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**Xiaole Wang,**

Student of group EMM-200004,  
Department of Economics and Management,  
Graduate School of Economics and Management,  
Ural Federal University named after the first President of Russia B.N. Yeltsin  
Yekaterinburg, Russian Federation

**Piscunova Larisa Petrovna,**

PhD in Philosophy, Associate Professor,  
Department of Economics and Management,  
Graduate School of Economics and Management,  
Ural Federal University named after the first President of Russia B.N. Yeltsin  
Yekaterinburg, Russian Federation

## **THE CHALLENGES OF DIGITAL TRANSFORMATION AND RENEWABLE ENERGY MANAGEMENT FOR THE GREEN ECONOMY TRANSITION**

### *Abstract:*

This paper aims to illustrate the challenges of digital transformation and renewable energy management for the green economy transition, and to assess uncertainties, then to analyze some methods on how to obtain sustainability. The conclusions of this paper reveal that companies and states should embrace the trend of the green economy through conducting an agile high impact innovation involving digital transformation and renewable energy management.

### *Keywords:*

green economy transition, uncertainty, sustainability, business model, digital transformation, renewable energy, innovation

### **1. Introduction:**

The effects of human-caused global warming are happening now, are irreversible on the timescale of people alive today, and will worsen in the coming decades. Actually, green economy transition is an urgent need for sustainable development of our whole human society. On the other hand, with the continuous globalization and increasingly competitive business environment, as well as the unprecedented combination of ongoing COVID-19 pandemic and recent global energy crisis, there have been various challenges for managers and executives to deal with, who should have a clear knowledge and a correct strategy about how to cope with uncertainty and how to win the global market and the future.

To the point, achieving sustainable development is the ultimate object of green economy. Green economy facilitates the implementation of sustainable development. It is encouraging but challenges are persisting. However, some managers and executives are not professional to treat and overcome the challenges in times of uncertainty, even some managers and executives tend to avoid to confront them, that irresponsible conduct can result in a management stagnation, making their organizations would be eliminated through sharp market competition.

As for green economy, finance, technology and energy remain the biggest challenges. National economic policies and global policies do not sail through successfully when there is global financial crisis. The green economy advocates green policies which are not detrimental to economic growth and development. Please notice that, this essay is scheduled to mainly focus on the two challenges: technology and energy.

For this essay, it is important to work out two research questions:

1. *What are the main challenges of digital transformation and renewable energy management for the green economy transition?*
2. *What are the methods and recommendations to cope with the above challenges for managers and executives?*

The aim of this essay is to make managers and executives have a clear understanding of how to agilely and correctly deal with the main challenges in the green economy transition, ensuring their business to obtain sustainability.

The contributions of this essay are presented as follows:

- a) Explain the reasons why the green economy transition and sustainable leadership are vital in the current period of uncertainty;
- b) Emphasize the functions of digital transformation and renewable energy management in realizing the green economy;
- c) Analyze the methods and recommendations on how to effectively manage digital transformation and renewable energy, promoting the green economy transition;

- d) Emphasize digital transformation is a solid service to help managers and executives to conduct business model innovation to obtain sustainability.

## 2. The Green Economy and Sustainability

For human-being, it is no doubt that the Earth is going through a terrible climate change.

Research shows that human actions still have the potential to determine the future course of climate. The evidence is clear that carbon dioxide (CO<sub>2</sub>) is the main driver of climate change, even as other greenhouse gases and air pollutants also affect the climate.

Global climate change has already had observable effects on the environment: shrinking glaciers, rising temperatures, rising sea levels, higher ocean temperatures, an increase in heavy precipitation, thawing permafrost, an increase in hunger, water and energy crises, health risks through rising air temperatures and heatwaves, spread of pests and pathogens, social fragility, loss of biodiversity due to limited adaptability and adaptability speed of flora and fauna, ice on rivers and lakes is breaking up earlier, more frequent marine heatwaves, ocean acidification, more frequent wildfires, longer periods of drought in some regions and an increase in the number, duration and intensity of tropical storms, plant and animal ranges have shifted and trees are flowering sooner.

Scientists have high confidence that global temperatures will continue to rise for decades to come, largely due to greenhouse gases produced by human activities. The Intergovernmental Panel on Climate Change (IPCC), which includes more than 1,300 scientists from the United States and other countries, forecasts a temperature rise of 2.5 to 10 degrees Fahrenheit (around 1.4 to 5.6 degrees Celsius) over the next century. [1].

Climate change will continue through this century and beyond. Some of future effects of global climate change are as the below [1]:

1. Temperatures will continue to rise
2. Frost-free season (and growing season) will lengthen
3. Changes in precipitation patterns
4. More droughts and heat waves
5. Hurricanes will become stronger and more intense
6. Sea level will rise 1~8 feet by 2100
7. Arctic likely to become ice-free

Therefore, stabilizing the climate will require strong, rapid, and sustained reductions in greenhouse gas emissions, and reaching net zero CO<sub>2</sub> emissions, plus limiting other greenhouse gases and air pollutants, can have benefits for both human health and the global climate.

Global warming is a serious problem in climate change, and the potential for discovering new ideas is how people are going to solve it. Due to that people will not stop economic growth, part of what people need is new technologies and business model innovation.

In a world of finite resources and ecosystem capacity, the prevailing model of economic growth, founded on ever-increasing consumption of resources and emission pollutants, cannot be sustained any longer. By 2030, in our world, global energy demand up by 45%; oil price up to US\$180 per barrel (International Energy Agency); greenhouse gas emissions up 45%; global average temperature up 6°C; sustained losses equivalent to 5~10% of global GDP; poor countries will suffer costs in excess of 10% of their GDP; ecological degradation and water scarcity will increase over US\$70 billion worth of biodiversity is lost every year (UNEP). In addition, scientists agree that to get on track to limit global temperature rise to 1.5°C, emissions must drop rapidly to 25 gigatons by 2030 (UNEP). In this context, the concept of “green economy” has offered the opportunity to change the methods that society manages the interaction of the environmental and economic domains.

