

# Towards a green economy: Technological change challenges for sustainability

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## Introduction

The concept of sustainable development has gone through several stations, and after practical practices to try to embody this concept, it became clear that it is one of the most difficult concepts to apply, and that its implementation on the ground will only be within the framework of a new economic approach known as the green economy approach. The need for a green economy and green growth emerged as a measure to stimulate national economies Following the global financial crisis, the International Monetary Fund, the World Bank, some regional development banks and the Organization for Economic Co-operation and Development (OECD) launched new programs to study the possibility of adopting the green economy approach at the macro and micro levels. sustainable.

The overall objective of this research is to pose a number of challenges that are encountered when pursuing sustainable technological change, which need to be properly understood by policy makers and professionals at different levels in society. We also identify some ways to research the future and its application within the Iraqi economy and the challenges facing this application and ways to address them. Therefore, the research included several axes:

- 1- Dealing with widespread environmental risks - and more global risks than before.
- 2- Achieving a radical, not just increasing, sustainable technological change.
- 3- Green capitalism and the state's role in designing an appropriate mix of policies to deal with new changes.
- 4- Challenges facing the application of the green economy in the midst of the changes facing the Iraqi economy.

**key words :**

Green economy, sustainable development, green capitalism, sustainable technology.

**First: the concept of green economy and sustainability**

The green economy is defined as:

According to the United Nations Environment Program <sup>(1)</sup>, it is defined as “that economy that results in an improvement in human well-being and social equality, while significantly reducing environmental risks and ecological scarcity of resources. We can look at the green economy in its simplest form, which is that An economy that reduces carbon emissions, increases resource efficiency, and accommodates all age groups.

**The green economy** can also be defined as one of the reasons that lead to the development and growth of humankind, and society will become equitable in the distribution of resources, and achieving it will significantly reduce risks and environmental scarcity.

**Sustainability** <sup>(2)</sup> is a concept given to the diverse biological environment, living organisms, and natural factors that maintain their existence for the longest possible period of time. Sustainability is also defined as maintaining the quality of life by adapting to the environment by exploiting natural resources for the longest possible period of time leading to Preserving the continuity of life Another definition of the concept of sustainability is that it is a set of vital processes that provide the means of life for living organisms of various types, which helps them to maintain the succession of their generations, and to develop the means of their growth over time.

**Second: Transition and transition to a green economy**

The thought of switching to a green economy came as a result of the repeated disappointments in the global economy and the many crises it is going through, including (the collapse of markets, financial and economic crises, high food prices, climate fluctuations, the rapid decline in natural resources and the speed of environmental change). The incentives to move to the green economy are as follows (3):

1- Attention to rural development with the aim of reducing poverty in rural areas: as the green economy contributes to poverty alleviation through wise management

of natural resources and ecosystems, and this will achieve benefits from natural capital and we can deliver them to the poor.

2- Paying attention to water, not polluting it, and striving to rationalize it: Improving water efficiency and its use can greatly reduce its consumption, and improving water access methods will contribute to saving groundwater inside wells and also preserving surface water.

3-Supporting the mass transport sector: Reducing energy subsidies in the Arab region by 25% will save more than \$100 billion within three years, and this amount can be transferred to greening energy and moving to it in the field of transport and greening 50% of the transport sector In the Arab countries, as a result of the high energy efficiency and the use of public transport and hybrid cars, it saves approximately 23 billion dollars annually, and by spending 100 billion dollars in greening 20% of the existing buildings during the next ten years, it is expected to provide more than 4 million job opportunities. .

4- Addressing the problem of solid waste and attempting to recycle it: (4) As (the production of phosphorous acid and fertilizers, the production of concentrated minerals, and the concentrated use of fertilizers in agriculture, industrial and traditional tanneries, and the pharmaceutical and manufacturing industries) more than 50% of These wastes are thrown into the water and the emissions from them lead to water pollution, but if they are disposed of well by burying them in a sanitary landfill or attempting to recycle them, they will lead to a cleaner environment and reduce toxic emissions.

