was more varied in C groups 4 (Croatia, Estonia, Hungary, Lithuania, Poland, Portugal, Slovakia) and 6 (Czech Republic, Ireland, Slovenia) across specific indicators. The clusters formed by the combination of I group 5 with C groups 2 and 1 (clusters 1 and 3, respectively) were the most homogenous, providing strong justification for these results.

Many countries in C groups 3, 4, and 5 showed poor overall sustainability performance, while countries in C group 6 exhibited more varied results, often progressing towards higher sustainability in some, but not all, areas. Despite C groups 1 and 2 consisting of more developed countries, they also displayed weaker performance in several sustainability areas. Overall, C group 3 is evaluated as the worst-performing group, with Greece being the worst in socio-economic aspects. Smaller economies often face unique conditions, leading to diverse indicator values, such as GHG emissions (NG13), making it challenging to assess their performance. Cyprus was identified as the lowest-performing economy in relation to the circular economy and green economy/growth. In summary, C group 1 is closer to achieving a compassionate economy and degrowth, whereas C groups 3 and 5 generally show the opposite trend, with some exceptions. While C groups 1 and 2 both demonstrate high and similar performance levels in several aspects of the circular economy and green economy/growth, C group 1 generally performs better or at least at a similar level as C group 2. Notably, some countries within these groups deviate from the general trend. Norway, Switzerland, the Netherlands, and Sweden can be assessed as countries with the highest performance in sustainability overall. Switzerland and Norway are particularly close to applying the concepts of degrowth and compassionate economics (level 3), while the Netherlands and Italy lead in circular economy and green economy/growth (level 2).

This study’s unique contributions include enriching the methodology for investigating sustainability and identifying inclinations towards specific concepts, including alternative concepts to sustainable development. This work should serve as a foundation for further research on countries' paths towards sustainability and the progress of lower analytical units within them. Understanding which concept a country predominantly follows is crucial for analyzing specific conditions for improvement, including opportunities for enhancing well-being and quality of life within environmental limits. It is necessary to explore whether the leading conceptual approaches to the environment and development can effectively support the achievement and implementation of the SDGs in the future. Therefore, it is essential to investigate which existing or combined practical, related, or alternative conceptual approaches to sustainable development can support SDG implementation and bring humanity closer to a sustainable development path. A key challenge for the future remains advancing the methodology for measuring sustainable development and developing a comprehensive set of indicators to measure progress towards supplementary and alternative concepts, beyond those covered in this work. The SDG set should be utilized for this measurement and should include indicators that can be directly applied to measuring progress towards the practical application of these concepts.

We acknowledge the limitations of this research, particularly the subjective evaluation involved in assigning points to indicators based on their relevance to the six applied concepts and assigning points to the groups of indicators accordingly. However, research in sustainability science inherently involves a degree of subjectivity, and all assignments were made based on extensive knowledge gained from long-term research in this field. The implications for both theory and practice are significant. The concepts studied should be supported by a clear set of indicators reflecting their crucial aspects, and these indicators should be incorporated into the SDG set. The global SD agenda should also account for countries' progress towards sustainability through the application of alternative concepts.

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