A green economy can be defined as one that results in increased human well-being and social equity, while significantly reducing environmental risks and ecological scarcities (UNEP 2011). The green economy concept can indeed play a very useful role in changing the way that society manages the interaction of the environmental and economic domains.

The “green economy” concept has been driven into the mainstream of policy debate by global economic crisis, expected increase in global demand for energy by more than one third between 2010 to 2035, rising commodity prices as well as the urgent need for addressing global challenges in domains such as energy, environment and health [6].

The term “green economy”, chiefly relating to the principles of sustainable development, was first coined in a pioneering 1989 report for the government of the United Kingdom by a group of leading environmental economists. The most widely used and reliable definition of “green economy” comes from the United Nations Environment Programme which states that “a green economy is one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. It is low carbon, resource efficient, and socially inclusive” [5].

The green economy can also be viewed as a set of principles, aims and actions, which generally include:

- (i) equity and fairness, both within and between generations,
- (ii) consistency with the principles of sustainable development,
- (iii) a precautionary approach to social and environmental impact,
- (iv) an appreciation of natural and social capital, through, for example, the internalization of external costs, green accounting, whole-life costing and improved governance,

- (v) sustainable and efficient resource use, consumption and production,
- (vi) a need to fit with existing macroeconomic goals, through the creation of green jobs, poverty eradication, increased competitiveness and growth in key sectors [6,7,8].

Recently, the green economy has gained attention as a concept that could overcome the connotation of environmental protection as a cost factor slowing down economic development and bring the environment and the economy into a positive relationship, in which the environment becomes an opportunity rather than a constraint, and a new driving force for economic development. Sustainability remains the vital long-term goal, in this sense, the green economy can be considered as a sustainable development path based on addressing the interdependence between economic growth, social protection and natural ecosystem. Moreover, managers should understand that green economy is not equal to sustainable development, and green economy means passageways to sustainable development and poverty eradication. On the other hand, the green economy provides a macro-economic approach to sustainable economic growth with a central focus on investments, employment and skills.

The course of realizing the green economy that means passageways to sustainable development and poverty eradication. The green economy is very important for sustainable development. The green economy suggests making alternative environment prone technology. The green economy helps reducing waste and pollution by changing patterns of production and consumption.

Some key characteristics in the course of realizing the green economy can be described by:

1. an increase in the share that “green sectors” contribute to the gross domestic product as well as in a country’s population that is employed in these sectors;
2. decoupling of economic growth from resource use and environmental impact;
3. an increase in public and private investment going into green sectors;
4. a changing composition of aggregated consumption in which the share of environmentally friendly products and services increases.

The actions of promoting the green economy can unlock new growth engines by [9]:

1. Enhancing productivity by creating incentives for greater efficiency in the use of natural resources, reducing waste and energy consumption, unlocking opportunities for innovation and value creation, and allocating resources to the highest value use.
2. Boosting investor confidence through greater predictability in how governments deal with major environmental issues.
3. Opening up new markets by stimulating demand for green goods, services and technologies.
4. Contributing to fiscal consolidation by mobilizing revenues through green taxes and through the elimination of environmentally harmful subsidies. These measures can also help to generate or free up resources for anti-poverty programmes in such areas as water supply and sanitation, or other pro-poor investments.
5. Reducing risks of negative shocks to growth due to resource bottlenecks, as well as damaging and potentially irreversible environmental impacts.

Promoting a green economy implies transformation of today’s policies and practices towards environmental sustainability. It also challenges business development. Noticeably, the digital revolution is already driving an economic transformation. The next frontier is how companies can influence the consumers of their products and services to support low-carbon operations and lifestyles. Three unstoppable forces are pushing human towards a future of prosperity, growth and clean energy: climate leadership, market forces and the digital revolution.

Key elements of green economy are efficiency, incentives, transformation, sustainability and inclusion, bringing people and key actors together towards better livelihoods in smarter, cleaner, innovative and more resource efficient economies; green economy accounts for the environment and the value of natural assets in planning and decision-making, and focuses on the quality and sources of sustainable economic growth.

To sum up, green economy intends to achieve sustainable development without degrading the environment and also participates in the reduction of environmental risks and ecological scarcity. The purpose of green economy is to create genuine, shared prosperity, enhanced energy and resource efficiency, and prevention of the loss of biodiversity and ecosystem services. Green economy can contribute to eradicating poverty as well as sustained economic growth, enhancing social inclusion, improving human welfare and creating opportunities for employment and decent work for all, while maintaining the healthy functioning of the Earth’s ecosystems [12].

### 3. Uncertainty and Uncertainty management

Around the world, managers and executives are operating under a series of ongoing uncertainty, including various things regarding the climate changes and the green economy transition and others.

There is great uncertainty surrounding the geopolitical context in which companies operate: the continuing saga of Brexit; trade tensions between the U.S. and China; tensions in the Middle East and Eastern Europe. Furthermore, there is structural uncertainty — namely, the disruption to many business models brought about by technological change, the rapidly changing nature of work, climate change, and tectonic shifts in consumer needs and tastes.

In addition, regulatory uncertainty is another omnipresent factor, as businesses grapple with shifting patterns of regulations such as tariffs, evolving data privacy regimes, structural shifts in tax policy and the regulation of technology transfers, and international investment. Last, for managers, when some different sources of uncertainty occur at once, exacerbating one another, the level of general emotional uncertainty rises.

Economist Herbert Simon won the Nobel Prize for his work on what he called “bounded rationality,” pushing back against the conventional wisdom that leaders are rational decision makers. Instead, he argued, they use judgment shortcuts, called heuristics (rules of thumb that simplify things), to make decisions [4].

