

Innovation

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January 2022

(forthcoming in the Palgrave Encyclopedia of the Possible)

Definition

Innovation is the human capacity to give an idea the power to change the course of events and to push back the frontiers of the possible. If innovation is nowadays praised in the West and even beyond, it has long had a negative connotation in a semantic field limited to politics and religion. It is with the Enlightenment and the faith in the progress of the human condition that innovation, instrument of disruptive change, takes on a positive meaning. Its semantic field then widens to other domains such as science, arts or society before the word 'innovation' becomes an essential concept in economics, the creative force that the economic system generates and that transforms it. This belated confidence in the beneficial effects of innovation may have reached its limits with the ecological crisis.

Keywords: creative destruction, creativity, innovation, possible, transformative creation.

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According to a quote attributed to the French poet Paul Éluard, "un autre monde est possible, mais il est dans celui-ci." [Another world is possible, but it is in this one.] The human imagination may have no boundaries, but our physical world is finite. Innovation is this human capacity to give an idea the power to change the course of events and to push back the frontiers of the possible at the risk that this power spins out of control and ends up annihilating everything. If the spirit of innovation is nowadays acclaimed and promoted in all Western societies and even beyond, this spirit has long been considered throughout history as harmful or even dangerous. This belated confidence in the beneficial effects of innovation may have reached its limits with the ecological crisis.

Definition through history

Changing the status quo involves an uncertainty that can provoke two reactions: hope and fear. Hope that a better future is possible or fear of losing the stability of a known present. Innovation as the introduction of novelty into the status quo can have a negative meaning when tradition and stability are highly valued and can have a positive meaning when people are confident in their ability to think and act to change the world for the better. Historically, the word 'innovation' shifted from a negative to a positive meaning during the scientific, political and industrial revolutions when elites and people became convinced that tradition was the obstacle to progress.

Etymologically, the word 'innovation' goes back to the Greek word *kainotomia* (from *kainos*: new) which becomes in Latin *innovatus*, past participle of *innovare*, itself derived from the Latin word *novus* which means 'new'. *Innovare* means 'to introduce something new', 'to modify', 'to renew' or 'to restore' (Oxford Latin Dictionary; Godin and Lucier (2012)). The etymology tends to suggest that innovation is the origin of something or the return to that origin.

Based on a careful reading of numerous texts, Godin (2015) traces the history of the word 'innovation' and its meanings from Antiquity to the present day. He observes that the word has a predominantly negative meaning from Antiquity until the 18th century and that it is used exclusively in the political and religious domains. In Ancient Greece, innovation (*kainotomia*) is seen as a change initiated by humans that disrupts the divine and natural order of things. For Aristotle, for example, innovators are people who seek to change the political order for private ends. Innovation is therefore political and subversive. It threatens the stability of the political order. Laws can be changed, of course, but carefully and gradually, whereas *kainotomia* is a disruptive change often translated as 'revolution'. This political and subversive connotation can be found in Ancient Rome, where the stability of the political order remains a social goal. But when Christianity becomes the official religion of the Roman Empire in the fourth century, innovation ('*innovo*') also takes on a religious

connotation and describes the spiritual renewing to which Christians are called in order to rid themselves of their old corrupted nature and to transform themselves into new people created in the image of God. Thus, innovation as a spiritual and moral renewing acquired a positive meaning that it would retain until the Protestant Reformation. In the England of the 16th and 17th centuries, innovation recovers its subversive and pejorative connotation from Antiquity. Protestants and Papists accuse each other of being 'innovators'. The Catholics consider the Protestants as heretics because their innovations lead to the creation of a new church. The Protestants retort that they want to create a reformed church in order to return to the original church, which the Catholics, by their innovations, have corrupted. Religious doctrinal innovation represented such a religious and political threat that in 1548 Edward VI, King of England, issued *A Proclamation Against Those that Doeth Innovate* and threatened the innovators with "*imprisonment, and other grievous punishmentes*". In 1626, King Charles I reiterated the prohibition of innovation. But who was concerned by this prohibition? For the Protestants, the Papists were guilty of having innovated since the origins of Christianity. For the Papists, the Protestants were guilty of having innovated since the Reformation. For the Puritans, the English Protestants were guilty of having kept certain Catholic innovations in the Reformed Church. Finally, everyone was an innovator! This is the logical impasse that Bentham (1844, p. 144) will later point out: "Whatever is now *establishment* was once innovation". King Charles I was also accused of innovating in religious and political matters. From the 17th to the 19th century, the established order in science and politics wavers. The past is less venerated and even contested while the future gives a glimpse of hope for progress. The revolutionaries are accused of being innovators by the supporters of the established order, but the state of mind in Europe begins to shift towards a spirit of innovation. Gradually, innovation ceases to be a source of fear and becomes an instrument of progress of the human condition.

