

The role of women's entrepreneurship in promoting the circular economy in European countries using (PCA).

دور ريادة الأعمال النسوية في تعزيز الاقتصاد الدائري في الدول الأوروبية
باستخدام المركبات الأساسية (PCA)

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Received :26/06/2024

Accepted:10/10/2024

.Published: 31/10/2024

Abstract :

Over the past few decades, the scope and diversity of discussions about women's roles in entrepreneurship have expanded, both around the world and within individual countries. This gives us the opportunity to investigate further how economic, environmental and social problems are interconnected.

Creating economic growth and the wealth that comes with it has significant benefits for society.

The results of numerous research projects that have looked at things like increasing wealth in the circular economy have helped. By starting their own businesses, women entrepreneurs in European countries may be able to better support their families and advance further in their careers.

When women start their own businesses, they gain a new perspective on societal challenges and the ability to actively participate and contribute to society's creative endeavours..

Keywords: circular economy, women's entrepreneurship, basic components

JEL classification codes : C38, F43, O15 ,L26

1. Introduction.

Huge obstacles as well as deep and quick changes in the economy, environment, and technology call for modifications to the economic growth paradigm. It becomes imperative to progressively give up on linear economics. The natural environment has been deteriorated as a result of the economy this model has produced, which mostly relies on the usage of energy and other few resources to manufacture and supply goods and services. The linear economic model has been replaced by a circular economy model by European nations and organizations in response to the overuse of resources and the quickening environmental deterioration of recent decades. As soon as feasible, the circular economy model has to replace the linear economy paradigm. Adopting the circular economy widely will need coordinated efforts to rethink all production plans and company structures from a circular standpoint. This implies that it is essential to match resource consumption with the long-term development objectives of mankind in the best feasible way to minimize waste and maximize reuse of resources. Resource optimization shouldn't interfere with their natural pace of recovery in enough amounts for next generations. In the circular economy, resources are used more efficiently to generate more economic value with the same or fewer resources, and waste from the social and economic environments is neutralized or benefited from, therefore safeguarding the environment. Designing a system that seeks to improve resource usage efficiency and lessen its environmental effect while also preserving human well-being is hence the essence of a circular economy. In other words, from the design phase to the point at which it becomes unusable, we should think about a product throughout its whole life cycle. As per the linear model, goods are either kept or thrown away at the end of their useful lives. Reuse - recycle - reduce is the three-step new strategy put forward by the circular economy. The earth's health has therefore restored to what it was before.

It is well known that businesses who have advanced the implementation of circular economy models have already attained maturity. They are operating inside the framework of economic systems where relationships between businesses and consumers, between industries and consumers, and between the value chain and sustainability are already mature and only include... few adjustments. Since it may provide actual advantages including reducing

environmental stress, enhancing the security of raw material sources, boosting competitiveness, promoting innovation, development, and job creation, the shift to a circular economy is imperative. More creative and sustainable goods that raise people's quality of life and eventually save them money will also assist consumers. Our study sought to understand and evaluate the effects on European economies of the shift to a circular economy.

Our study starts with the following key question as a consequence of the shift from the linear economic model to the circular economic model in view of economic growth, sustainable development and the environment:

Does women's entrepreneurship contribute to the promotion of the circular economy through sustainable economic development in European countries?

Through the problem posed, we ask some sub-questions:

- What are the motives that led to the transition from a linear economy to a circular economy?
- What are the foundations of this economy?
- Does the circular economy contribute to promoting women's entrepreneurship and sustainable economic development?

Study hypotheses: Represented in:

- The trend towards a circular economy contributes to the sustainability of the economic development of European countries.
- The motive from a linear economy towards a circular economy is a modern strategic trend in activating the sustainability of environmental and social development .
- The circular economy is based on several economic and environmental indicators.

Importance of the study:

The importance lies in studying and identifying the circular economy, because it has become a modern economic model based on modern concepts and principles that differ from its predecessors on the one hand, and on the other hand, presenting some of the determinants that are relied upon in the circular economy for a group of European countries to benefit from them academically and experimentally.

Study objectives: This study aims to:

- Identify the circular economy and the necessity of adopting it and addressing women's entrepreneurship.
- A brief presentation of the pillars and principles of the circular economy;
- Adopting the circular economy model as a modern strategic option ;
- Studying a group of European countries by analyzing the basic components,
- Developing a development environment that supports the behavior of moving towards the best;

Previous studies

- According to a study conducted by)Marit Moe Bjørnbet , Christofer Skaar ,Annik Magerholm Fet و ,Kjersti Øverbø Schulte ,Circular economy in manufacturing companies: A review of case study literature(2021 , The influence of manufacturing enterprises in enhancing global living standards has been significant. Nevertheless, within a linear framework, they are also linked to unsustainable patterns of production and consumption. In recent years, the idea of circular economy has acquired significant traction. Its primary objective is to disrupt the notion of linking by preserving resources. "During the episode." This work aims to reexamine the notion of circular economy in the manufacturing sector by conducting a comprehensive literature review. The objective is to ascertain if the research group has progressed from conceptual development to an industry-approved implementation. Moreover, our objective is to examine the significant correlation between the circular economy in industrialization and sustainable development. The review demonstrates that the area has progressed from abstract notions to practical study and research on instruments for implementation. However, empirical studies often focus only on the environmental aspect when assessing the sustainability effect of CEE practices, disregarding the socio-economic components. Furthermore, a significant observation is that the widespread adoption of a limited sustainability framework in the industrial sector is a potential obstacle to the successful implementation of a circular economy. The endeavors will be ineffective in delivering solutions that are advantageous from social, environmental, and economic perspectives. It is necessary to adopt inclusive strategies to prevent the

implementation of solutions that may be presented in a circular format, but fail to include the aspect of sustainability.

