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REDEFINING SUSTAINABLE DEVELOPMENT IN THE CONTEXT OF TRANSDISCIPLINARY PARADIGM

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The authors addressed the issue of defining sustainable development using a transdisciplinary approach, as well as systemic, process-oriented, and synergetic approaches.

Sustainability must be analyzed and evaluated in the context of five crises and transitions: 1) geopolitical transition; 2) energy transition; 3) climate transition; 4) demographic and medical transition; 5) technological transition. In this sense, we introduce the concept of multiple crises to reconfigure, in a transdisciplinary manner, the three aspects of sustainable development: resilience, viability, and disaster/crisis. By understanding the dynamics of sustainability, we can identify the types of strategies and ongoing development that could be implemented through technology, science, education, state regulations, and entrepreneurship. The concept of sustainable development, formulated by the UN in the 1980s, is insufficient in providing a comprehensive solution for addressing more sustainable development and ecological issues. Therefore, the authors propose a new perspective and approach to the concept through the transdisciplinary paradigm.

Keywords: *sustainable development, circular economy, polycrisis/permacrisis/metacrisis, non-resilient transitions, sustainable development dynamics matrix.*

REDEFINIREA DEZVOLTĂRII SUSTENABILE ÎN CONTEXTUL PARADIGMEI TRANSDISCIPLINARE

Autorii au abordat problema dezvoltării sustenabile folosind abordarea transdisciplinară, precum și abordarea sistemică, procesuală și sinergetică. Sustenabilitatea trebuie analizată și evaluată în contextul celor cinci crize și tranziții: 1) tranziția geopolitică; 2) tranziția energetică; 3) tranziția climatică; 4) tranziția demografică și medicală; 5) tranziția tehnologică. În acest sens, introducem conceptul de criză multiplă pentru a reconfigura într-un mod nou, transdisciplinar cele trei aspecte ale dezvoltării durabile: reziliența, viabilitatea și dezastrele/crizele. Prin înțelegerea dinamicii sustenabilității, putem identifica ce fel de strategie și dezvoltare continuă ar putea fi implementate prin tehnologii, știință, educație, reglementări de stat și de antreprenoriat. Conceptul de dezvoltare durabilă, formulat de ONU în anii ‹80, nu funcționează în oferirea unei soluții complexe pentru rezolvarea problemelor mai sustenabile de dezvoltare și ecologie. De aceea, autorii aduc o nouă perspectivă și abordare a conceptului prin paradigma transdisciplinară.

Cuvinte-cheie: *dezvoltare durabilă, economie circulară, polycrisis/permacrisis/metacrisis, tranziții non-reziliente, matricea dinamică a dezvoltării durabile.*

Modern definitions and models of sustainable development

The concept of sustainable development is not new in the day-to-day vocabulary and professional activities. In German language, the term *Nachhaltigkeit* was used since 1713, which approximately had the same meaning that we perceive today. It meant preserving natural resources for the future [1]. A *theory on the optimal rate of exploitation of non-renewable resources* was formulated by Harold Hotelling in 1931, which is still relevant today [1].

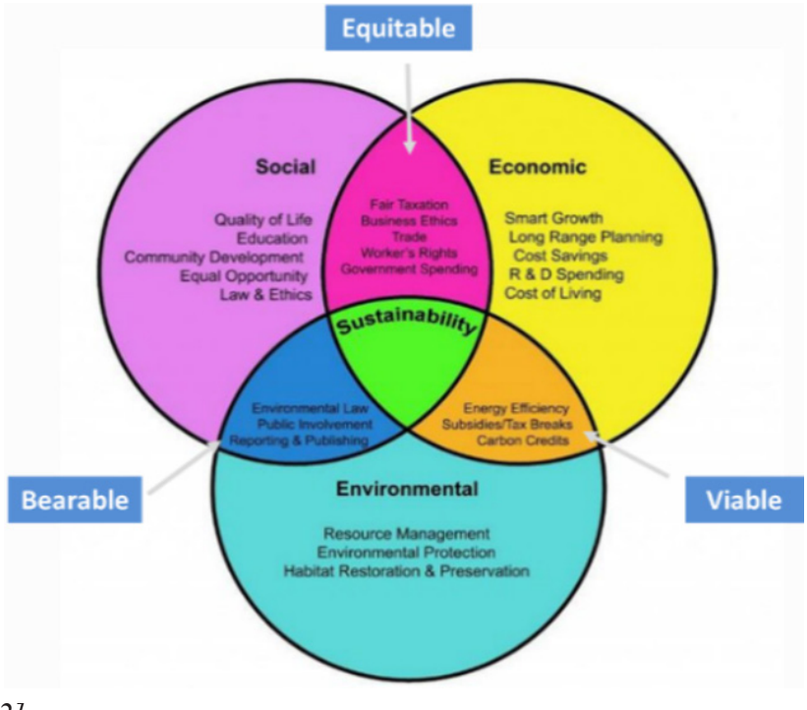
A concluding concept of the sustainability was given by the Brundtland Report of 1987, led by the former prime minister of Norway, Gro Harlem Brundtland, being formulated as a *development that meets the needs of the present, without compromising the ability of future generations to meet their own needs* [2]. Although it looks like a comprehensive and relevant definition, accepted by the UN, this definition looks to