From the word to the concept

In the 19th century, innovation becomes a virtue in the name of faith in scientific progress and its expected positive effects on living conditions (Godin, 2015). The word 'innovation' is no longer confined to politics and religion but extends its semantic field to the scientific, artistic and social domains. Innovation is then both the introduction of a novelty in all these domains and the consequences (change) resulting from this novelty which can be an invention or more broadly a creative idea. Innovation is "iconoclast, divergent, revolutionary thinking" (Kuhn, 1959) and the change resulting from innovation has an economic value which increased with the takeoff of economic growth in Europe following the Industrial Revolution. An invention or creative idea can

exist without having a market value. Not innovation, which always has economic consequences. It is because change has economic implications that innovation has an inescapable economic dimension. With economic growth, this economic dimension will become central in the 20th century and even reduce the meaning of innovation to its sole economic dimension. An invention or a creative idea that is not introduced to the market is not an innovation. The novelty becomes an innovation as soon as it acquires a market value and modifies the available supply on the market. This is the meaning that the 20th century gives to innovation. Of course, the term 'innovation' continues to be used in other fields than the economy but always followed by the adjective designating the field: technological, artistic, political or social innovation. When the term is used alone, it is an economic concept.

In the scientific literature and the media after WWII, innovation often has a technological dimension. But for the last two or three decades, undoubtedly influenced by the rise of the concept of 'creativity' in psychology and then in economics, the concept of innovation has broadened its semantic field to mean the commercialization of any creative idea (Artige and Lubart 2020). A representative definition of innovation in contemporary economic literature is as follows:

“Innovation can be defined as the application of new ideas to the products, processes, or other aspects of the activities of a firm that lead to increased “value”. (Greenhalgh and Rogers (2010), p. 4).

This "value" is defined in a broad sense to include the higher value added gained by the innovative firm but also the benefits to consumers (higher utility) or to the firms that buy the innovation (higher value added). All economic agents - households, firms, NGOs and public administrations - can introduce innovations. Nevertheless, from the point of view of economic change induced by innovations, it is the innovations made by firms that have the greatest impact.

Innovation: the engine of economic development

Innovation is widely regarded by contemporary economists as the main driver of growth in living standards. This has not always been the case. It was not until the first half of the 20th century and the pioneering writings of the Austrian-born American economist Joseph Schumpeter that innovation was considered a central economic concept in economics. Although he was a professor at Harvard University from 1932 until his death in 1950, Schumpeter's work was long labeled as heterodox by his peers and therefore had limited influence on mainstream economics until recently. This was not the right time for his work to attract interest. His contemporaries were preoccupied with the traumas of the crisis of the 1930s and the Second World War. Keynesian demand-side solutions met the

expectations of economists and governments seeking to pull Western economies out of the economic slump, thus overshadowing the Schumpeterian supply-side analyses of capitalism. The work of Robert Solow (1956, 1957) at the end of the 1950s, which highlighted the role of technological progress in economic growth, led to a reorientation of research towards innovation and, consequently, towards the pioneering work of Schumpeter. The supply-side economic crisis of the 1970s and the ensuing decline in productivity in Western countries accentuated this scientific shift and allowed the Schumpeterian approach to enter the mainstream of economics (Giersch 1984) and to inspire the first Schumpeterian growth models (Aghion and Howitt 1992; Klette and Kortum 2004).

Schumpeter praised the systemic approach used by Léon Walras, the father of the neoclassical theory of general market equilibrium, whose objective was to determine the equilibrium conditions for the allocation of scarce resources in perfectly competitive markets. However, no doubt influenced by the more historical approaches of Adam Smith or Karl Marx, he considered that the market mechanics of the neoclassicals completely missed the point of how market economies work. While he recognized that price competition between firms leads to an efficient market equilibrium, he stressed that this equilibrium was static and efficiency was limited to the short run. However, observation of the history of Western economies since the Industrial Revolution shows that the characteristic of market economies is their incessant dynamics of change. There is, Schumpeter argues, a "source of energy within the economic system" that deviates it from its static equilibrium of perfect competition (Schumpeter 1937). This "source of energy" is none other than innovation. Driven by a profit objective, firms compete not only by price but also by innovations that distinguish them from their competitors and allow them to reap temporary monopoly rents (deviations from perfect competition), i.e. the entrepreneur's profit. Neither neoclassical, nor Marxist, nor Keynesian, but inspired by many, Schumpeter proposed, at a time when the market economy was experiencing its deepest depression, an original theory of economic development where innovations sacrifice short-term static efficiency (the profit from the innovation is a loss for the consumer but an income that finances the innovator's research and development costs) to create long-term economic growth (innovations create productivity gains that raise material living standards).

