

# TECHNOLOGICAL INNOVATION AND ENTREPRENEURSHIP IN ACHIEVING ECONOMICS, SOCIAL, AND ENVIRONMENTAL SUSTAINABILITY IN G20 COUNTRIES

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## ABSTRACT

**Purpose:** *One of the key factors promoting economic growth is regarded to be technological innovation and entrepreneurship. However, technical innovation can also be utilized as a driver of new production alternatives to minimize the negative effects of developments on society and nature in the current economic climate, where issues relating to environmental preservation and conservation play a vital role. This research seeks to investigate the relationships in technological innovation in the G20 nations sustainable development from a theoretical standpoint. The results indicate that the G20 group has benefited greatly from technological innovation in terms of economic growth, social development, environmental sustainability, and sustainable development. The results also indicate that, depending on the development, technological innovation can have many types of repercussions.*

**Keywords:** *G20, Technological Innovation, Sustainability, Developments, Economic Growths*

## INTRODUCTION

Focusing on business sustainability in the context of the market is essential for all countries that wish to endure and remain competitive. One approach to do this is to focus on technical innovation, entrepreneurship, and continual development in this constantly changing environment that is being impacted by factors other than the crisis. One of the company's strategic goals is to put an emphasis on sustainable business, which results in resource allocation, resource setting, and socio-economic and financial sustainability, as well as a favorable effect on the globalized economy.

Economic strategies have always been concerned with the development of new technological innovations, but it has only been in the last few years that sustainability has come to the forefront of discussion and grown significantly in importance. Many nations economic expansion is frequently accompanied by overuse of natural resources, which has detrimental effects on the environment and society. It has become apparent that social equality and environmental sustainability

are necessary for sustained economic growth. In spite of its importance, economic growth should not be the primary determinant of progress, according to this paper, which also argues that Innovations, Entrepreneurship and environmental aspects should be considered into consideration.

Entrepreneurship and technological innovation can be seen as vital for the sustenance and development of today's economies in the world. Since, technological innovation and Entrepreneurship paves the way for new jobs, increased productivity, and new enterprises to achieve the sustainable growths, the competition is fierce and encourages innovators to keep coming up with new ideas or risk seeing their companies go out of business or their products become commodities. Innovative economies are more resilient, more productive, better equipped to support greater living standards, and more change-adaptive. The particular tool used by entrepreneurs to utilize change as an opportunity for a service or product is technological innovation. It is capable of

being introduced, of being practiced, and of being presented as a discipline (Drucker, P. 2014). The correlation amongst innovation, entrepreneurship, and economic development is nowadays a significant topic in today's fast growing world economy and technological innovation implementations.

The economy will be significantly more influenced by technological innovation in the years to come. We are in the early stages of a digital-industrial revolution, in which new digital technologies are beginning to transform various industries. For example, traditional industrial assets are now becoming intelligent, interconnected devices, and new manufacturing processes like additive manufacturing are revolutionizing how we design and construct products. Artificial intelligence and robotics developments will accelerate this shift even more.

## **THEORETICAL BASIS**

The term "innovation" is originated from the Latin word *innovatus*, although Schumpeter's work is where the present definition and established paradigms of innovation first appeared (Chen et al. 2018). Innovation is described as "new combinations" of new or existing knowledge, resources, equipment, and other elements as well as a dynamic process of the market providing of anything, resulting in additional value (Schumpeter 1934). Under the changing global environment, innovation is a key component of corporate values implementation, and understanding its effects is important as a growth engine for the economy (Chen et al. 2018; Ko and Lu 2010).

The previous studies recognized the significance of entrepreneurship and innovation in economic growth. The relationship between entrepreneurship and innovation and their effects on economic development was emphasized by Schumpeter in his book "The Theory of Economic Development 1911–1934." He

coined the phrase "entrepreneur as innovator" and saw innovation as a crucial force in driving economic dynamics and competitiveness. Innovation, in his words, is a "process of industrial mutation; that continuously revolutionizes the economic structure from inside, continuously destroying the old one, continuously constructing a new one. (Schumpeter, 1934).