be disjunctive and separates present and the futures, the generations and economic progress and environmental protection. Meanwhile, this approach fosters the idea and the dilemma of a *„weak" sustainability* (providing economic wealth to the next generation), and a *„strong" sustainability* (protecting the environment and preserving the natural resources) [1, 3]. In terms of achieving sustainable goals, it raises more questions than answers to tackle and solve the environment and the polycrisis.

Wrigley J. A., from Arizona State University, defines sustainability from the point of view of conservation as follows: *„Conservation is greater than individual, group or nation. Includes scope, scale, important demand that has ever taken with quick solutions to environmental protection and other complex problems"* [4, 5]. Leeuw S.V. submits a more complex definition, stressing the importance of justice as a broader asper of the social life by *„living in harmony with social and environmental conditions based on the sense of equality and justice"* [6]. A process-oriented approach is tackled by Pearce D and Turner RK in 1990, coming with the idea that development could assure sustainability and economic efficiency for the residents of communities by creating a *circular economy* [7]. At G20 Summit, held in New Delhi in September 2023, the circular economy model stays at basis of the sustainable development mechanisms [8]. It means that each output of the production or activities should be an input for the next operation or process. In this way, the waste should be recycled as the next chain of the process, preserving the resources, and protecting the environment. Although this concept plays a big role in rationalizing of the resources and waste management, circular economy does not help us to solve the polycrisis and help the world to create a viable economy and reduce the vulnerability (see description below).

The UN elaborated on the concept of the Triple Bottom Line (TBL), published in the *2007 Livable Cities Report*. It emphasizes that sustainable development should meet the needs of residents in three key areas: environment, economy, and social factors [4, 9]. In this respect, we can have an *equitable* development, if the economy provides a good quality of life and justice. A society with efficient environment preservation and resource management will create a *bearable* environment for individuals. But to ensure this ecosystem (See Fig. 1), we need to have an *ecological economy* with *viability* solutions in terms of energy efficiency, carbon emission reduction, good waste management, etc. This concept and the systemic approach involve the idea of equilibrium between the main ecosystem of the society and economy. If the system finds the right equilibrium, it will provide *equitability, bearability, viability or sustainability*.

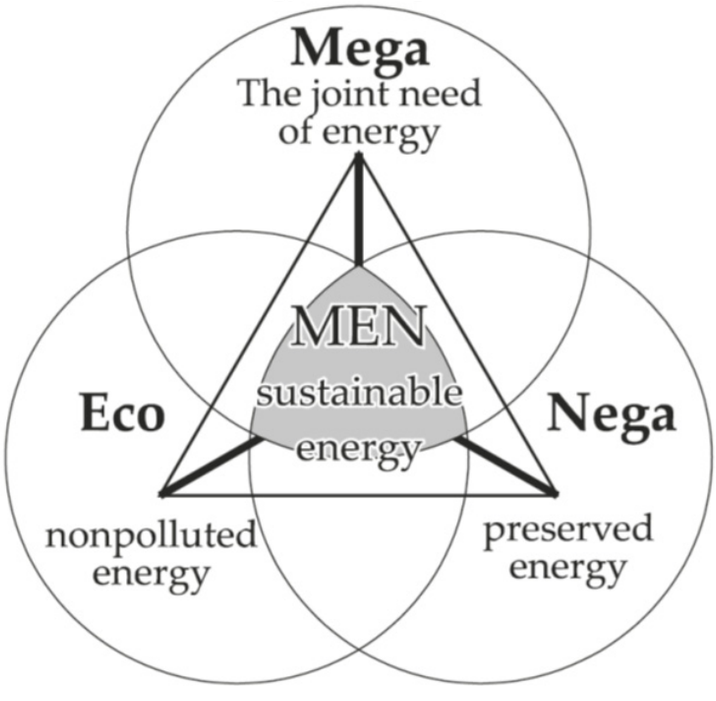
Fig. 1. ENSEC Sustainable Development Model (Triple Bottom Line).