- The objective of the research conducted by (Ziyu Chen, Shouming Chen, Chang Liu, Luu Thi Nguye, 2020) is to evaluate the influence of the circular economy on the economic development of China. In 2012, the fast economic expansion was hindered by limited resource supply and environmental contamination, necessitating the adoption of the circular economy development model. In this paper, we examine China's implementation of two sets of prominent cities in central facilitation to advance the development of the ecological economy and disrupt the conventional economic development model. This case serves as a semi-normal example. If completed Utilizing the displacement grading method (PSM) and the model of difference in differences (DO) to examine the influence of this negotiation strategy on the economic development of the local area. The findings indicate a notable decline in the GDP growth rate of the prominent cities, followed by a gradual recovery in economic degradation over the course of time. The Circular Economy does not have a significant impact on the economic growth of primary industries, as shown in the GDP growth rate.
- The research conducted by Daniela-Ioana MANEA ,Nicolae ISTUDOR ,Vasile DINU ,Dorel-Mihai PARASCHIV(2021 , seeks to examine the incorporation of quality of life and social well-being as key goals within the social policy framework of any given nation. The objective of this study is to examine the influence of many aspects, including circular economy, digital innovation, and sustainable entrepreneurship, on societal advancement. This research builds upon existing literature by evaluating the interrelationships among these phenomena. The objective of this study is to quantify the impact of many elements on social advancement. This will be accomplished by creating specific synthetic indicators, such as composite indicators, that can effectively capture the intricate nature of the phenomena under analysis. In order to assess the progress in the shift towards a circular economy The use of multivariate analytic techniques - A suggested and defined composite index has been put forward, which enables the ranking of European Union (EU) nations based on their orientation. This index serves as a forerunner to

social growth and may effectively illustrate national adjustment. Regulations. The indicator under consideration is included into the regression models used, alongside analogous indicators, in order to underscore the influence of the circular economy, innovation, and sustainable entrepreneurship on societal advancement. Therefore, by incorporating digital technology into established business models, the development of sustainable creative entrepreneurship facilitates the shift from a linear to a circular economy and offers new avenues for research.

- The study conducted by (Rajeev Rathi, Dattatraya Balasaheb Sabale, Jiju Antony, Mahender Singh Kaswan, & Raja Jayaraman, 2022) seeks to elucidate the impact of globalization on the manufacturing industry, specifically in terms of product quality, cost, and user experience. The reduction in the product life cycle results in an increased number of goods being added to the manufacturing lines. The introduction of this has resulted in increased intricacy in the input materials, operational expenses, and waste production inside the manufacturing system. The concept of the circular economy (CE) has significant promise in addressing the issue of industrial waste and offers a viable and competitive resolution. This research included doing a comprehensive literature review to examine the present state of citizenship education in India and other emerging nations. The present study investigated the current state of implementation, the advantages derived from it, and potential directions for future research. This research offers valuable insights to industry practitioners and frontline managers on the advantages of incorporating Circular Economy (CE) into their operations.

First: The theoretical literature on the circular model and feminist entrepreneurship:

1.2. Circular economy concept

The notion of circular economy (EC) is being introduced. Pearce and Turner (1990) were the first British environmental economists to do so. In the field of natural resource and environmental economics, it has been observed that the conventional open economy was established without an inherent inclination towards recycling, resulting in the perception of the environment as a mere repository for garbage. Given the prevailing environmental challenges and limited resources, proponents have called for the conceptualization of the land as an enclosed economic system. This

entails adopting an economic framework that diverges from linear interconnections between the economy and the environment, instead emphasizing a circular relationship. The authors put up a concept known as the circular economy, which entails a closed loop of material flows inside the economy, based on an examination of the interplay between economic systems and natural systems. Su et al. (2013), p. 215. The term "sustainable development" refers to a location where the economic value of goods, materials, and resources is preserved for an extended period, while simultaneously minimizing the formation of trash (Kamal-Chaoui&Chakor, 2020, p. 24).

The circular economy is a multifaceted framework including scientific, technical, economic, and social dimensions, which has been borrowed from nature in a manner that poses significant risks in contemporary times (Rémy LE MOIGNE, 2018, p. 32). It may be described as a production and exchange system that considers the durability and recyclability of goods or their components, allowing them to be reused or transformed into new raw materials. The goal is to enhance resource efficiency. According to Lamia Kamal-Chaoui and GliminaChakor (2020), the concept can also be characterized as an economy that exhibits minimal environmental impacts and effectively utilizes resources. This is achieved through the implementation of high resource efficiency practices and waste prevention measures, particularly in the manufacturing sector, as well as the minimal disposal of materials at the end of their life cycle(Lamia Kamal-Chaoui, & Glimina Chakor, 2020, p. 26).

The concept of a circular economy may be defined as the progressive substitution of virgin raw resources with recycled materials that are already in circulation. The concept of the circular economy refers to an economic system in which the longevity of goods, materials, and resources within the economy is maximized, while minimizing the generation of waste. According to the European Commission (2015), the adoption of a circular economy would make a significant contribution to the European Union's endeavors in establishing a sustainable, low-carbon, resource-efficient, and resource-competitive economy.

- **Reasons for moving from the linear model to the circular model:** We can summarize the most important reasons for moving to the circular model as follows:

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- **Economic losses and structural waste:** The current economy is highly wasteful in the value creation model. For example, we find in Europe a 31% wasteful rate in the value chain.