If managers use heuristics during periods of uncertainty, they can be counterproductive in the short or middle term, because that so-called procyclical manner they operate in leaves their organizations poorly positioned to benefit from the next stage of the cycle, when things start to improve.

Indeed, uncertainty can take place anywhere and anytime. Businessmen and entrepreneurs should not fear it but acknowledge it and embrace it. Thus, managers should build an awareness of the potential problems. However, it is suggested that managers should not be overconfident about dealing with uncertainty, because when managers forecast the best scenarios and the worst ones, they invariably underestimate both how good and how bad things can become.

To begin with, new mindsets, skills and execution capabilities are important for managers and executives, if they are to bring about successful change within their organizations. Successful implementation of change requires a correct understanding of the human response to change. Resistance to change is a barrier that can stop an organization from reaching its sustainability. Because response to change is predictable.

In the face of uncertainty, managers should adapt to the advanced approaches, new mindsets and new agile ability. The interlinked and mutually reinforcing attributes required to succeed in uncertainty are clear.

As a baseline, companies must strive to be fit for growth and sustainability, by aligning costs with priorities and strategy, investing in differentiated capabilities, and using historical experience, traditional and digital levers to execute.

Managers and executives should continually engage in scenario planning, constructing and evaluating an array of options that offer a broader view of the landscape and possibilities for success. They should build the capacity to be agile — possessing the balance and capability that enable them to shift focus, priorities, and resources to meet changing circumstances. And they must evolve to become more resilient — able to withstand strong external forces, quickly recover from setbacks, and stay in a position to benefit from new opportunities.

The great challenge of managing amid uncertainty is that the potential outcomes are much more numerous than is typically or traditionally expected — for the economy at large, and for the behavior of competitors and consumers. It means that managers need to be as clear about what they will not do as they are about the initiatives they will pursue. At this point, managers should have a clear knowledge of dynamic strategic decision making. Strategic decision making has to become more dynamic and probabilistic. Defining strategy, then testing and bettering it to adjust to internal and external changes, is critical to building a competitive advantage.

Technology and data play a crucial role in building a strategy that is agile, resilient, and dynamic. Big data and machine learning allow for a greater ability to model economic, corporate, and human behavior. Defining a set of plausible futures and constructing a digital twin (*Digital Twin is most commonly defined as a software representation of a physical asset, system or process designed to detect, prevent, predict and optimize through real time analytics to deliver business value. Digital Twins can help customers across three core areas: asset, network and process. [10]*) of the operating environment can create a picture of how different drivers of uncertainty interact with one another. Thus, organizations can consider a wide range of scenarios on uncertainty, then managers and executives are able to use scenarios analysis via some professional software to make the best strategy to cope with various uncertainties.

What is scenario analysis? Scenario analysis is a method for creating responses to various future events with the aim of reducing uncertainty and maximizing the chances of achieving a desired outcome. This process requires investments of people, time, and money. Imagination also comes into play as managers use scenario analysis to determine or invent possible courses of action to take, so the organization can reduce its overall risk and maximize its value.

Furthermore, a company should equip with an internal smart mechanism on the process of market sensing and market scenario analyzing and market testing. By this method, companies can focus their efforts on building out and scaling the capabilities that enable them to grow or reinforce competitive advantage, and to have a much greater sense of optionality under different contingencies. Managers and executives should understand that running multiple scenarios on how a company can succeed under different sets of conditions increases confidence.

In times of uncertainty, the most of companies tend to reduce head count, put hiring freezes in place, and leave positions open. But this is not beneficial for their sustainable development, they should ensure that their employees have the new skills required by the new digital world. Investing in efforts to make the existing workforce more agile and resilient to changes in the environment can boost an organization’s capacity to thrive in uncertain times. Meanwhile, managers should introduce the latest IT infrastructure to power their workforce.

Companies should respect, recognize and understand their employees, especially in times of uncertainty. Managers should treat employees more responsibly and honestly, always convey positivity and strength to them, and provide them consistent support in the work place. It is more vital for firms to develop their employees, so that they can adjust to fill the organization’s evolving needs. For example, Amazon is investing US\$700 million over six years to help current employees gain the skills that will enable them to move into technical roles in areas such as machine learning, software engineering, and IT support [4].

In addition, managers should recognize times of uncertainty can damage workplace culture. When employees are concerned about the future of the company, some may choose to leave for other job opportunities, and others may become fearful and less engaged. Managers, as they seek to build their employee skills for uncertainty, must double

down on consistent and positive communications that emphasize steps the organization is taking to be more agile and resilient.

Companies should be careful of evaluating deal opportunities in times of uncertainty. Managers are ought to focus on how to create value in the market. To make it clear, organizations should adjust its mindset (and mentality) initially, and try to enhance their current core business, and to acquire new technologies, operations and units that bolster capabilities desired. If companies lack clarity on the short-term prospects surrounding any one business, they can shape their future by focusing on the long-term structural trends about which they have some level of certainty — for example, the continuing evolution of e-commerce, or a move to a lower-carbon energy system. Only by this way, can companies be best suited to ride the next technological wave. Therefore, managers and executives need to attach importance to two crucial components that underlie the success of deals: culture and talent. As for it, leaders should work out a set of clearly and aggressively communicating value creation plans, which will help attract (and retain) key personnel and build buy-in from them.

Apart from the above three methods: implementing dynamic capabilities-driven strategies, investing in human capital and executing deals effectively, managers and executives still need to focus on operational agility, which is imperative for companies in times of uncertainty. Currently, the challenge (and opportunity), for operations is to utilize new technologies such as digitization, AI, Cloud, machine learning and robotic process automation to reshape operations rapidly, immediately to make them can reflect the constantly shifting commercial landscape.

Last, managers should ensure their companies have a strong financial foundation. As for commercial organizations, their working capital often increases, consuming more cash and effectively restricting liquidity. If companies want to quickly react to changes, they are supposed to utilize data and information technologies to run scenarios involving their business, then they are able to review and challenge economic, business, and sales projections, and continually feed the actual results into updated forecasts to improve business models.

