Chapter 2

The Role of Digital Product Passport in Sustainable International Trade

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Abstract

International trade is a highly dynamic structure due to the abundance of documents, time constraints, and complexity of processes. Sustainability compliance also has become a key determining factor in international trade for the upcoming period. Under the Green Deal implemented by the European Union, simply producing quality products or offering competitive prices is no longer sufficient. A product's entire journey, from production and raw material sourcing to energy use and recycling, must be documented with a digital identity. The digital product passport (DPP) is one of the standards introduced under the European Green Deal. The aim is to ensure that all actors in the value chain (producers, suppliers, importers, customs authorities, consumers, repair services, recycling facilities) have easy access to accurate and reliable information. Besides providing companies with advantages in terms of efficiency and cost reduction, it will also benefit them in terms of competitiveness and sustainability. However, there is a growing need for educational initiatives to inform all stakeholders about the benefits and use cases of DPP. Consumer awareness campaigns can increase demand for products with digital passports and encourage companies to adopt this innovative practice.

1. Introduction

As interest and concern for sustainability and environmental issues increase, countries, like individuals, have begun to take measures. Various new ways of doing business and standards in both production and consumption have become mandatory worldwide. Beyond national practices, environmental issues also dominate international trade. The first international movement on environmental issues is known as the Kyoto Protocol in 1997, followed by

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the Paris Agreement in 2015. Today, the environment and sustainability have become a topic that occupies the agenda more intensely among countries. One of the most comprehensive international agreements in this context in recent times is the EGD. The agreement is defined as the EU's roadmap for the green transformation process required by the Paris Climate Agreement. Announced on December 11, 2019, the EDG is the EU's new growth strategy aiming to make Europe the world's first climate-neutral continent with net zero greenhouse gas emissions by 2050.

The digital product passport (DPP) is one of the standards introduced under the EGD. Developed as part of the European Union (EU)'s goal to become climate neutral by 2050, the DPP is shaped within the framework of the EGD. Expected to be implemented starting in 2027, the DPP offers a digital identity covering all stages of a product, from production to use and recycling. A DPP is a digital database covering the entire lifecycle of a product. It includes information on all stages from production to the end-user, such as materials used, production processes, origin, waste management, environmental footprint, and usage instructions.

Therefore, the aim of this book chapter is to outline the scope, importance, and functioning of DPP, which is expected to have a significant application in international trade. Furthermore, its potential advantages and disadvantages, particularly for exporters, will be evaluated, and its expected role in international trade will be assessed from the perspective of both firms and governments.

2. Global Initiatives and European Green Deal

Sustainability compliance has become a key determining factor in international trade for the upcoming period. The common rule of tariff-free and quota-free trade, established by the World Trade Organization's multilateral agreement, now includes a "de facto" condition of sustainability compliance. As the United Nations identifies climate change, pollution, and biodiversity loss as interconnected issues—collectively known as the "triple planetary crisis"—threatening the future of the world, their impact is increasingly felt. In this environment where the climate crisis is constantly debated, the United Nations is intensifying its efforts by increasing the number of projects and working groups to develop new solutions, thereby leading the way in finding faster solutions. Since 1972, commissions have been established, reports have been prepared, conferences have been held, and numerous agreements have been signed under the auspices of the UN to support the international fight against environmental pollution and the preservation of the balance of nature, and to raise global awareness (Özmehmet, 2008). One of the most recent of these initiatives is the EGD, launched by the EU in 2019.

The EU, with its EGD announced on December 11, 2019, set out its goal of becoming the first climate-neutral continent by 2050. To achieve this goal, the EU stated that it would adopt a new growth strategy and reshape all its policies around climate change. Envisioning comprehensive changes in EU policies across a range of areas from industry and finance to energy, transport, buildings, and agriculture, the Green Deal is one of the EU's biggest initiatives. Announced in December 2019 by European Commission President Ursula Von der Leyen as the EU's new growth strategy, the EGD outlines the EU's plan for transitioning to a competitive, resource-efficient, and circular economy. Under the Green Deal, the Union plans to implement broad measures across numerous areas, ranging from energy and transport to agriculture, taxation, industry, innovation, and R&D policies (EU Presidency, 2021). The EGD, whose ultimate goal is to transform the EU into a fair and prosperous society with a modern, resource-efficient and competitive economy, has three main objectives: to achieve zero greenhouse gas emissions by 2050, to ensure a resource-independent economic growth model, and to leave no one and no region out (Kakişim, 2022; Lamenta & Grzybowska, 2023).