In recent times, several organizations have observed that the linear system amplifies their vulnerability to risks, particularly the fluctuation of resource and supply costs. Disruptions and significant fluctuations in resource prices have the potential to impede economic development via the amplification of uncertainty, deterrence of corporate investment, and escalation of investment and associated expenses. Mitigating hazards associated with resources. In the last ten years, there has been a significant increase in the volatility of metals and agricultural goods.

- **Supply risks:** Several global areas possess limited reserves of finite natural resources, necessitating reliance on imports. For instance, the European Union imports six times the quantity of commodities and natural resources it consumes. India imports around 80% and 40% of its total imports, respectively. In conjunction with the inherent risks pertaining to the availability of raw materials, it is evident that the provision of security and safety across extensive and well-established global supply chains poses a significant risk.

- **Degradation of natural systems:** An essential obstacle to achieving sustainable global wealth development is the convergence of adverse environmental consequences associated with the linear model, the exhaustion of inexpensive reserves, and, progressively, the deterioration of natural resources impacting economic productivity. The environmental pressures are influenced by several factors, such as climate change, the decline of biodiversity and natural resources, land degradation, and ocean pollution.

- **Regulatory trends:** In recent times, there has been a noticeable rise in regulatory initiatives aimed at mitigating adverse externalities and pricing within the corporate sector. The number of climate change legislation has seen a 66% growth since 2009, rising from 300 to 500. Approximately 40 nations and over 20 countries have either adopted or are planning to implement carbon pricing, which takes the form of an emissions trading program or carbon tax. Taxation on landfills is implemented by 20 European nations.

- **Advances in technology:** Driven by the tenets of the circular economy and technological advancements, societal growth has the potential to provide enhanced prospects. The advent of internet platforms and the widespread dissemination of information and industrial technology have facilitated the emergence of commercial approaches to the circular economy that were previously unattainable. These technological advancements provide enhanced cooperation, information dissemination, material tracking, forward and reverse logistics frameworks, and heightened use of renewable energy sources.

- **Acceptance of alternative business models:** A new transactional paradigm arises whereby people embrace business models that facilitate the acquisition of services rather than possessing the items they provide, therefore assuming the role of users. This phenomenon has already been seen in some areas, where rental, performance, and sharing models, facilitated by emerging technology, are already generating a substantial client base and undergoing rapid expansion.

- **Urban growth:** More than half of the global population now resides in urban regions, marking a significant milestone in history. By 2050, the urban population is projected to increase by 2.5 billion individuals due to ongoing urbanization and general demographic expansion. As the number of end-of-use consumables increases, the expenses associated with collecting them will also rise.

3. Pillars of the circular economy: There are pillars on which the circular economy depends, the most important of which is (nabila, karim, & chraf, décembre 2018, p. 651):

- **Eco-design:** Environmental impact management is a strategic process that considers the environmental effects of packaging, goods, processes, services, organizations, and systems at every stage of their life cycle. It allows to distinguish between what is waste and what is valuable.” This approach makes it possible in particular to reduce the amount of materials, to extend their lifespan, to facilitate repair, recycling or remanufacturing. Besides this environmental goal, ecodesign encourages innovation approaches and allows companies that use them to strengthen their competitiveness by saving on purchases or to gain a

competitive advantage by meeting market expectations or opening new markets.

- **Industrial ecology:** It is an operational element of sustainable development and is an inter-firm method of organization with synergies and exchange of flows, pooling of needs and reduction of circuits. Globally, industrial ecology can be defined as an attempt to identify transformations that are likely to bring the industrial system into compliance with “natural” functioning. for biological ecosystems. Therefore, it aims to reduce industrial impacts on the environment.
- **Functional economics:** The basis is based on the fact that the manufacturer, who is no longer selling his product but rather using that product, has every interest in having a product with a long shelf life and scalable to optimize his costs, especially on inputs. Thus functional economics favors use over possession. So you have to sell services related to the products rather than the products themselves. Applies to “durable” or semi-durable goods. The functional economy can be expanded to include exchange, car sharing and rental according to the desires and needs of certain actors.
- **Reuse:** Prolonging consumer life consists of resorting to repair, donation, used sale or used purchase in the context of reuse. It is the process by which a product is given or sold by its original owner to a third party, who will pre-emptively give it a second life. This makes it possible to extend the life of the product when, it no longer meets the needs of the owner by reintegrating it into the economic circuit. It is not a method of treating or transforming waste but rather an essential part of its prevention. It also means intervening in waste to introduce it entirely or in the form of spare parts into another department or economic sector, with a qualitative choice and a desire for sustainability.
- **Repair:** Repair consists of restoring damaged or unusable products to their working or working conditions in order to give them a new life. This process makes it possible to fight the logic of disposable things.
- **Recycling:** It is a set of waste transformation techniques after recovery, with the aim of reintroducing all or part of the waste into a new cycle of the product.

Therefore, the circular economy allows resources to be recycled and used more than once while exploiting new energy patterns, unlike the linear model that results in waste and environmental damage.

2. **The necessity of adopting the circular economic model:** The inevitable necessity towards adopting the circular economy is represented by the following): Robert C. Brears ,2018 ,

(صفحة 259)

- ✓ **Improving resource security and reducing dependencies:** It increases the efficiency of consumption of primary resources, by preserving the materials used in high-value products, or recycling waste and including it in the economy as high-quality secondary raw materials. Thus, the circular economy will reduce Demand for primary raw materials.
- ✓ **Less environmental impact:** The objective is to achieve a complete segregation of economic production and social well-being from the depletion of resources and energy, as well as the associated environmental consequences, via means of resource efficiency.
- ✓ **Opportunities for economic growth and innovation:** It is well acknowledged that the linear method places significant strain on both the environment and human well-being. Additionally, it has the potential to diminish the likelihood of enhancing the competitiveness of many sectors within the business. Hence, the circular economy offers novel approaches, including technology and business structures, with the aim of generating enhanced economic value. By reducing the use of natural resources
- ✓ **Sustainable consumer behavior and business opportunities:** It is anticipated that social innovation pertaining to sharing, eco-design, reuse, recycling, and other advancements would result in heightened sustainability in consumer behavior, hence making significant contributions to human health and safety.