#### **4. Digital Transformation and the Green Economy Transition**

With the advent of the fourth industrial revolution and this unprecedented COVID-19 pandemic, the global economy and the corporate cultures are facing a paradigm shift; along with it, management and implementation related to resource availability and outcome responsibility are being revolutionized.

Furthermore, digital technologies have a key role to play by enabling and accelerating our efforts to achieve the sustainable development goals (SDGs) that the world is aiming for by 2030, digital technology will be central to shaping the methods in terms of reaching this destination and accelerating action at scale.

For companies, they need to make critical shifts towards a more sustainable, circular and resilient direction for the survival of human and the Earth. Managers and executives should require fundamental changes in the data, data analytics, values and business models that dominate and dictate financial markets, global supply chains, and consumer behaviors, investment in new technologies. Thus, organizations should be able to harness the power of digital technology to facilitate sustainable and inclusive growth around the world.

In this regard, companies and governments should pay attention to the functions and development of new technologies, and the human society need to build up a communication mechanism that enable companies and governments can effectively and honestly assess and address various issues relevant to utilizing the new technologies in the green economy transition. If there is no synthesis of trust and cooperation, the green economy transition will be actually slow.

Consequently, companies need to actively invest in green technologies. But too often, the investment trends in green technologies have been lagging. Moreover, in times of uncertainty, there are an overwhelming number of procedures and data for managers and executives to meet with to make a correct decision, in this situation, if managers and executives are inefficient or careless, the opportunity will be lost, resulting their company lack of new technologies and in a weak position.

Digital transformation can help organizations to improve visibility and performance in its operations, increasing efficiency, reducing waste and pollution, and enhancing corporate social responsibility, attracting talents, promoting sustainability.

Digital transformation is not equal to technology. It is about transforming the methods people work and live to internalize the potential of digital tools and to embody a digital-first mindset without losing sight of the human experience. With significant advancements in communications technology and wide availability of internet and versatile electronics, people must be at the center of any successful digital transformation.

However, a digital transformation effort does not include all of these technologies, but can bring together multiple technologies to create a solution. One common thread often is data. At this point, companies should adapt to a “digital environment”.

In many ways, digital transformation is a mindset or way of thinking about problems and outcomes that is then enabled by technology.

Organizations are supposed to take digital technologies and putting them against agency problems. It is important to keep the current workforce with emerging technologies, regardless of whether they consider themselves a technologist. There is a term “digital fluency” to describe the characteristics the workforce, and there is another term “digital culture” to describe the idea that technology and the Internet significantly shape the way people interact,

behave, think, and communicate in a societal setting. It is the product of pervasive technology and limitless access to information — a result of disruptive technological innovation within our society.

Technologies of transformation often include artificial intelligence, machine learning, cloud computing, robotic process automation, blockchain, data management and analytics solutions, edge computing, digital twins, sensors and the Internet of Things (IoT). On the horizon are other emerging technologies such as 5G. Thus, a large number of data has become available anywhere and anytime, that means the challenge is harnessing data to better decision-making. Digital transformation is a tool realizing this object.

Digital transformation is reshaping every industry across the globe. According to the World Economic Forum, by 2022, over 60% of global GDP will be digitized and an estimated 70% of new value created over the next decade will be based on digitally enabled platforms [13].

Noticeably, digitalization leads to digital business, digital transformation needs digital business and digitalization [14]. Digitalization can help make digitized information work for managing a digital business.

To halve emissions by 2030, organizations need to maximize technologies at different levels of development. The future technology landscape will be the prevalence of data and the ability to mine the data and draw value.

The grand challenge for human-being is to ensure that groundbreaking technologies have a clear purpose for the Earth and everyone on it. Therefore, companies need to adopt an integrated framework for sustainable innovation with a digital transformation. To meet this requirement, companies need to align their digital transformation and sustainability objectives, and their decisions need to be grounded in data. To most extent, digital transformation should be purpose-led, delivering for all stakeholders as a requisite for company success.

Digital and especially mobile technology has fundamentally changed the way people behave as well as most of the companies' business models. New technologies, the availability of data about consumers and the interconnection among machines and human processes affect companies' strategies and operations, transforming the management [16]. Digital transformation means integrating digital technology into all areas of a business to fundamentally change how companies operate and deliver value to customers. With it, the strongest driver for companies is that they need to adapt their business models to survive in the market.

The process of digitization should be organically aligned with the core logic of business all the time. Disruptive technologies and digitalization will help companies achieve digital transformation with intelligent and highly agile digital supply chains that predict and respond to changes in the ecosystem to quickly capitalize on new opportunities and break down old barriers. In this sense, it takes modern technology, flexible data management, and highly agile processes, innovations in business models and operation models.

In the viewpoint of the green economy transition, for originations, there are main 11 challenges for promoting digital transformation:

1. The challenge of digital leadership and digital transformation strategy
2. The challenge of clarity on the digital transformation budget
3. The challenge of digital culture and organizational structure transformation
4. The challenge of technology integration and technology adoption
5. The challenge of IT infrastructure and digital expertise
6. The challenge of data and data analytics, data security
7. The challenge of meeting customers' new needs and expectations
8. The challenge of keeping up with the latest technologies
9. The challenge of resource management and energy management
10. The challenge of increased competency, productivity and profits
11. The challenge of agility in project management
12. The challenge of digital innovation to climate change

What are the suggested solutions to the above?

When creating a digital transformation initiative, it is imperative to start by redefining success. Managers and executives should recognize that the digital transition and the green economy transitions are closely intertwined, be positive to get innovations out of the lab into the market, besides, they should understand that digital transformation matters a survival issue for their companies. Managers and executives should be brave and smart to absorb new knowledge and principles on digital technology and digital transformation, and be open-mind to adopt to the changing environment, and have a clear recognition on what initiatives get prioritized, which technologies are selected and how to engage employees.