Also, Entrepreneurship is viewed as a critical avenue for creating sustainable goods and services and putting new initiatives into action that deal with a variety of environmental and social issues, according to prior literature. The economic literature has long recognised the significance of entrepreneurs as agents of society and economic change.

According to Stefan, Comes, Szabo, and Herman (2012), the combination of entrepreneurship with innovation produces innovative entrepreneurship, which refers to new businesses built on unique, ground-breaking innovations.

Many researchers have already shown how vital technical innovation is to achieving sustainability. This interest was generated by a variety of knowledge areas, including technology, energies, finance, entrepreneurship, and administration, among many others. These topics include, among others, the social impacts of technology, Telecommunications and sustainable growth, technologies for sustainable development, education and online learning, globalisation and forecasting technology, social entrepreneurship and technology, and sustainability and green energy technology. Omri (2018) also finds that technological innovation in high-income countries promotes environmentally friendly production by incentivizing investors to employ cutting-edge technologies for a kinder environment. He further argues that low- and middle-income countries should make substantial efforts to develop and implement cutting-edge technology in order to achieve a balance between

sustainability and economic growth, which is in the interests of the society.

According to Baumol (1990), it has become apparent that "Schumpeterian innovative entrepreneurs" exist side by side with "defending and need of entrepreneurs"; the latter are those who start a new business not because of growth markets or innovative ideas but rather because they must make money to survive. This type of "survival-driven" self-employment is especially prevalent in developing nations (Naudé, 2009), where people are frequently driven by poverty and a lack of structured possibilities into entrepreneurship development like informal economy and conventional and solutions and services, which are typically found in the informal sector (Stam, 2011; Goedhuys and Sleuwaegen, 2010). In addition, Canton et al. (2005) contend that human behaviour, such as educational achievement, as well as technological and economic variables, such as R&D investment and inventions, impact the economic growth of the country. In the beginning, human capital directly improves productivity across all factors. The introduction of advanced technologies, inventions, or representations might boost businesses' technical activity (Romer 1990; Benhabib and Spiegel 1994; Teixeira and Fortuna 2004; Cinnirella and Streb 2013). Aghion and Howitt (1992) demonstrated in their Schumpeterian endogenous growth theories that R&D efforts may result in innovation, which is a requirement for technical advancement, which determines economic development in a Schumpeterian creative destruction process.

The most vital competitive strategy, according to Schumpeter (1943), is one that is motivated by innovative products, innovative technologies, resources, and innovative organizational models. Schumpeter can be credited with helping to create the concept of innovation in general, according to Fagerberg (2002). According to this viewpoint, Fagerberg (2002) discovered that Nelson and Winter (1982)

continued to promote Schumpeter's theory by viewing capitalism as a force for change although agreeing that the word "neoSchumpeterian" was the most fitting term for the evolutionary approach. They recommended that businesses reinvest their revenues in technological advances and more productive equipment, introducing along the rewards of high profits and growth, as opposed to the corporates that did not put this into practice, Fagerberg (2002) noted, noting that these scholars shared some similarities with Schumpeter.

In fact, sustainable development is seen as a viable route to refocus growth towards a more integrated approach, which seeks to build a symbolic link between ideal economic, social, and environmental systems for both present and future generations (Folke et al., 2002; Cobbinah et al. 2011). This goal was inspired by the notion that the social, environmental, and economic pillars of sustainable development are intricately intertwined and cannot be taken into account separately (Strange and Bayley, 2008).

Fagerberg and Srholec (2008) argue that economists like Lucas (1988) and Romer (1986) started to create modeling techniques with an emphasis on technology as the engine of growth and development; technological innovation started to be seen of as a crucial variable, starting the "new era of growth." Thus, Entrepreneurs use technological innovation as a specialised technique to seize opportunities presented by change to launch new products or services. It can be taught, it can be practised, and it can be represented as a discipline (Drucker, P. 2014).

Since, Entrepreneurs act as change agents. An economy's performance is based on how successfully its citizens can adapt to new possibilities." (UNICE (1999, Fostering Entrepreneurship in Europe; the UNICE Benchmarking Report 1999, Brussels, p.6). Entrepreneurs play a crucial role in the invention process, and their potential for entrepreneurship is a crucial component of the information transfer and

commercialization processes (Stefan et al., 2012). According to (Wennekers & Thurik, 1999; Audretsch & Thurik, 2001), entrepreneurship is a micro driver of growth in the economy and technological innovations.