Targets and measures have been set in 8 areas to promote climate protection and conserve biodiversity, provide clean energy to Europe, create a sustainable industry, eliminate pollution, improve environmentally friendly mobility and establish large-scale sustainable agriculture. These 8 areas are as shown in the figure below:

- Increasing the EU's climate ambition for 2030 and 2050
- Providing clean, affordable and secure energy
- Mobilizing industry for a clean and circular economy
- Building and renovating in a resource-efficient way
- Accelerating the transition to sustainable and smart mobility
- "Farm to table": A healthy and environmentally friendly food system
- Protecting and restoring ecosystems and biodiversity
- The goal of "zero pollution" for a non-toxic environment

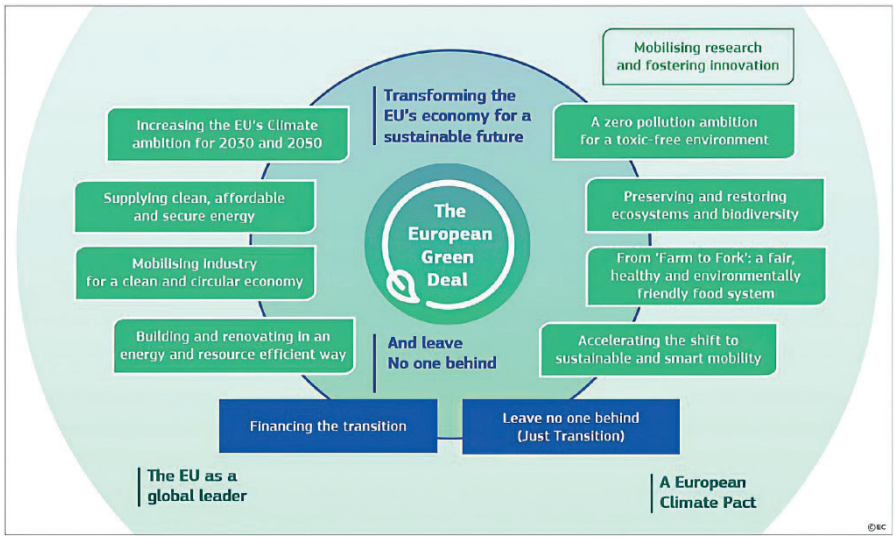

Figure 1. The European Green Deal

Source: (ab.gov.tr)

The Green Deal is based on four main components (ab.gov.tr):

1. **Reducing Carbon Emissions:** The Green Deal aims to achieve net-zero carbon emissions by 2050. It encompasses measures to limit the use of environmentally harmful substances, particularly fossil fuels, and to support the transition to renewable energy sources.
2. **Environmental Impact Assessment:** This component focuses on integrating the principles of a sustainable economy by mitigating the effects of the carbon cycle and using natural resources more efficiently. It aims to create and adopt practices that minimize environmental impacts.
3. **Just Transition:** This component involves planning and implementing measures to address social and economic inequalities. It particularly supports disadvantaged groups and low-income individuals working in high-carbon emission sectors through affirmative action.
4. **Conservation of Ecosystems and Biodiversity:** The final component aims to ensure the well-being of society and all living beings amidst threats to biodiversity and the destruction of natural ecosystems. It prioritizes the protection of ecosystems in agriculture, livestock, forestry and water resources.

Under these components, as part of the Green Deal's compliance package, Europe aims to reduce its emissions by at least 55% by 2030 compared to

1990 levels and to ensure that at least 32% of total energy consumption comes from renewable sources. The EU, through its Green Deal regulations, will seek compliance with sustainability conditions in imports from third countries, primarily Turkey, and will apply a carbon tax on imports depending on the level of compliance. The US and other countries are also preparing similar regulations. In this context, Turkey and other countries will face a carbon tax on exports to EU and US markets, and to markets that adopt these regulations.

The DPP application, also implemented by the EU within the framework of the Green Deal, has opened a new era in exports as of 2026. This regulation, which is being rolled out gradually, makes it mandatory for products offered to the European market to be traceable digitally throughout their entire life cycle, from production to recycling. Products that cannot provide the necessary data set will not be able to pass through EU customs.