Everyone in a company need to rethink the role and impact of IT, data, Cloud, AI, blockchain, machine learning, AR/VR in their day-to-day experience. People should not ignore the trend of digital initiatives. A new mindset is required to successfully operates in this fast-moving world, which are rich of data, digital technologies, various electronics and software. Intentionally encouraging employees and other stakeholders to grow accustomed to the digital culture, tools, technology, and solutions will help companies persuade the workforce during the digital transformation. To most extent, for managers, it is essential to select and leverage the digital transformation consultancy agency that understands and performs in a company's best interest.

Managers should have a digital transformation initiative. A well-defined strategy requires a vision for what the digitally transformed company will be as well as new metrics that will capture progress toward that vision. The digital

transformation vision should incorporate the company's existing core competencies and strengths and how to augment them through the conversion.

Companies should understand that the biggest digital transformation concern is how to integrate existing legacy assets with newly emerging technology tools. It is depending on the capacity of digital tools to not only link up with legacy systems but also to leverage them into new business values and opportunities. For managers, the integration process involves taking existing capacities and enhancing them with new technologies to become bigger and better options than either the old or the new.

Effective integration of legacy programming throughout the digital transformation process can repackage the value of legacy systems into vital elements of the transformed organization, which also can enhance the return on investment for those legacy systems [18].

For it, companies need to work out a long-term strategy on digital transformation to ensure their companies have a clear vision, then to use the green digital finance through the adoption of fintech innovations to ensure a healthy working capital, having a strategy in place for the long-term with a budget in mind is recommended to avoid potential financial risks of the company. On the other hand, with meticulous planning and a thorough understanding of the digital solutions and culture setting, a budget that deviates minimally from the actual estimation is highly possible. Furthermore, their companies could hire some advanced digital accountants to protect their budgets.

Plus, most firms believe that customer service will be the key aspect that they differentiate themselves from their rivals. Companies across industries should invest in digital transformation and adopt a customer engagement system to communicate with customers, improve customer experience, reduce friction, increase productivity, and deliver innovative customer-centric software. Digital transformation requires digital leadership, significant structural and process changes. Thus, companies need to equip with enough IT infrastructure, then companies should utilize digital technology and the latest technologies to speed competitive advantage construction to make organizational structure present develop tendency of network, flat, modular, matching the pace of change, keeping with the pace of technological innovation.

In addition, sustainable leadership needs to build continuous improvement into processes, short feedback loops built into workflows can identify issues quickly, making the organization more agile and flexible. Organizational structure should be efficient, fluid and flat through digital transformation, because the new frontier of technology, data science and the customer experience plus digital culture require it.

Companies should strengthen their collaboration to support a green innovation ecosystem, and managers should understand that the basic barrier of increasing the degree of digital transformation advancement is competency gap, which can be connected with a greater inclination and ability of utilizing the competencies of external partners. Encouraging cross-corporate collaboration is a need.

Also, if a company decides to be digital oriented, it need to support its employees, providing learning programmes that help them to deal with new management approaches and to harness big data. It means being able to read and understand new typologies of (unstructured) data, to process data and to make real-time decisions accordingly. Companies need to develop both technological and analytics capabilities in their teams. Managers should create a workforce transition plan as part of their digital transformation initiative. This plan should include communicating to employees the digital transformation strategy, identified skill gaps and objectives, and timing. After a series of training, employees should be agile and adaptable, can understand customers better and make real-time decisions based on customer's feedback.

The major digital transformation challenges center around people. Companies are suggested to utilize customer-focused software to connect their customers and partners. Managers can implement AI technologies and blockchain to help improve data collection and personalization efforts, advancing the level of data analytics. Modern software development tools and processes enable new workflows that organizations need time to adapt to and optimize. Without visibility into the application release processes that deliver customer value, an enterprise is unable to effectively manage its digital transformation challenges. For it, the internal alignment and readiness to operate should support organizational structures and operation models, business workflows.

Managers should build continuous improvement into processes, and the ability to adapt to changing government regulations and to respond rapidly to market changes requires a fundamental shift in an organizational structure. In urgent situations, managers can hire outside digital experts to supplement their team. Outsourcing is a highly utilized, economical, and efficient approach to bridge the competency gap.

Companies should sync and use all kinds of IT tools to make one online database, focusing on leading efficiency and innovation across units. That will help better resource management.

A successful integration of digital technologies requires a transformation of security, data security must be embedded into all applications as the first line of defense. Start to deploy real-time security controls across many different internal, public, and cloud environments.

## 5. Renewable Energy Management and the Green Economy Transition

The burning of fossil fuels sends heat-trapping gases into atmosphere, warming our planet at an alarming rate. In 2019, total greenhouse gas emissions, including land-use change, reached a new high of 59.1 gigatons of carbon dioxide equivalent. This means that atmospheric concentrations of carbon dioxide continue to grow. By 2019, NASA has researched out that: Average global temperatures have risen by 1.2°C in the past 120 years. To limit the global

warning of 1.5°C, as set out in the Paris Agreement (2016), human-made CO<sub>2</sub> emissions need to fall 45% by 2030, and must reach net-zero by 2050. 120 countries have pledged to meet this target. The Paris Agreement provides a framework for financial, technical and capacity building support to those countries who need it.

For this mission, the Paris Agreement (2016) is explicit in highlighting the importance of climate technologies for a sustainable future, stating in Article 10, that: “Parties share a long-term vision on the importance of fully realizing technology development and transfer in order to improve resilience to climate change and to reduce greenhouse gas emissions.” The Paris Agreement establishes a technology framework to provide overarching guidance to the well-functioning Technology Mechanism. The mechanism is accelerating technology development and transfer through its policy and implementation arms.