The implementation of the circular economy is anticipated to provide job prospects. According to the European Commission's evaluation of a legislative proposal on waste, implementing measures such as raising recycling goals, streamlining legislation,

enhancing monitoring and sharing of effective strategies to achieve higher recycling and reuse targets for municipal waste and packaging, along with reducing waste emissions, has the potential to generate up to 178,000 new direct employment opportunities by 2030.)EEA (European Environment Agency(14 صفحة، 2016، (

3. Circular economy indicators:

Economic development is seen as a manifestation of enhanced living prospects, therefore becoming a fundamental objective of macroeconomic policy. Economic growth is often understood as a positive upward trajectory in the overall performance of the macroeconomy. Economic growth refers to the measurable expansion of economic activities and their impact on the overall national economy. This growth is closely linked to the variables that contribute to this expansion. Economic growth is contingent upon the utilization of existing potential resources. All nations possess these characteristics, varying in magnitude, however there is no universally applicable formula to guarantee economic growth. The amount of aggregate demand, the absorptive capacity of the internal market, and the efficiency of the banking financial system are indirect variables that have a significant influence on economic development. The variables under consideration include the savings rate and investment rate, the international environment, labor and capital migration, and state budget and fiscal policy. The influence of intellectual capacity on social and economic development is increasingly recognized as a significant determinant in economic growth (Manea, Istudor, DINU, & Parasch IV, 2021, pp. 65-66).

Theories and models of economic growth point out the many ways that present activity influences the future and pinpoint the factors that might support sustained development. The evolution of an economy was characterized by the traditional models of A. Smith and D. Ricardo in terms of scarce land and growing population. A macroeconomic concept called Keynesian growth holds that as aggregate demand rises, so does national income. Three primary issues are highlighted by the Harrod-Domar model: the possibility of sustainable development; the likelihood of a steady rise under full operation; and the existence or instability of the specified growth rate. The way that technology advancement and capital accumulation impact the economy is explained by the neoclassical growth model. According to the new theory of economic development, knowledge acquisition and capital accumulation should go hand in together. The

human development is the third element of the new theory, which contains two fundamental models: the "learning by doing" model and the "innovation" model. Development has to raise people's standard of living and their capacity to influence their own futures (Mura, L., Gontkovicova, B., Dulova Spisakova, E., 2019, pp. 156-173).

Human rights and human development are complementary and interwoven concepts. Human rights are a means of enhancing the social institutions that support or ensure the capacities and freedoms that members of society enjoy, if human growth seeks to increase these characteristics. The options of people may be extended from the standpoint of human growth into three areas: life expectancy, education, and availability of the financial means required for a respectable existence. Growth of the economy mostly depends on human potential)Eglantina Hysa, Alba Kruja, Naqeeb Ur Rehman & , Ra(09-05 الصفحات 2020 ، .

SECOND :AppliedStudy :

a. Description of the model and study variables:

Advanced economies continue to innovate to promote growth and provide government support for producers to move from linear to circular economies. Hence, waste materials in industrial systems are recycled or reused, improving the efficiency of using limited resources with a zero waste approach.

This paper aims to:

- ✓ Identifying the main components of the circular economy and women's entrepreneurship, which also support sustainability and development in the 30 European countries during the period 2020-2021 as shown in the table below.

Table 01: List of countries accredited to the study

Norway	Germany	Austria
Poland	Greece	Belgium
Portugal	Hungary	Bulgaria
Romania	Iceland	Croatia
Slovakia	Ireland	Cyprus
Slovenia	Italy	Czechia
Spain	Latvia	Denmark
Sweden	Lithuania	Estonia
Switzerland	Luxembourg	Finland
United Kingdom	Netherlands	France

Source:

<https://data.worldbank.org/indicator/NY.GDP.MKTP.CD> 2022

International Energy Agency (IEA) 2022

OECD DATA 2022

UNITED NATIONS DEVELOPMENT PROGRAMME 2022

- Verifying the impact of these variables on women's entrepreneurship in European Union countries;
- Find out whether the three components of sustainable development based on circular economy indicators (environmental - social - economic) are important for women's entrepreneurship.

Depending on the theoretical and empirical literature relevant to the subject of the study, and according to the abundance of data, our research will rely on the following indicators:

- ✓ **Real GDP growth rate:** Gross Domestic Product (GDP) is a metric that quantifies economic activity by calculating the total value of all products and services produced, minus the value of any commodities or services used in their production. The calculation of the yearly growth rate of the Gross Domestic Product (GDP) serves the objective of facilitating comparisons between the temporal dynamics of economic development and economies of varying magnitudes. In order to assess the rate of GDP growth in terms of volume, the evaluation of GDP at present prices is conducted by comparing it to the prices of the preceding year. Consequently, the computed changes in volume are applied to the level of the reference year, a concept known as a linked chain. Consequently, fluctuations in prices will not result in an increase in the pace of growth (World Bank national accounts data, 2022).
- ✓ **Adjusted net savings, including damage from particulate emissions (ANIPPED)** The concept of adjusted net savings may be defined as the sum of net national savings and education expenditure, subtracted by energy depletion, mineral depletion, net forest depletion, and carbon dioxide emissions. This series covers the harm resulting from the release of particulate matter (World Bank national accounts data, 2022).
- ✓ **Total natural resources rents (TNRR)** The aggregate value of natural resource rents include the combined income derived from oil rents, natural gas rentals, coal rents (both hard and soft),

mineral rents, and forest rents(World Bank national accounts data, 2022).