5-Working to increase sustainable investments in the field of energy and measures to raise energy efficiency: where the transition to a green economy will lead to a significant reduction in greenhouse gas emissions, in the investment scheme in which 2% of GDP is invested in major sectors of the economy Green allocates more than half of that investment to increase energy efficiency, expand production and use renewable energy resources, and the result is a 36% reduction in energy intensity globally.

### **Third, the transition to a green economy and sustainable technological change**

Over the past years.. it has been a recurring trend that traditional economic models need reform in order to address climate change, biodiversity losses, water scarcity, etc., while addressing major social and economic challenges at the same time. The global financial crisis of 2008-2009 stimulated this debate (5), These concerns have been translated into the vision of a "green economy". Moreover, in 2015, countries around the world adopted the so-called 2030 Agenda for Sustainable Development and the 17 Sustainable Development Goals. These goals recognize that eliminating global poverty must go hand in hand with strategies that build economic growth but also meet a range of different social needs including

education, health, social protection and job creation, while also tackling environmental pollution and climate change.

Thus, the SDGs also establish a true interdependence between the ecosystem and the economic system. They also reinforce the need for a transition to a green economy, that is, a fundamental shift towards more sustainable patterns of production and consumption.

In this paper, we focus on a particularly important component of such a transformation, which is the development of sustainable technological change, that is, production and consumption patterns that have less profound negative impacts on the natural environment, including the global climate. Specifically, the research addresses a number of key challenges in supporting - and overcoming the barriers to - sustainable technological change.

It is clear that addressing climate and environmental challenges requires natural scientific knowledge as well as engineering expertise regarding the various technical solutions that can be adopted to mitigate the impacts. Negative (such as zero-carbon energy technologies)

However, the pursuit of sustainable technological change is also a societal, organizational, political and economic endeavor that includes many non-technical challenges. For example, the so-called transition literature recognizes that many sectors, such as power generation, water supply, etc. can be conceptualized as socio-technical and/or innovation systems <sup>(6)</sup>. These systems consist of networks of actors (individuals, private companies, research institutes, government authorities, etc.), the knowledge possessed by these actors as well as related institutions (legal rules, codes of conduct, etc.).

In other words, the development of new carbon-neutral technologies may require, for example, the creation of new value chains that host actors who did not necessarily interact in the past; This entails a relatively long process that can change society in a number of ways, for example, through legal modifications, changing consumer behavior, distributional effects, infrastructure development, new business models.

Economic and societal adaptation is necessary to achieve sustainable technological change. Indeed, history is replete with examples illustrating the need to address the organizational and institutional challenges associated with technological change and innovation. In hindsight, the societal impacts of electrification in terms of productivity gains were enormous during the twentieth century. However, while electric power was discovered in the late 1870s, in the 1900s, less than 5% of mechanical energy in American factories was supplied by electric motors and it took another 20 years before their productivity rose <sup>(7)</sup>.

An important reason for the slow spread of electric power was that in order to take full advantage of the new technology, the existing factories had to change their entire operating systems, i.e. the production process, architecture, and logistics, as well as the ways in which workers were hired, trained, and paid.

For a long time, many companies have invested in computers for little or no reward. However, in this case also, the new technology required systemic changes so that companies could take advantage of the computer.

This means, for example, decentralizing, outsourcing, and simplifying supply chains as well as offering more choices to consumers <sup>(8)</sup>.

Accordingly, the question of how to promote sustainable technological change has received increasing interest in policy and academic research. The main objective of this research is to discuss some of the most important societal challenges in pursuing such change, and to identify key ideas for policy makers as well as important avenues for future research.

In doing so, we draw on several strands of academic literature. The article focuses on the following three general challenges <sup>(9)</sup>:

- Dealing with pervasive and ever-increasing environmental risks.
- Achieving radical sustainable technological change - not just incremental.
- The emergence of green capitalism: the uncertain business-as-usual scenario.

The first two challenges address the different types of structural tasks required to pursue sustainable technological change, and the barriers that must be overcome when pursuing these tasks.

The last point concerns a role and responsibility. Each of these three challenges in turn includes more specific challenges, which are identified and detailed under each heading. We also provide hints on how to address and manage these challenges, but the specific solutions are likely to vary depending on national or regional contexts. The paper briefly concludes with some key avenues for future research, focusing on research that can aid in a green social and technical transition.