However, people are on the brink of missing the opportunity to limit global warming to 1.5°C. If people rely only on the climate commitments of the Paris Agreement, temperatures can be expected to rise to 3.2°C in the 21<sup>st</sup> century. By 2019, temperatures have already increased 1.1°C, leaving families, homes and communities devastated. People need to close the “commitment” gap between what people say people will do and what people need to do to prevent dangerous levels of climate change. Governments cannot afford to wait. People and families cannot afford to wait. Economies must shift to a decarbonization pathway now.

Today we still have the chance to limit global temperatures to 1.5°C. While there will still be climate impacts at 1.5°C, this is the level scientists say is associated with less devastating impacts than higher levels of global warming. Every fraction of additional warming beyond 1.5°C will result in increasingly severe and expensive impacts.

Our challenge: based on today’s commitments, emissions are on track to reach 56 gigatons of CO<sub>2</sub> by 2030, over twice what they should be.

This figure is our global solution. Collectively, if commitments, policies and action can deliver a 7.6% emissions reduction every year between 2020 and 2030, we CAN limit global warming to 1.5°C.

10 years ago, if countries had acted on this science, governments would have needed to reduce emissions by 3.3% each year. Today, we need to reduce emissions by 7.6% every year. Today, even the most ambitious national climate action plans are far short of a 7.6% reduction. The world now needs a five-fold increase in collective current commitments. The cuts required are ambitious, but still possible. Every day we delay, the steeper and more difficult the cuts become. By just 2025 the cut needed would will be 15.5% each year, making the 1.5°C target almost impossible. Delayed action delays the inevitable. Delayed action sends the eventual price tags for sea defenses; food security; infrastructure adaptation ever higher. While we wait, emissions continue to be released into the atmosphere, and the cost and difficulty to reduce them only becomes more challenging [27].

According to the Emissions Gap Report 2019, if people want to prevent warming of 2°C by 2100, people will have to make sure that our emissions output does not exceed 40 gigatons of CO<sub>2</sub> equivalent by 2030.

To limit warming to 1.8°C by the end of the 21<sup>st</sup> century, emissions will have to be cut even further, not exceeding 34 gigatons of CO<sub>2</sub> equivalent by 2030.

And to prevent 1.5°C of temperature rise by 2100, our total emissions will have to stay below 25 gigatons of CO<sub>2</sub> equivalent.

Why is 1.5°C important? While there will still be climate impacts at 1.5°C, this is the level scientists say is associated with less devastating impacts than higher levels of global warming. Every fraction of additional warming beyond 1.5°C will bring worse impacts, threatening lives, livelihoods and economies.

At 1.5°C, over 70% of coral reefs will die, but at 2°C virtually all reefs will be lost. Insects, vital for pollination of crops and plants, are likely to lose half their habitat at 1.5°C but this becomes almost twice as likely at 2°C. The Arctic Ocean being completely bare of sea ice in summer would be a once per century likelihood at 1.5°C but this leaps to a once a decade likelihood at 2°C. Over 6 million people currently live in coastal areas vulnerable to sea level rise at 1.5°C degrees, and at 2°C this would affect 10 million more people by the end of the 21<sup>st</sup> century. Sea-level rise will be 10 centimeters higher at 2°C than at 1.5°C. The frequency and intensity of droughts, storms and extreme weather events are increasingly likely above 1.5°C [27].

Green investments typically involve a combination of elements from the four areas of activity: energy efficiency, renewable energy, resource efficiency, climate change adaptation, reducing pollution and protecting natural assets. Green technology generates energy without nontoxic, harmful by-products. A main driver for green growth is the transition towards sustainable energy systems. Accelerating, encouraging and enabling innovation is critical for an effective, long-term global response to climate change and promoting economic growth and sustainable development. For managers and developers, they need to face and overcome the challenge of digital innovation for climate action.



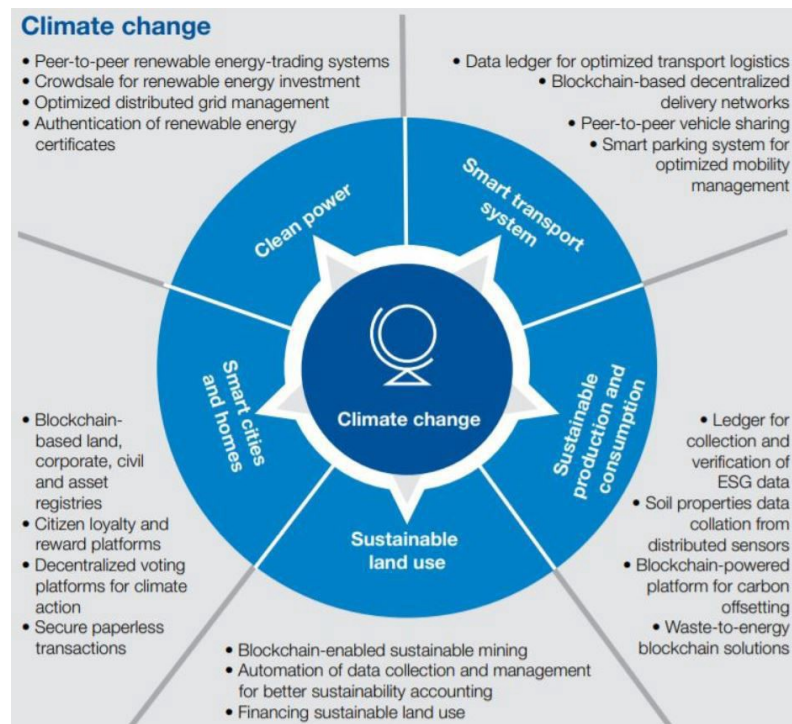


Figure 1: World Economic Forum (2018) Building Block(chain)s for a Better Planet

Technologies that can address climate change are known as climate technologies. Climate technologies that help us reduce greenhouse gases (GHGs) include renewable energies such as wind energy, solar power and hydropower. As figure 1 shows, organizations will prepare a lot works to improve resilience to climate change and to reduce greenhouse gas emissions. At this point, there is a mechanism, the Climate Technology Centre and Network (CTCN), which is hosted by the United Nations Environmental Programme, it has three core services: providing technical assistance to developing countries; creating access to knowledge on climate technologies; and fostering collaboration among climate technology stakeholders.