Additionally, growing survival entrepreneurship could be detrimental from an economic and environmental standpoint (Vivarelli, 2013). Entrepreneurs with an innovative mindset can change the economy, add to sustainability, and generate employment (Silvester, 2015). Through innovation, institutions, organisations, and nations may spur change and advance the development of more sustainable services and sustainable goods (Silvestre, 2015). Survivalist businesspeople can disrupt markets and harm growth in the economy (Quatraro and Vivarelli, 2014).

The study by Freeman and Soete (1997) on the possible advantages and disadvantages of technological innovation has revealed that while it is identified as a catalyst for economic progress, technological innovation is also considered as a factor in environmental and social deterioration. According to Hall and Vredenburg (2003), technical developments might be seen as offering competitive benefits from a commercial perspective. On the other hand, they can also be viewed as a risk factor, a deterrent to competition, and a reason for business collapses.

According to the data from the literature study in the previous paragraphs, technological innovation has had a significant role in boosting economic growth (OECD 2005). While technological innovation is acknowledged as a catalyst for economic progress, Freeman and Soete's (1997) study on the possible harms and advantages of technological innovation has demonstrated that it is also considered as a factor in environmental and social deterioration.

The foundation of technological innovation is technology, which is a complex system made up of multiple entities or subsystems of technologies with

a relationship between each entity and at least one other entity in the system for achieving particular goals (see Coccia, 2019a, 2019b; Coccia and Watts, 2020). According to Coccia (2005a, 2020a), technological innovation may be classified into a number of typologies based on the degree of change and socioeconomic impact: Technological systems (a collection of innovations that are technically and economically interrelated, such as nanotechnology or biotechnology); technological revolutions (pervasive changes in technology); incremental innovations (gradual modifications of existing products and/or processes, such as detergents for dark clothes); radical innovations (dramatic changes of existing products/processes, or creation of new products to satisfy needs or solve problems in society, such as contact lenses) cf., Coccia, 2012, 2015a, 2015b, 2016b, 2017a, 2017b, 2018a, 2018b, 2019c, 2020a, 2020d, 2020e; Coccia and Wang, 2015).

In order to attain and/or maintain goals, problem-solving activities in a particular research/technology field produce technical innovations (Coccia 2016a, 2017c). Since they transform environmental and organizational inputs into valuable new products and/or processes for satisfying needs, solving problems, and/or supporting goals of adopters in markets and society, technical competence and problem-solving approaches are essential for developing technological innovations. However, According to Hall and Vredenburg (2003), technical developments might be seen as offering competitive benefits from a commercial perspective. On the other hand, they can also be viewed as a source of danger, decline in competition, and collapse of businesses.

A process known as "diffusion of technological innovation" occurs when various groups of individuals or businesses begin utilizing new goods and/or procedures. The innovators, early adopters, early majority, late majority, and laggards

are the main groups of adopters in the dissemination of technological innovation. According to Coccia (2005a), the diffusion of technological innovation has an effect on social economic systems that is comparable to seismic waves.

Science, technology, and innovation are the fundamental pillars of development and competitiveness between businesses and nations, according to authors like Viotti and Macedo (2001). In addition, they directly affect population quality of life and have the potential to address social and environmental issues. By affecting the three pillars of sustainability and having a significant impact on initiatives to advance economic vitality, environmental sustainability, and social progress, Constantinescu and Frone (2014) demonstrated that technological innovation is essential to advancing sustainable development.

Different theories can be used to explain technological evolution, including: traditional theories based on the competitive replacement of an old technology or innovation with a new one; and new theories based on a multi-mode interaction between technologies or innovations, like the theory of technological parasitism proposed by Coccia (2019a) and Coccia and Watts (2020).

