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A geographical information systems (GIS) perspective on European green deal and sustainability

Mustafa Önder*[1], Ahmet Güntel[1], Özgür Yanıt Kaya[1]

[1]*Mescioğlu Engineering and Consulting Inc. Ankara, Türkiye*[2]*University, Faculty, Department, City, Country*

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ABSTRACT

The European Union (EU), known for its sensitivity to environmental and social sustainability issues, especially on topics such as combating climate change, reducing greenhouse gas emissions, and using renewable energy since the 1990s, took these sensitivities one step further in November 2019. In November 2019, it took these sensitivities one step further and presented a package of initiatives, a commitment by the Union to take firm and ambitious steps in environmental and sustainability issues: The European Green Deal. The Memorandum aroused significant repercussions for all state, international organisations and private sector players that have economic, political and geographical connections with the EU, because the Consensus, which consists of the standards set by the EU for its member states, also has the potential to affect the relations of EU countries with third parties. This situation has revealed the necessity of a good understanding of the Agreement by everyone, given the wide commercial and diplomatic ties of the EU. In the geographic data infrastructure designed within the scope of this study, a total of 26 intermediate criteria grouped in 5 main criteria were used. Within the scope of the study, we aim to test the analysis to be made with the availability of quantitative data and topographic data by the European Green Reconciliation. By making use of these data used in the continuation of our study, expert opinions, surveys, etc. can be weighted with AHP or TOPSIS method, and positions, companies, etc. that are important for the Green Reconciliation can be determined.

1. Introduction

Within the scope of the initiative created after the President of the European Commission, German Politician Ursula Von Der Leyen took office on 1 November 2019, it is aimed to complete the transition of the EU to a carbon-free economy by 2050. In order to achieve this goal, the Commission has published the «Sustainable Europe Investment Plan». The Green Deal is the EU's new growth strategy that includes the main objectives of zeroing net greenhouse gas emissions by 2050, decoupling economic growth, and leaving no one and no region behind. That is, the agreement will create jobs and improve quality of life while reducing emissions. At the heart of the core components of the EGD is the aim of transforming the EU economy for a sustainable future. In order for Turkey to continue its cooperation with the EU, it needs to understand the regulations in the sectors that are expected to undergo the most changes and transformations within the scope of the agreement; such as agriculture, electronics, packaging, plastics, textiles and construction including manufacturing branches that provide input to construction. It also needs to follow the developments and develop the ability to take quick steps in adapting the standards to be established (Güçlü, 2021). It is shown in figure 1.

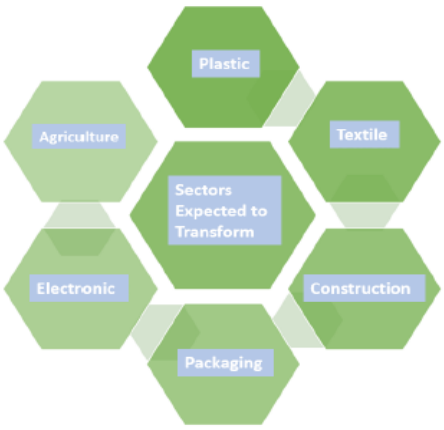

Figure 1. Sectors expected to change and transform the most

The main elements of the agreement for 2030 and 2050 have been identified as follows by the European Green Deal with the aim of making Europe a climate neutral continent by 2050:

***Corresponding Author**

*(monder@mescioglu.com.tr)ORCID ID 0000-0002-9267-1543
(aguntel@mescioglu.com.tr) ORCID ID 0000-0001-5718-3280
(ykaya@mescioglu.com.tr) ORCID ID 0000-0002-2776-3468

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• Clarifying the EU's climate targets for 2030 and 2050,
• To provide clean, accessible and safe energy,
• Mobilizing the industry for a clean and circular economy,
• To follow an energy and resource efficient way in construction and renovation,
• From farm to fork: designing a fair, healthy and environmentally friendly food system,
• To achieve the zero pollution target for a toxic-free environment,
• Accelerating the transition to sustainable and smart mobility,
• Protecting ecosystems and biodiversity (Kaya, 2022).

2. Sustainability

Sustainability is the ability to meet the needs of the present without compromising the ability of future generations to meet their needs (United Nations). The understanding of sustainable development is the structuring of the economic and social development goals of countries according to the principles of "sustainability". United Nations sustainability development goals are No Poverty, Zero Hunger, Good Health and Well-being, Quality Education, Gender Equality, Clean Water and Sanitation, Affordable and Clean Energy, Decent Work and Economic Growth, Industry, Innovation and Infrastructure, Reduced Inequality, Sustainable Cities and Communities, Responsible Consumption and Production, Climate Action, Life Below Water, Life On Land, Peace, Justice, and Strong Institutions, Partnerships for the Goals.