3. Concept of Digital Product Passport (DPP)

Global trade rules are radically and permanently mutating by 2026. It is no longer sufficient to merely create quality products or provide competitive prices as witnessed in the Green Deal adopted by the EU. The whole process of a product, which involves production, source of raw materials, energy consumption and recycling should have a digital identity. The DPP is the point of most critical in this new generation of trade laws. This is supposed to guarantee easy access of accurate and reliable information by all the actors in the value chain (producers, suppliers, importers, custom authorities, consumers, repair facilities, recycling facilities). DPPs are applied to improve product sustainability and process transparency as a digital twin or identity of physical products. This offers a total information system which records and protein all data on a product, starting with its production, till consumption, and then recycling. When the DPP is made available online through QR codes or RFID tags, stakeholders in the value chain are able to access this data in real time. A DPP has many advantages that it can bring in different sectors. As an example, a DPP can be utilized by a textile company to open up its manufacturing process and materials of the product to be manufactured (Domskiene & Gaidule, 2024). This not only builds consumer confidence with the company but also creates a more sustainable image of the company. A DPP can be utilized by a food company to trace the food safety and the origin of its products. This helps avoid counterfeiting as well as enhances the reliability of the products. A DPP can be used to recycle the products of an electronics company. This will limit the waste that the company will generate and will limit its adverse effect to the environment. Indicatively, a manufacturer of batteries can use DPP to give information on the chemical composition of

the battery, the projected lifespan of the battery, safe disassembly protocols, and recycling. This also allows consumers to properly use the battery, and also the recyclers (who are authorized to handle the battery) to properly recycle it at the end of its life.

The importance of DPP is particularly evident in the following areas (Koppelaar vd., 2023; Schuberth vd., 2024; Walden vd., 2021):

- **Transparency and Traceability**: DPP provides consumers and businesses with reliable information about products. For example, when buying a textile product, you can learn about the fabric's origin, production processes, and environmental impact. This allows consumers to make informed choices. It increases accountability in supply chains by ensuring transparency in all processes from the origin to the disposal of products.
- **Accelerating the Transition to a Circular Economy:** It supports circular business models by providing the necessary information for the reuse, repair, and recycling of products.
- **Sustainable Consumer Choices:** It enables consumers to make more informed purchasing decisions by informing them about the environmental and social impacts of products.
- **Facilitating Regulatory Compliance:** It facilitates compliance with EU regulations such as the Eco-design for Sustainable Products Regulation (ESPR) and national environmental legislation.
- **Supporting Extended Producer Responsibility (EPR) Practices:** It provides the necessary data infrastructure for producers to fulfill their responsibilities regarding the end-of-life management of their products.
- **Global Competitiveness:** The EU is making DPP a prerequisite for products to legally enter the market. A product without DPP may not be able to find a place in the European market.
- **Sustainability and Environmental Impact Reduction:** DPP encourages the transition to more sustainable production processes by tracking the environmental impact of products. It also supports the circular economy by increasing the recycling and reuse potential of products.
- **Efficiency and Cost Savings:** Seamless data sharing among stakeholders in the supply chain reduces manual entry errors and speeds up processes. This saves businesses both time and money.

The information to be included in the DPP will vary according to the product group and relevant legislation. However, the following information categories are generally expected to be included:

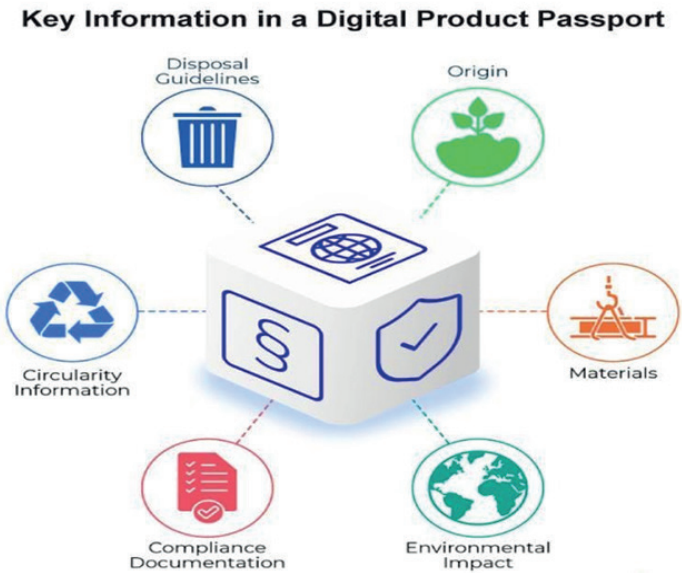

Figure 2. Key information in a Digital Product Passport

Source: Bluestone PIM, 2025

- **Basic Product Information:** Product identifier (e.g., GTIN), model number, manufacturer and importer information, TARIC code.
- **Material and Component Information:** Raw materials used in the product, chemicals (especially substances of concern such as SVHC), percentage of recycled content.
- **Sustainability Performance:** Carbon footprint, water footprint, energy efficiency, durability, repairability and recyclability information, voluntary labels such as the EU Eco-Label.
- **Use and Maintenance Information:** User manuals, repair instructions, safety warnings.
- **End of Life Cycle Information:** Disassembly instructions, recycling methods, waste codes, manufacturer's take-back or EPR program information. Documents of Conformity: Declaration of conformity, test reports, certificates.