Fokkema et al. (2005) asserted that technology was a crucial component for sustainable development with a more concentrated emphasis on the social and environmental components of economic progress. The authors claim that in order to maintain sustainable development, technical advancements should be at the forefront of concerns due to the requirement for a qualitative leap in environmental efficiency and the creation of products and services. According to Martens and Rotmans (2005), a proper emphasis must be placed on the complexity of social processes in order to make the transition to sustainability. Fokkema et al. (2005) claim that all firm stakeholders are

involved in the process of sustainable technological innovation from the outset of the technical design process, beginning with the conceptualization of the problem to be solved.

### ***G20 Countries***

The G20 is an intergovernmental group of 19 major economic countries and European union (both developed and emerging), which are spread over Asia, Europe, Euro-Asia, North and South America, the Middle East, and Oceania. G20 countries consists of Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Republic of Korea, Mexico, Russia, Saudi Arabia, South Africa, Turkey, the United Kingdom, the United States, and the European Union.

The G20, today's primary economic council of developed countries, is formed by including the European Union as a single entity. Together, the 19 G20 member nations represent around 77% of global GDP, 60% of global commerce, and 62% of global population (Vestergaard 2011). Most of the world's top economies, both industrialized and developing countries, are represented by the G20, which also accounts for around two-thirds of the world's population, about half of its geographical area, and about 90% of worldwide commerce.

The G20 is a significant form of global governance and whether it is legitimate (Beeson and Bell 2009; Callaghan 2013b; Cammack 2012; Cooper 2010, 2012; Cooper and Pouliot 2015; Cooper and Thakur 2013; Downie 2017; Kharas and Lombardi 2012; Postel-Vinay 2013; Subacchi and Pickford 2011; Wade 2011; Woods 2010). The G20 is a step forward from the pre-existing G7 (Group of Seven) leaders' meeting in terms of its ability to improve collaboration and coordination among the different established and emerging nations that form its membership, as well as its ability to avert future economic crisis.

"Necessity Entrepreneurship" is more prevalent among G20 nations that are in the efficiency-driven stage or transitioning to the innovation-driven stage than those with "innovation-driven" economy.

Given the requirement to guarantee interoperability across G20 markets, G20 nations advocate for shared standards in the steps to be adopted to capitalize on this progress. Platforms, ecosystems, and frameworks for collaboration underpin these new technologies; thus, international collaboration, standard harmonization, and interoperability will be crucial to maximizing advantages and minimizing interruptions.

## **METHOD**

In order to conceptually analyze the relationships amongst technological innovation investment and economic, environmental, and social growth, the nations that make up the G20 group were chosen for this study using the secondary data and resources.

## **ANALYSIS AND DISCUSSION**

According to the phases of development of a nation, the empirical study shows that the impact of innovation and entrepreneurship on economic growth and development varies. According to the economic theory of phases of development, there are three stages: the factor-driven stage, the efficiency-driven stage, and the innovation-driven stage (Porter et al., 2002).

As economies get closer to the boundaries of knowledge, innovation becomes even more crucial since it becomes harder to add value by just absorbing and modifying foreign technology.

Out of the 19 economies of the G20 member countries, only one, India, is at Stage I being factor-driven, one is in transition from Stage I to Stage II Saudi Arabia, three are efficiency-driven economies, Indonesia, China, and South Africa, five are in transition from Stage II

to Stage III Russia, Turkey, Argentina, Brazil, and Mexico, and the rest are innovation-driven economies.

The Innovation Input Index and Innovation Output Index are each built around five and two pillars, respectively, according to the "Global Innovation Index, 2015", which is based on the simple average of input and output sub-index scores. Each pillar is then further broken into three sub-pillars, each of which is made up of a separate indication, for a total of 79 indicators. There are three performance groups: "Innovation leaders," which are the top 25 countries with GII scores of 50 or higher, including eight G20 nations: South Korea/Republic of Korea, Japan, France, United Kingdom, Germany, Canada, United States, and Australia; "Innovation achievers," which are the economies that performed 10% better than their peers for their level of GDP, including India and China; and "Innovation underperformers," which were the nations that performed 10% worse than their peers. Some nations, such as Italy, South Africa, Turkey, Mexico, Brazil, Russia, and Saudi Arabia are also referred to as "innovation underperformers" since they merely underperformed to the point where they didn't meet any GII grouping requirements. It must be emphasized that economies that are factor-driven, efficiency-driven, or in transition from Stage II to Stage III, with the exception of Saudi Arabia, have lower GDP per capita levels than economies that are innovation-driven or that are in transition from Stage II to Stage III.