#### **Fourth - new variables and the mechanism of dealing with their risks**

With the advent of modern environmental policy in the 1960s, strict regulations were imposed on emissions to air and water. However, the focus was more or less exclusively on stationary sources of pollution (i.e. industrial facilities), which were relatively easy to monitor and regulate, for example, through factory-specific emissions standards. In addition, during this early era there was a strong focus on local environmental influences, for example, emissions in nearby river basins causing negative effects on other industries and on the surrounding community as well.

In order to address these pervasive environmental impacts, society has to find alternative - but indirect - ways to monitor and regulate them. This can translate into attempts to close physical cycles and promote a circular economy, i.e. an economy in which the value of products, materials and resources is preserved for as long as practicable, this means an increased focus on reducing, recycling and reusing raw materials <sup>(10)</sup>, and material and energy efficiency, In addition to sharing resources. In other words, rather than regulating emissions as close to the damage that has occurred, authorities may instead support specific activities (eg, recycling of materials) and/or technologies (eg, low-carbon production processes) that can be assumed It is associated with reduced environmental load. However, the processing of tunnels while the third stage of the previous stage begins. An important way to encourage recycling and reuse of products is to support product designs that affect the repairability and reuse of products. Improved recycling can also benefit from a modular product structure. However, this also comes with challenges. Companies often make products in such ways that increase recycling costs for downstream treatments, but for institutional reasons, there may not be a way by which a waste recovery facility can provide the manufacturer with any incentives to change the product design. One example is the use of multilayer plastic for food packaging, which is often incompatible with mechanical recycling <sup>(11)</sup>.

In short, the increasing importance of addressing the spread of emissions in the natural environment implies that environmental protection must be based on indirect strategies to reduce pollution. However, pursuing each of these strategies (for example, promoting recycling and material efficiency) presents challenges; They may encounter significant barriers (eg, product design, use of by-products) and can have negative side effects (eg, rebound effects). Moreover, the focus on recycling and resource efficiency should not distract from the need to improve the traceability and traceability of hazardous materials and materials as well as provide stronger incentives for product design. Both technological and organizational innovations are needed <sup>(12)</sup>.

**Fifthly, the mechanism of technological change that is permanently sustainable**

Increasing innovations, as well as increasing the material and energy efficiency of current production processes, are essential elements of the transition to a green economy. However, there is also a need for more profound technological innovation eg the replacement of fossil fuels in the transportation sector as well as in iron and steel production requires fundamental technological shifts and not just incremental improvements in efficiency. However, there are a number of factors that will make innovation difficult. We can highlight three important obstacles <sup>(13)</sup>:

**First:** The first aspect is the risks facing companies investing in technological development (basic research and development, pilot testing, etc.) along with the limited ability of the capital market to deal with the issue of long-term risk. These markets may fail to provide risk management tools for immature technology due to Lack of historically sequenced data for risk assessment. There are also concerns that the liberalization of global financial markets may imply that private financial investors are taking a more short-term view.

**Second:** private investors often have poor incentives to pursue investments in long-term technological development. The economic literature has noted the risks of a shortage of public goods such as knowledge resulting from research and development efforts and learning by doing. Thus, private companies will be able to allocate only a fraction of the total rate of return on this investment, because significant benefits will also accrue to other companies (through reverse engineering). Because there are such cognitive ramifications, investments in long-term technological development will become ineffective and very modest.

**Third:** new green technologies often face unfair competition with existing ones.

From incumbents, who may be close substitutes to their greener competitors, will be at a comparative advantage as they have been allowed to expand during periods of less stringent environmental policies as well as institutions and infrastructures.

In one way or another, this leads to path dependencies, ie where the economy tends to lock down on certain technological paths <sup>(14)</sup>. In general, companies typically use the accumulated knowledge of technology when developing new products and processes, and technology choices tend to be particularly self-reinforcing if the investments are characterized by high initial costs and increased returns from adoption (such as scale, learning and network economics). Existing institutions, such as laws, codes of conduct, etc., can also contribute to path dependency because they often favor existing technologies.