Source: [10, 11, 12].

In terms of energy management, MEN concept (Mega-Eco-Nega) is one of the basic models that is linked to ENSEC sustainable development concept [10, 11]. It implies that there is a growing *demand for energy* (Mega), but the challenge lies in ensuring that its consumption and sources are ecologically sustainable (Eco), involving either reduced consumption or efficient use of regional and preserved energy sources, as these resources are finite (See Fig. 2). The MEN concept stays at the basis of the viable solutions in terms of energy consumption. In 1990, *Rocky Mountain Institute* has come up with an innovative way to foster such efficient gains by *negawatt markets* that would treat saved electricity as a commodity [13, p. 22]. The actual technologies and state policies are oriented to megawatt markets aiming to gain indirectly from the green economy. As Lovins states, ,,perhaps the strongest incentive to create negawatt markets is their win-win solutions to many environmental problems… it's now generally cheaper to save fuel than to burn it, global warming, acid rain and urban smog can be reduced not at a cost but at a profit” [13, p. 23].

Fig. 2. MEN Concept of sustainable energy consumption.



Source: [10].

A variety of approaches and models of sustainable development have emerged in the last 40 years, all attempting to define the concept while being closely linked to contemporary trends. Often, these concepts have been formulated in response to issues such as pollution, scarce resources, climate change, geopolitics, and energy crises. However, these approaches and models also present additional dilemmas and challenges for the world, governments, and international institutions.

Challenges of Sustainability and its Interpretations

Despite the existence of numerous local and international mechanisms aimed at promoting sustainable development and addressing ecological issues, dilemmas and vulnerabilities in achieving sustainability goals persist since the Rio Earth Summit in 1992. Progress toward international institutional goals has been limited [14], and new challenges continue to emerge, contributing to a state of permacrisis. The main challenges and dilemmas associated with the current understanding of sustainability are as follows:

- There is an ongoing debate between ,,strong” and ,,weak” sustainability, questioning whether the new generation will inherit economic wealth or a preserved resource economy.
- The dilemma of balancing economic progress and environmental preservation remains unsolved, both in terms of conceptualization of sustainability and practical implementation in creating viable economies.

- None of the sustainability goals set since the Rio Earth Summit in June 1992 have shown significant progress [14].
- Renewable energy technologies are more labor and material-intensive and require rare earth elements [15].
- Geopolitically, energy security poses a risk for most countries and companies [15].

The discouragements and limitations of the sustainable development understanding is not expressed just by the scientific communities but by high ranked officials of international organizations such as the UN Secretary-General *António Guterres.* He addressed to the *UN Economic and Social Council* in 2022 that *„Our world is suffering from the impact of unprecedented emergencies caused by the climate crisis, pollution, desertification and biodiversity loss, the COVID-19 pandemic, by new and ongoing conflicts, and by the ungoverned development of new technologies"* [16, 14]. The same challenges are being addressed in international forums such as G20 Summits [9], highlighting that decarbonization, poverty, pandemics, and efficient resource utilization remain significant unresolved issues.