Despite the COVID-19 pandemic, the growth rate in the world's renewable energy capacity jumped 45% in 2020, part of "an unprecedented boom" in wind and solar energy, according to a new report from the International Energy Agency (IEA). It is the largest annual rate of increase since 1999. (The IEA predicts large capacity gains in renewable energy will become the "new normal" in 2021 and 2022.)

Take a solar power project in Kazakhstan as an example, that is: The 50 MW Burnoye solar power plant is the first large-scale solar project in Kazakhstan. Located in the southern Zhambyl region, the facility aims to help redress an energy imbalance that sees 80% of Kazakhstan's electricity come from coal-burning in the north of the country. The south, less rich in fossil fuels, relies on foreign imports and supplies from the north and transmission losses are equivalent to the total electricity consumption of Latvia. If generated by conventional means, the energy Burnoye produces would emit about 60,000 tons of CO<sub>2</sub> annually [20].

Climate technology is in response to a global need to reduce carbon emission and save the planet. It is not necessarily a response to any price fluctuation to natural gas and oil, coal. Therefore, companies should attach great importance to the challenges and opportunities of utilizing and managing renewable energy in the green economy transition.

According to the report of Exponential Climate Action Roadmap, digital technology sector is a powerful influencer to accelerate action to stabilize global temperatures well below 2°C. Because digital technologies could already help reduce global emissions, through solutions in energy, manufacturing, agriculture and land use, buildings, services, transportation and traffic management. With the movement of the Fourth Industrial Revolution, 5G, the Internet of Things (IoT), artificial intelligence (AI) and drones, digital technology sector take the pace of change to the next level.

Noticeably, blockchain is a powerful tool that can serve to significantly improve the transparency, accountability, and traceability of greenhouse gas emissions. It supports companies to provide more accurate, reliable, standardized, and readily available data on global emissions.

Energy efficiency, many types of renewable energy, carbon capture and storage, nuclear power, smart grids and new transport technologies could all contribute to curtailing greenhouse gas emissions while promoting energy security. This will also deliver wider environmental and social benefits. Efficiency improvements can reduce the need for investment in energy infrastructure, cut fuel costs, increase competitiveness, lessen exposure to fuel price volatility and improve consumer welfare. It also delivers on environmental benefits by reducing greenhouse gas emissions and local air pollution. Efficiency gains can also boost energy security by decreasing reliance on imported fossil fuels [21].

Moreover, clean energy transitions in the period to 2030 will largely rely on variable renewables for electricity generation. Dramatic cost reductions in wind and solar photovoltaic (PV) power generation over the last decade are underpinning their record levels of expansion [22]. The resilience of renewables is driven by the electricity sector.

Thus, companies need to consider how to use digital innovation and digital technology to enhance the renewable energy production, consumption and management, it is meaningful for their investment and our globe.

Take a case to illustrate it.

Battery electricity storage is a key technology in the world's transition to a sustainable energy system, which will have a high proportion of renewable energy and power electronics devices and be highly digitalized and Intelligent, providing various industries decarbonization solutions.

Huawei Digital Power Technologies Co., Ltd., was found on June 07, 2021 in Shenzhen city of China, with a registered capital of RMB 3 billion (468 million USD) and was placed Hu Houkun, deputy chairman and rotating chairman of Huawei as its legal representative. Its business scope includes online energy measurement technology research and development; research and development of emerging energy technologies; research and development of energy recovery system; research and development of electromechanical coupling system; sales of new energy vehicle power exchange facilities, etc. Shareholder information shows that the company is 100% owned by Huawei Technologies Co., Ltd. (<https://carrier.huawei.com/en/products/digital-power>)

The goal of Huawei Digital Power Technologies Co., Ltd. (Huawei Digital Power) is: Integrate digital and power electronics technologies to drive energy revolution for a better, greener future. Leading power digitalization for a smart and sustainable world, Huawei Digital Power strives to help carriers improve efficiency and smarten up facilities, to provide solutions help both telecom and tower carriers simplify facility deployment, improve power reliability, increase energy efficiency and make O&M smart, enable ICT networks to evolve to 5G and cloud smoothly.

Under the theme of "Leading power digitalization for a zero-carbon and smart society", Huawei Digital Power has presented its zero-carbon all-scenario solution at SNEC 2021, the world's largest solar trade exhibition which was being held in Shanghai until June 5, 2021.

The Huawei FusionSolar All-scenario PV & Storage Solution covers "4+1" scenarios: Smart PV Generator FusionSolar 8.0, Green Residential Power 2.0, Green C&I Power 1.0, and Off-grid (fuel removal) Power Supply Solutions + Energy Cloud, aiming to accelerate the shift to zero-carbon generation and bridge the energy divide.

#### **FusionSolar 8.0: Create A Future-proof Smart PV Generator**

Disrupting the traditional structure, Huawei launched the future-proof smart PV generator, called FusionSolar 8.0. It offers customers two benefits: First, the smart PV generator promises improved grid stability; second, the world's first "Gemini"  $\pm 1500V$  design can help to support larger sub-arrays, higher voltages, thus could reduce LCOE by 7%.

#### **Green Residential Power 2.0: Start New Life in a Zero-carbon Home**

The upgraded Green Residential Power 2.0 solution highlights the innovative "1+3+X" structure. With the Smart Energy Controller at the core, it is equipped with three key components: the optimizer, the smart string ESS and the Green Power Cloud to build the intelligent power ecosystem. The Green Residential Power 2.0 solution, focusing on smart power generation, storage and smart power consumption with multiple active safety features, aims to lower energy bills.