Green Deal that it is not possible for Europe to achieve the consensus environmental target by acting alone. The drivers of climate change and biodiversity loss are global and not limited to national borders. The EU has planned to use its sphere of influence, expertise and financial resources to mobilize its neighbours and stakeholders to join it in a sustainable way. To achieve the goals of the EGD, there is a need to rethink the policies of clean energy supply, industry, production, consumption, large-scale infrastructure, transportation, food, agriculture, construction, taxation and social benefits throughout the economy. To achieve these goals, it is essential to increase the value placed on the protection and restoration of natural ecosystems, the sustainable use of resources and the improvement of human health. This is where transformational change is most needed and potentially most beneficial to the EU economy, society and natural environment. The EU should also promote and invest in the necessary digital transformation and tools, as they are key drivers of change (Görgün, 2021).

3. Geographical Information Systems

The environment, which is defined as where living and non-living beings coexist since the existence of human beings, is at the full focus of life, interacting with the human, plant and animal factors of the main elements such as soil, water and air. In this formation, the interaction of all actors in all aspects creates the life cycle. The survival of human beings in a certain quality in this process takes place within the "rules set" that is set and applied by him. A map, in its simplest definition, is the representation of the land on paper by reducing it to a certain scale. After the positions of natural and artificial objects on the earth are measured by map engineering techniques, their projections on the horizontal plane are presented graphically with lines and special signs. Since today's maps are now produced and stored in electronic media instead of paper, users can be provided with much faster and more detailed information. Depending on the changes in information technology, the need to use computers in order to perform classical mapping operations faster and more accurately has significantly accelerated the development process of location-based information systems. Therefore, traditional paper maps have turned into electronic maps, thus the concept of "smart maps" has emerged (Figure 2).

Today, decision makers need not only graphic but also additional textual information describing object properties. This situation has made it inevitable to create more effective new systems that can combine graphical and textual information. Such shortcomings, initially encountered in CAD (Computer Aided Design) systems, paved the way for the emergence of Geographical Information Systems (GIS) in today's sense. (GIS, 2017).

Figure 2. Database management system

Geographical Information System collects, analyses and presents location-referenced data, which is basically defined as geographical data, with appropriate technological tools. Unlike other information systems, GIS simultaneously stores and processes the geometric information of all kinds of objects on the map in a database. Therefore, there is a feature that is not found in classical databases but only in GIS, which is the ability to analyse "location" based transactions. However, when GIS is considered as a system that manages geographic data rather than a map display tool, five basic components of a geographic information system, consisting of data, software, hardware, people and methods, should work in an integrated structure. In general, data collected by mapping techniques and methods are first stored in computer databases with the help of appropriate software and processed according to user expectations. User requests become guiding for the duplication of information produced by the necessary hardware and for sharing over virtual networks. Data, which is accepted as the most basic element for GIS, is also seen as the most difficult component to obtain. Due to the multitude of data sources and their different structures, data collection, organization and verification

in GIS requires at least more than half of all the time and cost of a system to be established.

3.1. Widespread impact and application areas of GIS

Geographical information technology has a wide range of applications used in many sectors. GIS is included in all kinds of applications related to location information. GIS has started to be used as an important common concept in many applied professions such as land management, planning, agriculture, forest, landscape, construction, geology, climate, atmosphere, defense, safety, tourism, archeology, local government, population, education, environment and health. Processing and analyzing large volumes of data based on geographic information and making decisions based on the results is only possible with the effective use of GIS. When we look at the common usage areas mentioned above, it is observed that almost all of them coincide with the areas of interest of EGD (GIS, 2017) (Figure 3).