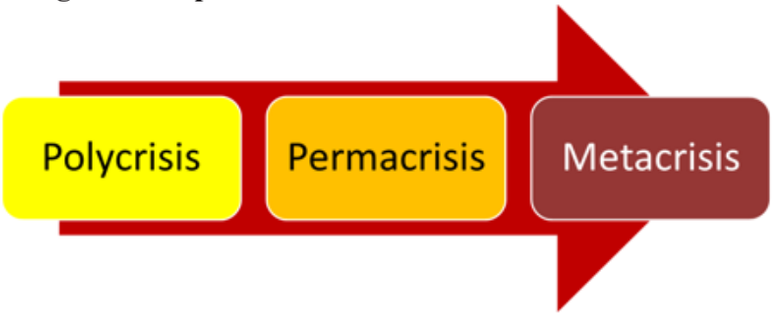
The efforts made in recent decades to achieve sustainable development appear to be more ideological than substantial progress or development that would propel society to the next level. This situation prompts us to question the definition of sustainability and seek new approaches to addressing this complex challenge. The environment and geopolitics are becoming increasingly complex and unpredictable. Therefore, we believe that sustainable development needs to be approached from a transdisciplinary perspective to effectively navigate the complexities and uncertainties of the global economy, environment, and geopolitics.

The Transdisciplinary Approach of the Sustainability

As stated by Pop I., Talpoș M., and Prisac I., transdisciplinarity offers a framework to comprehend and address complexity, providing a new level of understanding and solutions to human needs and society [18]. In the context of the challenges facing sustainability in the 21st century, we believe transdisciplinarity is essential for understanding and tackling these issues because [18]:

- Transdiciplinarity gives interpretive approaches, critical science, and grounded theory.
- This paradigm explores the values in a new synergistic generative context.
- It helps to create a new praxis through working pragmatically by a sustainable all life learning.
- Uses integrative learning concepts as a movement toward integrated lessons.
- This approach helps people to make connections, putting together skills and knowledge from multiple sources and experiences.
- It applies skills and practices in various settings, utilizing diverse and even contradictory points of view.
- This is the paradigm aimed to tackle system far from equilibrium, in transition/crisis, and is chaotic.

Fig. 3. Multiple Crisis State of the World Phenomena.



Source: Elaborated by the authors.

The constant of the multiple crisis is one of the fundamental reasons why we need to approach sustainability development in the view of the transdisciplinary way. The specific situations in the communities, countries, and around the world are of paramount importance, and these phenomena: polycrisis, permacrisis, and metacrisis, with general integrative multiple crisis, have implications about worldviews, probabilities, and priorities, in the conditions of all risks (climate changes, wars, tsunami, corruption, energy, pollution, desertification, migrations), disasters, hazards and other such situations. The term "crisis" is often used, including polycrisis, permacrisis, and metacrisis as well (See Fig. 3). The term polycrisis indicates that there are many intersecting crises with general causes [19], whereas permacrisis indicates that these are no longer unusual periods of time [20], while metacrisis indicates that there are some deeper crises relating to most of the individual crises [20]. Very often, most individuals even

do not understand that there is a crisis or what kind of crisis they are going through. In other words, the multiple crises the world is suffering from, leads to the state of continuous crisis that makes it very difficult to perceive and cope with.

In this respect, Dochia A. calls this state the *5 non-resilient transitions,* meaning that we are passing through 5 types of crises that *resilience* is limited in tackling these transitions [21]. It needs individual and *viable* solutions. We are not able to resist the change and the transition to the climate, energy transition, geopolitical transition, demographic and medical transition, as well as technological transition (See Fig. 4). We need to rethink the relationship between resilience, viability, and subsistence to eliminate the risks of socio-economic and environmental vulnerability. To assure sustainable development in an unsustainable, unfair and unstable environment, we must respond with viable solution and help the system „to jump” to the next level of development and to create the state of a *dynamic equilibrium* [22, 23, 24, 18]. The creation of a dynamic equilibrium is the way to cope with the permacrisis and lay the foundation for the sustainable development when instability take place and the development adapts and detect the right equilibrium and positioning to respond to the permacrisis.

Fig. 4. Five non resilient transitions.