The assumption that the G20 group's implementation of this type of investment helps them achieve their sustainable development goals and is geared to meet market pressures and anticipate consumer needs, as discussed by Hall and Vredenburg, was made possible by the rise in investments in technological innovation, which were associated with rising CO2 levels (2003).

The innovative performance of nations like Argentina, Indonesia, South

Africa, Turkey, Mexico, Brazil, Russia, and Saudi Arabia, whose GDP/capita has been recognized as also being cut, is lower than the G20 average of 45.71 (own estimates). While both China and India have maintained high innovation performances over the past several years, they do have one thing in common: they perform better when it comes to producing new technologies and knowledge. Due to poor performance in certain of the inventive performance measures, Italy has maintained a stable standing since 2014 but has been unable to gain a spot on the innovative leaders or achievements boards.

According to recent studies, innovation—and particularly the ability of businesses to innovate—is crucial for economic growth. Identifying the effects of innovative entrepreneurship on economic and social development. As a percentage of all G20 SMEs engaged in manufacturing, SMEs introduced product and process innovations (technological innovations), whereas marketing and organizational innovations (nontechnological innovations) were introduced by SMEs.

Public R&D (innovation) spending has a considerable macroeconomic beneficial influence on economic growth, making R&D investment essential for a sustained economic growth in the G20 countries. It is entirely consistent with Schumpeterian theories of economic development and may be characterized as "innovation driven" GDP growth.

the cause of young entrepreneurs at the local, national, and international levels; an alliance of organizations from industrialized and developing economies that makes discernible progress toward its objective of a world where more entrepreneurs grow businesses, create jobs, change lives, and ensure future economic prosperity; and as a recognized body that exists as part of the official G20 process and is able to engage, contribute to, and influence the findings of the G20 Economies and sustainability.

In comparison to other G20 nations, the business environment in India is more entrepreneur-friendly, according to a research by Ernst & Young. According to the Ernst & Young research, Entrepreneurship Barometer, private equity agreements increased 523% in India between 2005 and 2010 compared to a 22% decline in the average G20 country. Eighty percent of Indian business owners said they had better access to capital, and the highest percentage of G20 nations—98 percent—agreed that their culture supports entrepreneurship.

One of the first multilateral organizations to provide developed and developing market nations with equal standing, the G20's creation marked a milestone in global collaboration. The G20 agenda reflects this, having changed throughout time to cover topics relevant to both established and emerging countries. For the G20 members, sustainable development is one of these top priorities.

## CONCLUSION

Individually and collectively, innovation and entrepreneurship are beneficial for overall economic growth. Due to the fact that certain economies are far behind the average level of creative entrepreneurship seen in G20 countries, there is also a negative association. Investment in R&D is essential for a sustained economic growth in the G20 countries since public R&D (innovation) spending has a large positive macroeconomic influence on economic growth. In order to facilitate the transition from necessity-driven entrepreneurship to innovative entrepreneurship, economies with necessity-driven entrepreneurship should adopt policies that inform entrepreneurs about the powerful economic potential of innovative entrepreneurship to impact the economic development of their respective nations, assist them in organising their businesses through expert consultation, fund entrepreneurs to run their businesses efficiently, and reward new idea

implementation by them. The economic and social components of sustainable development are favourably impacted by technological breakthroughs and entrepreneurship in G20 nations, whereas the environmental dimension is only marginally. The G20 should research and participate in the creation of policies that will maximise the possibilities for more flexible and entrepreneurial work styles that new technology will be enabling more and more. Digital industrial breakthroughs have lowered the bar for starting your own business and working for yourself. New technology, however, also make labour more adaptable and efficient.