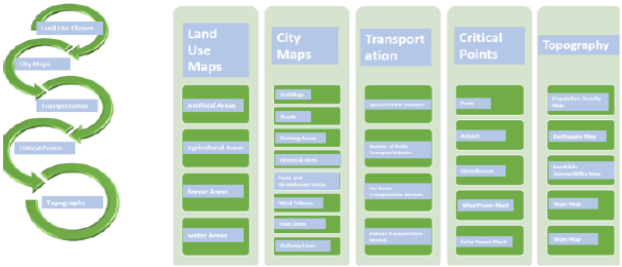

Figure 3. Classification of geographical data used

3.2. Database and database management systems

A database can be defined as a dataset that typically describes the activities of one or more organizations. If we can store these databases on a computer using various software such as spreadsheet software, and even enable others to access these data in a controlled manner and perform operations such as adding and changing on the data, then we have a "database management system". Today, the term Database Management System (DBMS) is understood as software systems that contain databases, allow users to be authorized, provide various data access and data processing functions and interfaces, and contain supporting mechanisms such as backing up and repeating data (Figure 4) (Ergünal, 2021).

Figure 4. Geodatabase

When the system is examined in the context of EGD interests and topics, it will be observed that a large number of public institutions and organizations and the activities carried out in this context by the private sector can talk to each other under a single roof, repetitions can be avoided, and an efficient and effective structure will be achieved. The most important advantage of using database management systems in the processing of geographical data is that geographical and no geographical data are collected in a center, on a single system, and more efficient data processing, sharing, protection and backup opportunities are obtained within a geoportal architecture (Figure 5) (Erginoğlu, 2021).

Figure 5. The importance of 3D geographic data

4. Major EGD Topics and New Geographical Data Concepts in This Framework

EGD has brought many new terminologies with it to the present day such as: Green and Circular Economy, Green Finance, Sustainable Agriculture, Sustainable Smart Transportation, Green Logistics, Carbon Neutral, Green Building, Emissions Trading System (ETS), Border Carbon Regulation Mechanism (BCRM). All of these include the main descriptions of the arrangement of natural or man-made objects on the earth's geography within the scope of EGD When the subject is geography, that is, a spatial structuring that includes all of the earth's and underground riches of the atmosphere, it has been evaluated that it will be important to emphasize the necessity of geographical data and to highlight the issues of LULUCF and Green Cadastre, which symbolize sustainability in the best way, so that the most appropriate use of this geography, which we call environment, can reach future generations (Taşkıran, 2020).

Carbon Absorber: They are natural or man-made systems that absorb and store carbon dioxide from the atmosphere. Forests are the most common type of pharynx. Also, soil, peat, permafrost (permafrost) soil layers, ocean water, and carbonate sediments in the deep ocean are other forms of sink.

Carbon Capture: It is the process of capturing and/or removing carbon from the atmosphere and storing it in a warehouse in a way that prevents it from being released into the atmosphere for a specified period of time.

Importance: CO2 in the atmosphere can accumulate in terrestrial ecosystems as carbon by photosynthesis in vegetation and soil. Under the United Nations Framework Convention on Climate Change (UNFCCC), any process, activity or mechanism that removes greenhouse gases from the atmosphere is called a sink. Through human activities, land use, land use change and

forestry (LULUCF) activities, the exchange of CO2 (carbon cycle) between terrestrial sinks and thus the terrestrial biosphere system and the atmosphere can be altered. LULUCF Sector consists of 6 land uses. These are Forest Areas, Agricultural Product Areas, Pastures, Wetlands, Settlements and Other Areas (Rocky, sandy lands). In LULUCF sector, in addition to land uses, there is also a resource sub-sector Wood Products (Timber, Panel Products, Paper-Pulp).

Agriculture and forestry are two important sectors that affect and are affected by climate change. Greenhouse gas calculation studies in the LULUCF sector are carried out in Turkey with the coordinated work of the General Directorate of Forestry and the General Directorate of Agricultural Reform (Figure 6) (Acar (2021).

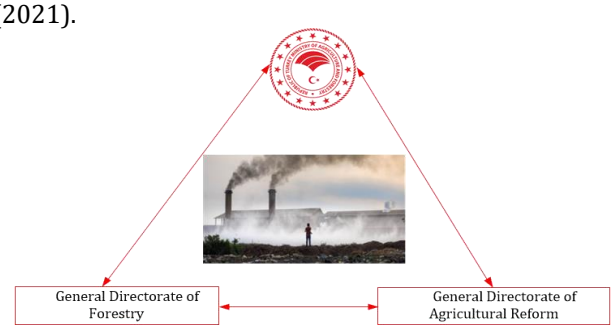

Figure 6. Greenhouse gas calculation studies

Another prominent land use in the LULUCF sector is wetlands. The amount of carbon accumulated in wetlands accounts for one-fifth of all carbon on the planet. This is a value equal to the total carbon in the atmosphere. Therefore, the protection of wetlands, especially peatlands, is of critical importance in the fight against climate change. Today, half of the world's population lives in cities. In the next 40 years, the urban population is expected to exceed 2.8 billion people. As a result, for example, in 2030, residential areas will need to increase by 250%, i.e. 1 million square kilometers. In the fight against climate change, a correct urbanization approach with green areas should be seen as a basic and critical solution approach. One of the important goals within the scope of combating climate change is to balance greenhouse gas emissions and attitudes. In this context, the importance of LULUCF, which is the only sector in which carbon sequestration is calculated in the greenhouse gas inventory, emerges.