- ✓ **Human Development Index(HDI)**A composite statistic that quantifies the average level of accomplishment in three fundamental aspects of human development: longevity, knowledge, and a satisfactory quality of life (UNITED NATIONS DEVELOPMENT PROGRAMME, 2022).
- ✓ **EmissionsCO2:** Carbon dioxide (CO₂) emissions arise from the combustion of fossil fuels and the production of cement. Carbon dioxide emissions are generated as a result of the use of solid, liquid, and gas fuels, as well as the burning of gas(International Energy Agency (IEA), 2022).
- ✓ **Research and development expenditure(RDE)** Gross domestic spending on research and development (R&D) is quantified as a proportion of the Gross Domestic Product (GDP). It encompasses both initial investments and ongoing investments in the four primary sectors: industry, government, higher education, the private sector, and non-profit organizations. Research and development include fundamental research, practical research, and experimental advancement(World Bank national accounts data, 2022).
- ✓ **Environmental tax revenues(ETF)** The indication is presented in two distinct ways. As a percentage of the overall money generated by environmental taxation in relation to all other tax and social contributions. This demonstrates that tax allocations vary based on variables such as the environment, labor, and capital. Furthermore, the index is shown as the ratio of environmental tax receipts to the Gross Domestic Product (GDP). This facilitates a comparative analysis of environmental taxation among Member States, considering the varying magnitudes of their respective national economies(OECD DATA, 2022).
- ✓ **Generationofmunicipalwastepercapita (GMPWC)**The indicator assesses the quantity of rubbish that is collected by local authorities or managed by them via the waste management system. The majority of it comprises garbage produced by homes, however it may also include waste from sources such as commerce, offices, and governmental organizations(OECD DATA, 2022).
- ✓ **Recycling rate of municipal waste (RROMW)** The metric quantifies the proportion of recycled municipal trash in relation to

the overall volume of municipal garbage. Waste management encompasses several methods such as material recycling, composting, and anaerobic digestion. The measurement is denoted as a percentage (%), with both terms being stated in the same unit, namely tons (Eurostat, 2022).

- ✓ **Resource productivity and domestic material consumption (RPDMC)** The index is a measure that calculates the ratio of GDP to domestic consumption of materials. The organization conducts a direct assessment of the aggregate quantity of materials used within the economy. The term "export volume" refers to the yearly amount of raw materials obtained from the home territory of the central economy, taking into account all physical imports and subtracting all physical exports. It should be emphasized that in DMC, the word "consumption" specifically pertains to perceived consumption rather than ultimate consumption. The DMC framework does not include primary flows associated with the import and export of raw materials and goods that originate from external sources. As an individual aspiring to assess resource productivity(Eurostat, 2022).
- ✓ **Annual change renewables (ACR)**It originates from natural processes that undergo continuous renewal in their many manifestations. The energy is obtained either from solar radiation or from the thermal energy produced in the Earth's interior. Encompasses the production of energy and heat produced from many renewable sources such as solar, wind, ocean, hydro, biomass, geothermal resources, biofuels, and hydrogen. The rapid implementation and effectiveness of renewable energy, considering the technical expansion of energy sources, result in notable advantages in terms of energy security and economic prosperity. Additionally, it will mitigate environmental pollutants, namely air pollution resulting from the combustion of fossil fuels, enhance public health, decrease premature mortality resulting from pollution, and provide cost savings in healthcare. The yearly fluctuation in energy sources unavoidably results in the promotion of energy sustainability and improvement, fostering rivalry among nations(International Energy Agency (IEA), 2022).
- ✓ **Environmental Performance Index (AND)**This approach entails the quantitative and numerical assessment of the environmental efficacy of governmental programs. The purpose of this index is to enhance the environmental objectives outlined in the United

Nations Millennium Development Goals. It was derived from the prototype Environmental Performance Index, which was first released in 2002. While the Environmental Performance Program (EPP) came before the Environmental Sustainability Program (ESP), the EPI utilizes outcome-driven metrics and therefore functions as a standard that is readily accessible to policymakers, environmentalists, activists, and the general public. The Global Green Economy Index (GGEI) is an additional indicator that offers a comprehensive assessment of the environmental, social, and economic aspects of national economies. The Global Green Efficiency Index (GGEI) utilizes Environmental Performance Index (EPI) data to evaluate the environmental aspect of the index. It also assesses the performance of efficiency sectors, including transport, buildings, and energy, as well as investment, green innovation, and national leadership in addressing climate change (Wolf, M. J., Emerson, J. W., Esty, D. C., de Sherb, 2022).

- ✓ **Waste Management (WMG)** The necessary processes and procedures for effectively managing garbage from its initial generation to its ultimate disposal. This encompasses the activities of waste collection, transportation, treatment, and disposal, as well as the oversight and control of the waste management process, as well as the laws, technology, and economic processes associated with trash. Waste materials might exist in solid, liquid, or gaseous states, each necessitating distinct approaches for their removal and management. The field of Waste Management encompasses a wide range of waste categories, such as industrial, biological, residential, municipal, organic, biomedical, and radioactive waste. In some instances, trash has the potential to be a risk to human health.
- ✓ **Controlled solid waste (MSW)** Waste that requires special handling and disposal techniques to avoid health risks, nuisances or environmental pollution. Controlled waste disposal requires prior approval and a permit issued by the regional district prior to disposal.
- ✓ **Ecosystem Vitality (ECO)** :The primary aim of the ecosystem vitality policy goal is to assess the extent to which nations are effectively preserving, safeguarding, and augmenting ecological systems and the associated benefits they provide. The EPI score is composed of seven topic areas, namely biodiversity and habitat,

ecosystem services, fisheries, climate change, pollution emissions, agriculture, and water resources. These subject categories together account for 60% of the overall score)[https://epi.yale.edu/epi-results/2020/component/eco\(2022](https://epi.yale.edu/epi-results/2020/component/eco(2022) ‘