## REFERENCES

- Annunziata, M., & Bourgeois, H. (2017). The Future of Work: How G20 countries can create the conditions for digital-industrial innovations to create stronger high-quality employment as well as faster economic growth. *G20 Insights*.
- Bashir, H. A., & Akhtar, A. (2016). The role of innovative entrepreneurship in economic development: A study of G20 countries. *Management Studies and Economic Systems*, 54(4258), 1-10.
- Brandão Santana, N., Rebelatto, D. A. D. N., Périco, A. E., Morales, H. F., & Leal Filho, W. (2015). Technological innovation for sustainable development: an analysis of different types of impacts for countries in the BRICS and G7 groups. *International Journal of Sustainable Development & World Ecology*, 22(5), 425-436.
- Coccia, M. (2018). Theorem of not independence of any technological innovation. *Journal of Economics Bibliography*, 5(1), 29-35.
- Dhahri, S., & Omri, A. (2018). Entrepreneurship contribution to the three pillars of sustainable development: What does the evidence really say?. *World Development*, 106, 64-77.
- Fagerberg J, Verspagen B. 2003. Innovation, growth and economic development: why some countries succeed and others don't. Paper presented at: Innovation Systems and development Strategies for the Third Millenium; Rio de Janeiro.
- Fritzen Gomes B.M., Marques C.T. (2020) Economic, Social, and Environmental Results of Innovation. In: Leal Filho W., Azul A.M., Brandli L., Lange Salvia A., Wall T. (eds) Industry, Innovation and Infrastructure.
- Fokkema J, Jansen L, Mulder K. 2005. Sustainability: necessity for a prosperous society. *Int J Sustain*. 6:219–228.
- Goyal, T. M., & Kukreja, P. (2020). The Sustainable Development Agenda: Evaluating the G20 as a Stage for National and Collective Goals. *Sustainable Development*.
- Hanusch, H., Chakraborty, L., & Khurana, S. (2017). Fiscal policy, economic growth and innovation: An empirical analysis of G20 countries. *Levy Economics Institute, Working Paper*, (883).
- Jaksic, M. L. (2017). Sustainable innovation of technology and business models: rethinking business strategy. *South-Eastern Europe Journal of Economics*, 14(2).
- Lüdeke-Freund, F. (2020). Sustainable entrepreneurship, innovation, and business models: Integrative framework and propositions for future research. *Business Strategy and the Environment*, 29(2), 665-681.
- Neumann, T. The impact of entrepreneurship on economic, social and environmental welfare and its determinants: a systematic review. *Manag Rev Q* 71, 553–584 (2021).
- Omri, A. (2020). Technological innovation and sustainable development: does the stage of development matter?. *Environmental Impact Assessment Review*, 83, 106398.

- Schaltegger, S., & Wagner, M. (2011). Sustainable entrepreneurship and sustainability innovation: categories and interactions. *Business strategy and the environment*, 20(4), 222-237.
- Schumpeter J. 1939. *Business cycles: a theoretical, historical, and statistical analysis of the capitalist process*. New York (NY): McGraw-Hill.
- Schumpeter J. 1937/1989. Preface to the Japanese edition of “theorie der wirtschaftlichen entwicklung”. In: Clemence RV, editor. *Essays on entrepreneurs, innovations, business cycles and the evolution of capitalism*. New Brunswick (NJ): Transaction Publishers; p. 165–168.
- Štverková, H., Czerná, K., & Pohludka, M. (2021, November). The importance of innovation in terms of a sustainable entrepreneurship in environment. In *IOP Conference Series: Earth and Environmental Science* (Vol. 900, No. 1, p. 012044). IOP Publishing.
- Wüstenhagen, R., Sharma, S., Starik, M., & Wuebker, R. (2008). Sustainability, innovation and entrepreneurship: introduction to the volume. *Sustainable innovation and entrepreneurship*, 1-23.
- Wüstenhagen, R., Sharma, S., Starik, M., & Wuebker, R. (2008). Sustainability, innovation and entrepreneurship: introduction to the volume. *Sustainable innovation and entrepreneurship*, 1-23.
- Xiao, D., & Su, J. (2022). Role of Technological Innovation in Achieving Social and Environmental Sustainability: Mediating Roles of Organizational Innovation and Digital Entrepreneurship. *Frontiers in Public Health*, 10.
- Youssef, A. B., Boubaker, S., & Omri, A. (2018). Entrepreneurship and sustainability: The need for innovative and institutional solutions. *Technological Forecasting and Social Change*, 129, 232-241.