Source: *Elaborate by the authors.*

The goal in this situation is to create dynamic equilibrium or to jump to the next level of development (See Fig. 5). It is possible by creating positive feedback for the system in transition. Very often this „jump” to the next level opens the horizon to new viable solutions. It helps to see the „black swans” of energy or resources solutions [15]. Or, the non-resilient transitions open a whole spectrum of opportunities to grow to the next level and to benefit from a new form of equitable, bearable, and viable society and a new level of sustainable development. In this respect, we consider that transdisciplinary sustainable development could be defined as *developments aimed to cope with the climate, energy, geopolitical, demographic/health and technological transitions in a viable, bearable and in an equitable way to create the right dynamic equilibrium and jump to the next level of human development.*

Considering non-resilient transitions, we can identify more sustainable development strategies. These strategies could be based on the classical parameters of sustainability the as well [22], such as:

- Equitable development, fair society;

- Energy security/free access to energy and resources;
- Viable economy;
- Cost optimization and economic efficiency;
- Bearable development;
- Net-zero emissions/efficient waste management.

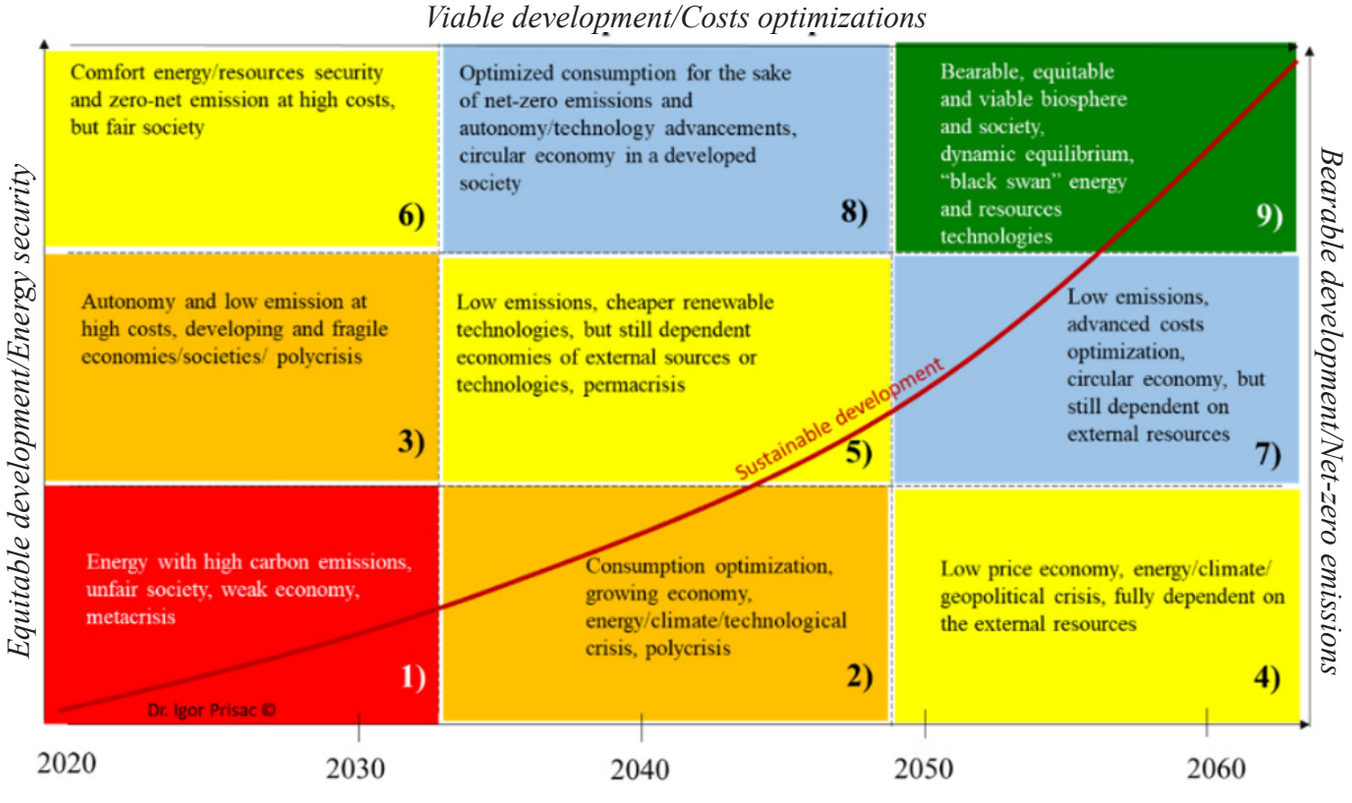
This approach enables us to discern at least three levels of development and nine strategies that address the aforementioned parameters over time. Level 1 and situation 1, represent the stagnation in development with an energy consumption with high carbon emissions, unfair society, weak economy in a metacrisis (See Fig. 5).