- ✓ **Ecosystem Services (ECS):**The diverse array of advantages that a natural environment and healthy ecosystems provide to human beings. The many types of ecological systems include agroecosystems, forest ecosystems, grassland ecosystems, and aquatic ecosystems, among others. The interdependent nature of these ecological systems facilitates several benefits for human beings, including the natural pollination of crops, the maintenance of clean air, the reduction of severe weather events, and the promotion of mental and physical well-being. Together, these advantages have been referred to as ecological services, and are often essential for the supply of food, the supply of uncontaminated drinking water, the breakdown of waste, and the durability and efficiency of food systems.
- ✓ **Climate Change (CCH):** Climate change is a phenomenon characterized by enduring changes in temperatures and weather patterns. While these changes may occur naturally, it is important to note that human actions have been the primary catalyst for climate change since the 19th century. This is mostly attributed to the combustion of fossil fuels, such as coal, oil, and gas, which emit greenhouse gas emissions(Wolf, M. J., Emerson, J. W., Esty, D. C., de Sherb, 2022)
- ✓ **Pollution Emissions (APE):** Emissions refer to the release of gases and particles into the atmosphere from several sources. The quantities and categories of emissions undergo annual fluctuations. These alterations are a result of shifts in the nation's economy, industrial operations, advancements in technology, transportation patterns, and several other causes.
- ✓ **Sustainable Nitrogen Management Index (SNM):**The rating score in question is a unidimensional metric that integrates two indicators of agricultural production efficiency: nitrogen usage efficiency (NUE) and land use efficiency (crop productivity)(Wolf, M. J., Emerson, J. W., Esty, D. C., de Sherb, 2022).
- ✓ **Wastewater treatment (WWT)**The primary objective of wastewater treatment is to effectively eliminate suspended particles prior to the release of the residual water, known as effluent, into the surrounding environment. During the process of

solid decomposition, it depletes the oxygen required by aquatic plants and animals (Wolf, M. J., Emerson, J. W., Esty, D. C., de Sherb, 2022).

.2.3. Presentation and discussion of results:

To accomplish this study, we relied on one of the techniques of factor analysis (the method of analyzing basic components). The idea goes back to the British scientist Sperman in the early twentieth century. Then the idea was developed by many scientists and focuses on its essence. (Moulay & Kafi, 2015) Simplifying the raw data table, which in all studies contains a large number of variables and statistical items, into a reduced table of new units formed by collecting the raw data in tables that contain a large number of variables and units. This data cannot be read and interpreted, and the structure of this data cannot be known. Therefore, this method is used to limit the dimensions and facilitate reading the raw data.

After we discussed the concepts of the basic compounds (APC) method, the study variables included (**GDP; EPI; WMG; MSW; ECO; ECS; CCH; APE; AGR; SNM**).

WWT ; CO2 ; RROMW ; RPDMC ; GMPWC; ETR ; RDE; ACR ; HDI ; TNRR; ANIPPED) and the European countries adopted in the study were numbered (01-30).

When interpreting the results of factor analysis, we begin by extracting the correlation coefficients, as one of the assumptions of this analysis is that the correlation coefficient leads to zero. This is what we found achieved through the correlation matrix by applying this R statistical program using the following instructions:

```
D1<-read.csv2(file=file.choose(),dec="," ,header=TRUE,row.names=1)
```

```
D1
```

```
>art<-edit(data.frame(D1))
```

```
>art
```

While the table below shows the results of two basic tests, the Kayes-Meyer-Olkin (KMO) test, which expresses the adequacy of the sample and the Bartlett test, which is a good indicator of the difference of the correlation matrix from the unit matrix, meaning there is a common variance between the study variables that

constitute a group of factors. The hidden, which is what we seek not to find.

Table 02: KMO Index

0.689	KMO) test) Alken-Mayer-Kayes
0.000	Bartlett test

SPSS outputBasedon :Source

Through the table above, we note that the (KMO) test is greater than 0.6 is a good indicator, and the level of significance of the Bartlett test is 0.000, which indicates the difference of the correlation matrix from the unit matrix, in the sense that there is a common variation between the study variables formed by the hidden factors that we seek to find. From this point of view, we say that the conditions for applying factor analysis are available in the study variables.

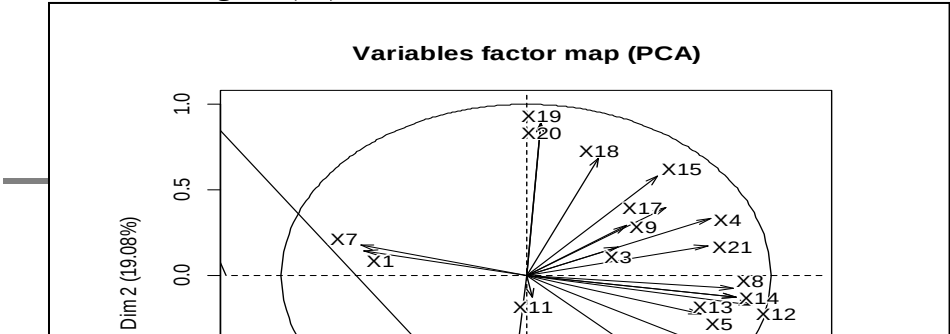
Therefore, we try to find the minimum variables that represent how well the variables are represented by finding the basic components, we use the package (FactoMineR) on the application **R** according to the following instruction, after installing it:

```
>library(FactoMineR)
```

```
>rs.pca<-PCA(art)
```

```
round(rs.pca$eig,2)
```