#### **Green C&I Power 1.0: Let Green Power Empower All Industries**

Huawei launched its new C&I solution this year, which fits for different application scenarios: solar only, storage only, solar + storage + charging and off-grid. With the application of optimizers and the smart string energy storage system, the solution can improve the energy yield by 30% and energy storage power by up to 15%. Huawei inverters support intelligent AFCI arc protection and automatically shut down within 0.5s, ensuring the active safety of systems.

#### **Huawei's Digital Power Zero-carbon All-scenario Solution: Lead the Power Digitalization for a Zero-carbon and Smart society**

In addition to zero-carbon power generation, Huawei also displays the digital power zero-carbon all-scenario solution for the first time at SNEC. In the era of carbon neutrality, Huawei Digital Power business unit gives full play to its strengths in digital technology and power electronics and integrates the watt, thermal, energy storage, cloud, and AI technology, to accelerate the digitization of the energy industry and contribute to a zero-carbon smart society.

During the unfolding energy transition, renewables represented by solar PV will inevitably become the primary source of energy, and building a new power system with renewable energy as the main source is the key to achieve carbon neutrality. With profound expertise in the integration of digital technology and power electronics, Huawei works with customers and partners to promote the energy transition and build a zero-carbon and smart society.

Huawei Digital Power has concluded its Global Digital Power Summit 2021 in Dubai, UAE, with more than 500 participants from 67 countries attending, on October 16. At the summit, Huawei Digital Power signed a key contract with SEPCOIII for the Red Sea Project with 400 MW PV plus 1300 MWh battery energy storage solution (BESS), which is currently the world's largest energy storage project. The two parties will cooperate to help Saudi Arabia build a global clean energy and green economy center.

This 1300 MWh off-grid energy storage project is the largest of its kind in the world and represents a milestone in the global energy storage industry.

## 6. Discussion and Conclusion

Since human society would face various uncertainties in a time due to a lot of reasons, for now, people have experienced economic and financial crisis, energy crisis, health crisis, ecological crisis. People should be responsible for their survival and sustainable development and future.

The concept of green economy brings the environment and the economy into a positive relationship, in which the environment becomes an opportunity rather than a constraint, and a new driving force for economic development. Sustainability remains the vital long-term goal, but the green economy is describing pathways to sustainable development and poverty eradication.

Meeting with all of the changes, it is difficult for managers to confirm quickly which challenges truly present opportunities for sustainable growth. Managers should have smart mindset, a long-term strategy, sustainable leadership, agile operation and digital transformation to create new business models, making their organizations to work efficiently to satisfy customers' expectation without harming our environment and society justice.

As for the green economy transition, to mitigate climate change is a big mission.

Therefore, managers should understand that, digital transformation is an ongoing process of changing the way people do business. It requires foundational investments in skills of data management, project management, IT infrastructure construction, and digital culture, etc. It requires mixing people, machines and business processes with data mining and cloud computing.

Digital transformation is a challenge that sustainable leaders want to take on not only because of its wide-ranging technological and economic benefits, but also because of the impact it could have for their organizations as they usher in the next generation of the workforce.

Managers should realize that the goals of both IT and business have been aligned, because connectivity between business and technology is increasingly close.

On the other hand, the unprecedented disruption by COVID-19 pandemic is accelerating the urgency for agility, adaptability and transformation. Industry structures and business models are being disrupted – and the digitalization of the economy is being rapidly accelerated. Digital transformation can help people work out precise and plausible solutions online for most sectors of energy, industry, buildings, transport, food, forestry and agriculture.

The rapid digitalization catalyzed by COVID-19 pandemic presents the opportunity to rethink how people make real-time decisions and how people apply technology in new and meaningful ways. Immense opportunity exists for enterprises that can capture the value of data to drive more sustainable solutions. The digital transformations of today must be purpose-led, delivering for all stakeholders as a requisite for company success.

Digital transformation changes how companies manage their relationships with the wider world. There has been a trend or culture for companies to apply digital technology, flexible data management, machine learning, cloud computing, AR/VR, drones and highly agile processes. All of operations, actions and feedbacks are interdependent and visible and traceable. In addition, it brings out transformation of society's perception of technology.

As for renewable energy management for the green economy transition, most companies should understand decoupling economic growth from resource use and environmental impact is not of wisdom. They should promote green investment, innovation, digital transformation and new technologies to produce digital power for renewable energy network, protecting our globe from greenhouse gas emissions, resource degradation and environmental pollution.

Towards the green economy transition, areas of policy-making which provide key enabling conditions for a green economy transition include [26]:

- (i) promoting investment and spending in areas of technology, infrastructure or infant industries that stimulate a green economy;
- (ii) limiting government spending in areas that deplete natural capital through a reduction of environmentally harmful subsidies
- (iii) establishing sound regulatory frameworks that create rights, incentives, minimum standards and prohibit the most harmful forms of behaviour and substances;
- (iv) addressing environmental externalities and existing market failures by employing taxes and market-based instruments that promote green investment and innovation;
- (v) strengthening international governance in areas where international and multilateral mechanisms regulate economic activity in addition to national laws.

In conclusion, the concept of the green economy is considered as a valuable tool to simultaneously address economic, social, and environmental issues to have a sustainability. This essay can help managers and executives have a clear understanding of the relationship of green economy transition, digital transformation, technology transition, renewable energy management, meanwhile explain the reasons why the green economy transition requires large investments, sustainable leadership, digital technology plus agile and efficient operations in order to take place successfully. Companies need to admit the necessity of this trend with a belief that science and technology are primary productive forces, no matter what kinds of uncertainties would come, a digital, smart and sustainable leadership is a vital prerequisite, the others are responsibility, collaboration, trust and transparency.

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