All data will be systematically collected and then technically transferred to product labels and packaging using QR codes, RFID chips, or a combination of both. Digital records must be physically present on these labels. Digital data must remain accessible until the end of the product's life cycle, and the data flow must be transparent and continuous, with records shared with centers designated by the EU competent authorities. End consumers or control authorities will be able to scan the QR code or RFID chip with mobile and industrial devices and be directed to an online page displaying a complete and updated product passport for the specific product (Kalkancı, 2025). The data included in DPP is collected from all stages of the product lifecycle and can be used to optimize design, manufacturing, use, and disposal processes (Walden et al., 2021).

One of the most significant challenges in developing DPPs is exploring the possibility and potential of a standardized DPP that can support a unified format, rather than creating separate passports depending on the product or service in question. Such situations necessitate additional resources and components, increasing the complexity of the procedure by requiring the creation of separate DPPs that may differ in terms of information, purpose, and data types (Voulgaridis et al., 2024).

4. Role of Digital Product Passport in International Trade

Trade facilitation aims to simplify, standardize, harmonize, and make transparent the norms and practices involved in international trade. Transparency goals have become an increasing focus of international organizations and multilateral agreements (Bernal Turnes & Ernst, 2015). The DPP covers not only the main producer but the entire supply chain. In case a supplier of raw material or other material does not provide the required data, the passport of the company exporting the final product will be invalid. This has a very big domino effect on the supply chain. Exporters should also keep a close eye on their sub-suppliers and make them a part of this digital machinery. A sustainable export success appears unattainable without setting up a system of supplier management and constant monitoring. The most daunting to exporters in the near future will be the abysmal difference between the intention and the evidence. In the case of the countries where most of their products are sold to the EU states, this restructuring process requires new methods of structuring production, investing into green technologies, and other policies oriented at sustainability (Akpinar, 2025). New regulations like the DPP of the EU, or the Ecodesign of Sustainable Products Regulation (ESPR) currently require clear and proven information about the content of products. Under such regulations, in the event that you lack control of the data at the very end

of your supply chain, you will be automatically locked out of the European market, no matter how good the product is. Specifically, the manufacturers are currently financially and physically liable, through the EU law known as the Extended Producer Responsibility (EPR), that requires them to collect, recycle, and dispose of their products. That is, product waste is now having a direct effect on the balance sheet. The rules that were applied by EU under the green deal are mainly meant to enhance environmental sustainability. Nevertheless, these policies reshape international value chains with the trade policy. The change not only raises the cost of production of the Global South countries, but also limits their ability to invest in green technologies and subjects them to marginal economic models. The environmental transition zone countries, such as Turkey, are stuck between the integration with Europe and competition with other countries (Kucuk & Yuce Dural, 2024). Although there is growing attention to the topic of digital commerce and sustainability question, there is still a lack of evidence on the effects of regulatory disparity in digital services commerce on environmental performance (Dai et al., 2026). The enhanced contribution of digitalization and environmental protection is a key concern within the framework of the global economy development. The fundamental question to address is whether digital trade rules can reduce export-related carbon emissions and what mechanisms are necessary to achieve this (Liu & Gao, 2025).

5. Conclusion

International trade is a highly dynamic structure due to the abundance of documents, time constraints, and complexity of processes. Ensuring that all these processes are carried out quickly, accurately, and transparently provides significant advantages for all parties. Speed and security are crucial elements for both importers and exporters. Furthermore, transparent processes facilitate trade and support increased trade volume. In addition, conducting transactions in a sustainable manner and in compliance with environmental regulations is now an international requirement. The EU's Green Deal, in particular, has implemented serious standards to ensure sustainable trade. The DPP, which will begin implementation in 2026, is one of these. This passport process, which countries trading with Europe must have for their products, aims to make processes extremely transparent. Enabling the tracking of products from the first to the last stage, the passport makes the entire lifecycle traceable. Besides providing companies with advantages in terms of efficiency and cost reduction, it will also benefit them in terms of competitiveness and sustainability.

However, there is a growing need for educational initiatives to inform all stakeholders about the benefits and use cases of DPP. Consumer awareness

campaigns can increase demand for products with digital passports and encourage companies to adopt this innovative practice. Furthermore, governments should enact and enforce environmental protection laws to support social welfare, ensure a more livable world for future generations, and promote intergenerational justice. They should offer tax exemptions and incentive packages and implement sustainable development programs. These regulations should be designed to support businesses and facilitate the achievement of stated economic and commercial goals.

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