Figure (01): Variable correlation circuit



Source: R Output

Through the figure, we note the representation of the study variables (study dimensions) on the correlation circle, as we find a correlation between the variables, as we obtained five factors, and the dimensions of environmental tax revenue, solid waste, environmental performance, waste recycling rate per capita and management, sustainable development index and CO2 emissions represent one factor The rate of gross output, R&D expenditure is the second factor, the sustainable nitrogen management index, agriculture is the third factor, the annual change of renewables and the ecosystem is the fourth factor, while the rest of the factors represent the fifth factor, which includes wastewater treatment, total natural resource revenues, adjusted net savings, pollution emission, ecosystem vitality, climate change, resource productivity and consumption. To select the base components, we rely on the eigenvalues (eigv) of the variance matrix and covariance according to the following instruction:

```
>round(rs.pca$eig,2)
```

Table (03): Eigenvalues

	Self-esteem	percentage of variance	cumulative percentage of variance
Comp 1	7.50	37.48	37.48
Comp 2	3.82	19.08	56.56

Comp 3	1.89	9.44	66.01
Comp 4	1.46	7.32	73.32
Comp 5	1.04	5.21	78.53
Comp 6	0.96	4.80	83.33
Comp 7	0.75	3.77	87.11
Comp 8	0.61	3.04	90.14
Comp 9	0.47	2.36	92.50
Comp 10	0.37	1.85	94.35
Comp 11	0.35	1.76	96.11
Comp 12	0.24	1.19	97.31
Comp 13	0.17	0.85	98.15
Comp 14	0.13	0.64	98.80
Comp 15	0.11	0.54	99.34
Comp 16	0.07	0.36	99.70
comp 17	0.04	0.18	99.88
Comp 18	0.02	0.12	100.00
Comp 19	0.00	0.00	100.00
Comp 20	0.00	0.00	100.00

Source: R Output

We can see from the table above and the graph below that the first five basic components explain 73.95% of the total explained variation of more than 70% to explain the phenomenon which is an acceptable ratio, according to the criterion of)Jean-Jacques Croutsche(309-308 الصفحات 1997 ، Kaiser style« Kaiser criterion » 1960: It is the most common method where it depends on determining the number of factors according to their intrins, if the latter reaches one or more integer then the factor is included in the model, and if the eigenvalue is less than 0.4, the factor is excluded from the model. Considering that the eigenvalue $\lambda_1=7.50, \lambda_2=3.38, \lambda_3=1.89, \lambda_4=1.46, \lambda_5= 1.04$.

This method was also invented by the scientist Cattells in 1966 and depends on a graph of factors, if the factor is characterized by a strong degree of regression, meaning that it tends to the vertical downward direction, it falls into the model, and excludes factors that tend to gradual decline any that tends to the horizontal direction.

Figure (02): Showing the regression diagram of circular economy vehicles according to Scree Plot



Source: SPSS Output

From the diagram above, it is clear that the steep region in the graph includes the base components (1-2-3-4-5), and therefore looking at the regression chart and the components with eigenvalues greater than the integer leads to retaining the same number of compounds. The rest of the factors tend to have a horizontal regression and are therefore excluded from the model.

From the above, we conclude that the application of factor analysis (basic component method) explains the value of 78.53% of the total information explaining the circular economy, represented by eigenvalues, are distributed as follows:

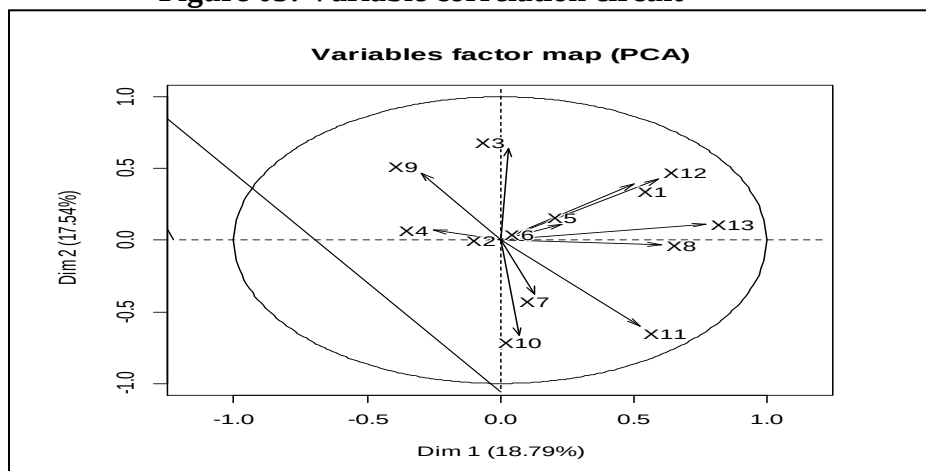
- ✓ **The first factor:** explains what is worth 37.48% of the total variation, which includes two dimensions (environmental tax revenue, solid waste, environmental performance, waste recycling rate per capita and management, sustainable development index and CO2 emissions) and from it highlights the relationship between environmental performance and environmental tax revenues and waste, in other words how environmental tax revenues and waste recycling contribute to increasing the index of sustainable development and environmental performance This work can be called **the environmental factor under the circular economy**.
- ✓ **The second factor:** explains what is worth 19.08% of the total variance includes (and the rate of gross output and expenditure on research and development) we call **the R&D expenditure factor of the circular economy**.