The tendency of the above three factors to prevent all kinds of long-term technological development in the private sector, but there is reason to believe that they can be particularly troublesome in the case of green technologies. First, empirical research indicates that green technologies (in energy and transportation) generate significant cognitive ramifications compared to the dirtier technologies they replace. Furthermore, while protecting property rights is one way to reduce these spillovers, the patent system is subject to limitations.

On this basis, technological change for sustainability requires more radical technological transformations, and these transformations are characterized by long and risky development periods during which new systemic structures - i.e. networks of actors, value chains, knowledge and institutions - need to be implemented and are in line with emerging technologies. In general, the private

sector alone cannot be expected to create these structures, and for this reason, some kind of policy support is needed.

However, for any policy tool or combination of policies to be effective, it must build on a proper understanding of the fundamental obstacles to long-term technological development. As different technologies tend to contend with context-specific learning processes, patent prospects, risk profiles etc., technology-specific support may be required.

### **Sixth - The emergence of green capitalism and the mechanism of uncertain work**

At least since the emergence of the modern environmental debate during the 1960s, economic and environmental goals have been seen as incompatible with each other. It has been said that business decisions are based on the pursuit of maximum profit; Thus, attempts to address environmental concerns simultaneously will result in lower profits and lower productivity<sup>(15)</sup>.

However, along with the growing concerns about the environmental footprints of the global economy and the growth of organic products and labels, waste material recycling, climate compensation schemes etc., sustainability issues are starting to move into mainstream business activities. In fact, many large companies often no longer distinguish between environmental innovation and innovation in general; The environmental footprints of business operations are always taken into consideration during the innovation process.

Some even put this in Schumpeter terms, arguing that sustainable technological change involves “a new wave of creative destruction with the potential to fundamentally alter competitive dynamics in many markets and industries. The literature has recognized the potentially important roles that so-called entrepreneurs can play in The field of sustainability in bringing about a transition to a green economy; these types of entrepreneurs seek to combine traditional business practices with sustainable development initiatives.

That is, there is a growing demand for companies operating across two logics that were once seen as incompatible (commercial and environmental). However, there is huge skepticism about the scope and depth of green capitalism in this regard. Moreover, the answer to the question of to what extent The market-driven sustainability transition will take us, likely to vary depending on the business sector and on factors such as the availability of financing in these sectors. From all of the above it is clear that there are reasons to assume that in the absence of direct policy support, companies will not be well equipped to invest in the

development of green technology in the long term. Developing and nurturing green product innovations is often easier because companies may charge a premium to consumers in fact, many of the world's leading sustainability entrepreneurs have been. By contrast, green process innovation is more difficult to pursue. It is difficult to get consumers to pay premiums for these innovations. For example, great efforts are needed to develop a carbon-free blast furnace process in modern iron and steel mills <sup>(16)</sup>.

And even if this is achieved, it remains unclear whether consumers will be willing to pay a premium on their car purchases based on the knowledge that the primary production process is less carbon intensive than it used to be. Moreover, taking basic R&D results, which appear promising on a laboratory scale, through "Death Valley" into commercial application is a long and risky journey. Process innovations usually require incremental increase and improvement in production techniques. For small and medium businesses in particular, this can be a major hurdle.

In general, it is likely that only green capitalism and sustainable entrepreneurship may have problems in achieving the transition to a green economy (at least) in two respects <sup>(17)</sup>.

**First**, because there are long-term ramifications of knowledge and the need to take risks, the business and fundamental transformation may involve very few radical technological transformations.

**Second**, the baseline scenario is very likely to involve a lot of digitization and automation, which in turn greatly increases the potential for increased material and energy efficiency. However, due to rebound effects, efficiency gains from new technologies alone may not be sufficient to address the challenge of sustainability.

### **Seventh: Challenges of transformation and transition to a green economy:**

There are many challenges that countries will face in their transition to clean (green) energy, especially Iraq, but they must intensify their efforts to overcome these challenges.

Among these challenges <sup>(18)</sup>:

- 1- Lack of careful planning in the field of development policies.
- 2- The shift of jobs from sectors to other, as the increase in jobs in certain sectors is offset by a decline in a number of jobs in other sectors, especially in the transitional phase, and this leads to the spread of the problem of unemployment among a large group in society, especially the youth group.
- 3- The possibility of the emergence of protection policies and additional technical barriers to trade.