4.1. Green cadastre

Green Cadastre; It is a new term that has emerged to help today's urban and rural areas become greener. It covers the processes for mapping, recording, and cataloging all public green spaces, including every shrub and tree. The creation of the “green cadastre” is part of a program that aims both to promote the expansion of green areas for urban and rural areas in line with European norms, and to improve the city's preparedness, in particular, for natural disasters and climate change. Experts have long argued that to improve planning and policy making, the countryside and the city need a complete record of parks and other green spaces, including all plant species. Conservation of green spaces is very important for environmental reasons as well as for the health and quality of life of urban and rural residents (TOBB, 2021). Gündüz & İyiler (2021) UNDP emphasizes that establishing a green cadastre will especially help to increase the urban resilience of cities and the city will need to develop strategies to deal with the future effects of climate change on urban infrastructure (Figure 7).

Figure 7. Sample green cadastre draft study

The green area cadastre is the basis for the efficient and cost-effective management of green areas and facilities. Access to up-to-date data simplifies planning for manpower allocation and machine operation. Besides allowing the economical and targeted use of materials, it ensures the optimization of the entire business operation and at the same time increasing cost transparency. Existing property data held by government authorities is of essentially limited value for greenfield cadastre, as it does not provide a description of objects or information about the use and condition of your facilities. These factors are absolutely essential for the efficient management of green space. Here, the use of GIS for the management of all kinds of geographical data is of great importance. The reduction in farmland area resulting from global population growth requires active monitoring and protective measures to prevent the loss of this valuable resource. Currently, most countries do not have a geographic information system that comprehensively supports agricultural policy. However, there are many dispersed systems containing various data on agricultural production. The analyzes reveal that a reference Land Management System (LAS) integrated with farmer databases can contribute to the monitoring of farmland and support agricultural policy (Noe, 2019).

5. Conclusion

The basic fuel of the technologies (Big Data, Cloud Computing, Internet of Things, Artificial Intelligence, Sensors, Virtual Reality, Platforms, Drones, 3D Printer, Simulation, Smart Cities, etc.) of the Industry 4.0 Revolution we live in is "Digital Data". A large part of this data is within the scope of "Spatial (Spatial)", that is, "Geographic Data", and the process of collecting this data and converting it into "Geographical Information" together with the content of the attributes is directly in the field of interest of the "Map and Cadastre" sector. The

biggest negativity created by the industrial revolutions, which have been going on for more than 200 years and especially today, has resulted in a significant deterioration in the balance of nature and life. The climate change caused by the greenhouse gas effect, with the production frenzy as a result of the industrial revolutions, is rapidly leading to a world that cannot sell its production in the near future. Efforts such as the European Green Deal, Paris Climate Agreement, and COP 26 that emerged in order to put a stop to this negative trend stand out as mechanisms to regulate activities that will minimize the negative effects in different areas of production. The multiplicity of areas that create negativity (construction, energy, transportation, etc.), the search for solutions within each area and the efforts to create a set of working groups for this brought along the necessity of continuing the work done on a common ground. Climate change directly affects the geography of the earth, and its atmosphere, aboveground and underground elements take their share from this change (Önder, 2019; Melik, 2020).

The solution goes through a structure which not only seriously analyzes the geographical data collected by various sensor systems (Digital camera, Lidar, etc.) from the air (airplane, drone, etc.), from space (satellite) and on the ground, from the past to the present, but also provides new data that the areas where negativities arise on this geography promptly with new measurement and mapping techniques when necessary. By creating a database based on GIS and supported by Industry 4.0 technologies as a common denominator, it will be possible for different sectors to talk to each other through this base, to observe the adequacy levels of the efforts, to monitor and question the measures taken, and to provide an EGR infrastructure that facilitates the work.

Author Contributions

The contributions of the authors to the article are equal.

Statement of Conflicts of Interest

There is no conflict of interest between the authors.

Statement of Research and Publication Ethics

Research and publication ethics were complied with in the study.

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