At level 1 we can have at least 3 development strategies and the biggest response to the crisis is just providing a low-price economy in a geopolitical crisis and fully dependent on external resources. These countries are caught in geopolitical dependence and lack sufficient political, financial, and economic power to navigate the permacrisis easily. While wealthy countries may find it easier to manage the crisis, this doesn't necessarily equate to transitioning to the next level of development, where actors engage in a fundamentally different game within a new paradigm.

If the subject of sustainability will stay at level 1, it means that their strategies will not help to cope with the transitions. In other words, they are not in transition at all.

The initial „jump" to level 2 may position the system within the permacrisis, leading to reduced emissions and access to new technologies, but the system may still remain dependent on external sources. The primary strategy at this level is to identify suitable energy and natural resources or to uncover the „black swans" of these resources in order to transition to the third level of sustainability. The risk at this level is that developmental investments may result in stagnation or even regression to level 1 if the system cannot effectively handle new crises or transition to the next level. Most of the developing countries in the world are at level 1 or 2, having the danger of being stuck in the middle and never developing in terms of sustainability.

Fig. 5. Sustainable Development Dynamics Matrix.



Source: Elaborated by the authors.

In the case of level 3, due to advanced technologies and scientific discoveries, the system demonstrates advanced cost and energy efficiency, a fully circular economy, and establishes the right dynamic equilibrium to cope with the permacrisis. The only condition to achieve strategy 9 is to discover the ,,black swan” of energy, resources, technologies, and solutions, and to break the vicious circle of remaining at a lower level of development that is unable to create the right dynamic equilibrium.

Conclusions

1. The concept of sustainable development, formulated by the UN in the 1980s, cannot provide a comprehensive solution for addressing crises in the ENSEC (TBL) context. Therefore, we propose a new perspective and approach to the concept, called the multiple crisis, using the transdisciplinary paradigm, which offers additional models and concepts for a better understanding of this complex problem.
2. Disaster has emerged as a new approach to address what is recognized as polycrisis, permacrisis, or metacrisis, constituting a general, integrative multiple crisis that persists as a permanent crisis across all levels of society and economy, manifesting in various ways. Whether natural, man-made, or a combination of both, disasters typically involve geographically specific events, such as hurricanes or oil spills.
3. Although wealthier countries possess the financial resources to mitigate local disruptions, this does not necessarily indicate a transition to the next level of sustainable development within the framework of a transdisciplinary approach.
4. Resilience and viability are intricately interconnected, making it challenging to isolate them from each other. Therefore, they must be reconfigured contextually in an integrative transdisciplinary manner, fostering self-reliant resilience and local adaptation. This approach could yield outcomes that empower professionals in international cooperation to discover new significance through a more pragmatic framework for their endeavors. It is imperative to reconsider the relationship between resilience, viability, and subsistence to mitigate the risks of socio-economic and environmental vulnerability in the short to medium term.
5. Sustainable development endeavors to address climate, energy, geopolitical, demographic, health, and technological transitions in a manner that is viable, bearable, and equitable, with the goal of establishing the appropriate dynamic equilibrium.
6. The system requires the correct dynamic equilibrium to navigate the permacrisis and advance to a higher level of sustainability.
7. We must consider the appropriate parameters to achieve positive feedback on sustainability and attain a dynamic equilibrium in transitioning to the next level of human development.
8. We can identify nine scenarios of sustainability dynamics to understand what strategies, continuous improvements, and positive feedback can be achieved through technologies, science, education, state regulations, and entrepreneurship to ensure progress and development by transitioning to the next level of dynamic equilibrium.
9. It is crucial for our mission not only to pursue specific goals of sustainable development ideology, but also to establish the appropriate dynamic equilibrium within the context of permacrisis, aimed at offering pertinent solutions to society, the economy, and the environment.

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