- ✓ **The third factor** explains the value of 9.44% of the total variation, which includes (the index of sustainable nitrogen management and agriculture) through the contribution of agriculture to environmental sustainability. We call it **the environmental sustainability factor**
- ✓ **The fourth factor:** explains the value of 7.32% of the total variance and includes (and the annual change of renewables and the ecosystem) through the annual change of energy sources and its reflection on the ecosystem. We call it **the factor of energy implications on the environment**
- ✓ **The fifth factor** explains the value of 5.21% of the total variation and includes (includes wastewater treatment, total natural resource revenues, adjusted net savings, pollution emission, ecosystem vitality, climate change, resource productivity and consumption). We call it **ecosystem change**.

Second: The variable for women's entrepreneurship

We follow the same steps as the previous ones, as we have reached the following:

Figure 03: Variable correlation circuit



Source: R Output

Through the figure, we notice the representation of the study variables (study dimensions) on the correlation circle, as we find a correlation between the variables, as we get five factors, and the ratio of females and males in the early stage, the female unemployment rate, and the women's mobility index represent one factor, the female

entrepreneurship index, the gender parity index, and the female fatherhood index represent the second factor, and the women's pension index represents the third factor, the female workplace rate, the female wage index, and the cost of conducting entrepreneurial work represent the fourth factor, while the rate of Borrowing for women's entrepreneurial businesses, retention rate and female marriage index are the fifth factor. To select the base components, we rely on the eigenvalues (eigv) of the variance matrix and covariance according to the following instruction:

```
>round(rs.pca$eig,2)
```

Table (04): Eigenvalues

	Self-esteem	percentage of variance	cumulative percentage of variance
Comp 1	2.07	18.79	18.79
Comp 2	1.93	17.54	36.33
Comp 3	1.44	13.08	49.41
Comp 4	1.16	10.54	59.95
Comp 5	1.10	10.03	69.98
Comp 6	0.87	7.94	77.92
Comp 7	0.69	6.24	84.16
Comp 8	0.66	6.03	90.19
Comp 9	0.50	4.57	94.76
Comp 10	0.35	3.22	97.98
Comp 11	0.22	2.02	100.00
Comp 12	0.00	0.00	100.00
Comp 13	0.00	0.00	100.00

Source: R Output

We can see from the table above that the first five fundamental compounds are interpreted 69.98% of the total explained variation of more than 70% to explain the phenomenon which is an acceptable ratio, according to the criterion of)Jean-Jacques Croutsche '1997 ' (309-308 الصفحات Kaiser style« Kaiser criterion » 1960: It is the most

common method where it depends on determining the number of factors according to their intrins, if the latter reaches one or more integer then the factor is included in the model, and if the eigenvalue is less than 0.4, the factor is excluded from the model. Considering that the eigenvalue $\lambda_1=2.07$, $\lambda_2=1.93$, $\lambda_3=1.44$ $\lambda_4=1.16$ $\lambda_5=1.10$.

From the above, we conclude that the application of factor analysis (basic component method) explains the value of 69.98% of the total information that explains women's entrepreneurship, represented by subjective values, is distributed as follows:

- ✓ **The first factor:** explains the value of 18.79% of the total variation, which includes two dimensions (the percentage of females and males in the early stage, the female unemployment rate and the women's mobility index), from which the relationship between the unemployment rate and women's mobility of work compared to males emerges. This factor can be called **the mobility factor in women's entrepreneurship**.
- ✓ **The second factor:** explains what is the value of 01.93% of the total variation, which includes (the Women's Entrepreneurship Index, the Gender Parity Index, and the Female Fatherhood Index) we call **the entrepreneurial parity factor**.
- ✓ **The third factor:** explains the value of 1.44% of the total variance, which includes (and the women's pension index) we call **the retirement factor in women's work**.
- ✓ **The fourth factor:** explains the value of 1.16% of the total variance, which includes (the female workplace rate, the female wage index, and the cost of conducting entrepreneurial work) we call **the entrepreneurial business cost factor**.
- The fifth factor** explains the value of 1.10% of the total variance, which includes (borrowing rate for women's entrepreneurial works, retention rate and female marriage index). It has nothing to do with it. If a woman is married, this affects the retention or borrowing rate for women's entrepreneurial works. We call it the factor **of funding returns in women's businesses**.

3. Conclusion and recommendations:

The circular economy has become a leading concept that guides future decisions. Besides providing a risk management pathway for businesses and society, it offers significant opportunities

such as cost savings, fostering innovation and creating new jobs. Cooperation between companies, governments, science and non-governmental organizations in this area remains crucial. The successful implementation of a circular economy necessitates the active involvement and dedication of diverse stakeholders, hence facilitating the creation of increased and improved employment prospects. The available research indicates that the adoption of a circular economy has a substantial influence on the advancement of economic growth, and the promotion of sustainable human development in European nations. The objective is to establish novel marketplaces that effectively address the changing consumption patterns, which have shifted from conventional ownership to the use, reutilization, and sharing of items. Additionally, there is a particular emphasis on promoting female participation in the business sector across diverse nations. This fosters economic expansion and facilitates advancements in technology and consumer products in developed nations. The influence of entrepreneurship on economies in developing nations is substantial, since it contributes to job creation, income generation, and social cohesion. Governments prioritize the promotion of development and revenue, therefore successfully providing assistance to women entrepreneurs. Augmenting the quantity of accomplished female entrepreneurs might perhaps bolster their families and facilitate their upward mobility in the professional sphere. By assuming control of their own institutions, women get a fresh perspective on social obstacles and the liberty to actively and creatively engage in changing their communities. The increased involvement of women in the labor field and broader society yields advantages for both families and communities.

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