- 4-Poverty still affects nearly seventy million people in the Arab world, including the lack of minimum health services and clean water for more than forty-five million Arabs, and the lack of efficient use of fresh water and energy sources.
- 5- The option of switching to a green economy is an expensive option and may not result in an automatic and equal victory on the economic and environmental levels, and this may be at the expense of other development goals.
- 6- The high cost of environmental degradation in the Arab countries, which amounts to ninety-five billion dollars annually, equivalent to five percent of the total gross domestic product.

### **Conclusions:**

- 1- The green economy is the best solution to preserve the sustainable environment.
- 2- Technological solutions support the transition towards a green economy and the sustainability of natural resources in light of a set of approved data and foundations that were addressed in the framework of the research.
- 3- In order to implement the green economy requires many basic pillars that depend mainly on the state's economic policy and its orientation towards the transition to a sustainable green economy.
- 4- The shift towards a green economy depends mainly on an individual and governmental initiative to support this transformation, as it is reflected in the positives first on individuals and then on society and the state in general.

### **Recommendations..**

- 1- Adopting alternative solutions and imposing taxes on industries that pollute the environment is very important, meaning that the carbon tax is very important to reduce endless pollution while increasing production.

2- The importance of supporting companies and the state to adopt energy-saving and low-waste production policies using the latest technologies adopted in production.

3- The importance of preserving the environment, not wasting resources, and focusing on the shift towards a green economy that supports the environment and its components.

### Sources..

- United Nations Development Programme, Green Economy in Action: Articles and Excerpts that Illustrate Green Economy and Sustainable Development Efforts, 2012, p4.
- John Morelli, Environmental Sustainability: A Definition for Environmental Professionals, Journal of Environmental Sustainability, vol 1, iss 1, 2011, p5.
- 3- Sustainable Finance and Green Investment, The Third Forum for Strategies for Transitioning Towards a Green Economy, Arab Republic of Egypt, 2021, p. 21.
- 4- Abdi Mustafa, The green economy as a requirement to achieve sustainable development, Al-Manara Journal for Legal and Administrative Studies, Hassan I University, Morocco, 2020, p. 7.
- 5- Sustainable finance and green investment, previous source, p. 22.
- 6- David Popp, The Role of Technological Change in Green Growth, Center for Policy Research The Maxwell School Syracuse University, 2012, p24.
- 7- Kaja Rebane, Knowledge and adoption of solar home systems in rural Nicaragua, Energy Policy, 2011, p39.
- 8- <https://www.oecd.org/g20/summits/osaka/OECD-G20-Paper-Innovation-and-Green-Transition.pdf>
- 9- Larissa Batrancea, An Empirical Investigation on the Transition Process toward a Green Economy, Sustainability, 2021, p6.
- 10- <https://www.mc-doualiya.com/chronicles/evirnonnement-mcd/20120615>.
- 11- <https://www.deutschland.de/ar/topic/alaqtsad/rasmalyt-almstfydyn-shkl-aqtsad-almstqbl>
- 12- Abdi Mustafa, a previous source, pg 7.
- 13- Fabio Natalucci, How Investment Funds Can Propel the Green Economy, IMF See : <https://www.imf.org/ar/News/Articles/2021/10/04/gfsr-ch3-how-investment-funds-can-drive-the-green-transition>
- 14- <https://www.greeneconomycoalition.org/news-and-resources/the-5-principles-of-green-economy>
- 15- Eva Alfredsson, The Inclusive Green Economy, 2017, p17.
- 16- Adam Albekov, Green Economy and Economic Growth: Trends, Challenges and Opportunities for the EU, vol 5, iss 1, 2017, p3.
- 17- <http://www.gci.org.uk/Documents/128075741-Green-Economics-an-Introduction-to-Theory-Policy-and-Practice.pdf>
- 18- [http://pdf.wri.org/adapting\\_for\\_a\\_green\\_economy.pdf](http://pdf.wri.org/adapting_for_a_green_economy.pdf)