Transformative creation rather than "creative destruction"

Economic development fueled by innovation-based competition is not a smooth evolutionary process. Schumpeter calls this process "*creative destruction*". Innovations create new activities and jobs but also destroy existing activities and jobs. As the budget of consumers is limited, there is no

room for all firms (existing and new) on the markets. This is why innovative firms that gain market share drive those that are not innovative enough out of business. In other words, innovations create winners and losers: firms are born and others go bankrupt; workers find or change jobs and others lose theirs. At the macroeconomic level, innovations have a positive net social effect if and only if the value created by the innovations outweighs the value destroyed. Competitive pressure ensures that this is the case, since firms that survive competition are necessarily more profitable than firms that disappear. This cycle of creation and destruction of activities is a process of selection of the firms best able to respond to demand or to generate it. The innovations brought about by these firms make it possible to create a long-term growth process accompanied by structural change due to the different growth rates across sectors of activity. It is not the random effect of multiple external causes but the economic system itself that “generates the force that incessantly transforms it” (Schumpeter 1937). This dynamic economic process makes it clear that the concept of “*creative destruction*” is a misnomer. The destruction of activities does not create new ones. It is the creation of activities that both creates and destroys value and leads to the transformation of the supply of goods and services over time. At the origin of this process, there are creative ideas that penetrate markets and disrupt the existing supply and demand by proposing a competitive innovative supply. By constantly stimulating demand, innovations put pressure on the existing supply, which is forced to innovate in turn or exit the market. This incessant pressure contributes to both a quantitative increase in the value created and a qualitative change in what is produced and sold in the economy. The successive waves of innovation thus generate a process of *transformative creation* of the economy (Figure 1).

The existence conditions of innovation

The process of transformative creation is based on the production of creative ideas, some of which will become innovations introduced on the market. The production of these ideas and the development of innovations have an economic cost that the innovator is willing to pay if the profit she can expect covers at least this cost. However, this is not guaranteed for several reasons. First, the search for a creative idea is an uncertain process that often requires a research expenditure. If the search is successful, the creative idea can lead to two opposite economic situations. If the author of the creative idea manages to keep it secret, she can incur expenses to develop an innovation that she alone will be able to supply on the market. This situation is the best for the innovator since the monopoly allows her to set the price at a level sufficient to refund the cost of research and development of her innovation. The opposite situation occurs if the creative idea is publicly disclosed

for some reason. Once public, the creative idea is a public good, i.e. it is a non-rival good (many people can use the idea at the same time) and a non-excludable good (it is difficult to prevent others from using the idea). When the creative idea becomes public, its author loses the monopoly on it and, most likely, on the innovation that will be supplied on the market. The more people who sell the innovation, the lower the market price and the lower the profit. Of all the sellers, it is the author of the creative idea who loses out, since it was she who financed the initial research. Arrow (1962) argues that the disclosure risk borne by the innovator discourages innovation and leads to a sub-optimal production of creative ideas. In a market economy, the optimal consumption and the optimal production of an innovation resulting from a creative idea are incompatible. The optimal consumption of the innovation requires the lowest possible price, i.e. a price equal to its marginal production cost (zero profit), which would result in a loss for the innovator (the profit does not cover the research and development costs). The optimal production of the innovation requires a profit high enough to cover the initial research and development costs, which is possible if the creative idea is not made public. In this case, the innovator can sell her innovation at a monopoly price, i.e. at a price higher than the marginal production cost. While this price is optimal for the producer of the innovation, it is not optimal for the consumer. This incompatibility is what economists call a market failure. If the author of a creative idea (for example, a new vaccine) cannot appropriate the economic benefit of her idea because of its public disclosure, then she has no economic incentive to seek and develop a creative idea and then an innovation. Conversely, if the author of a creative idea (the new vaccine) has exclusive ownership forever of the economic benefit of her innovation, then the monopoly price will restrict access to the new vaccine, and the exclusive ownership of the idea will prevent others from using it to create new ones. Creative ideas grow out of each other. It is therefore useful that they can spread and be used by others. In order to solve this dilemma, the institutional solution that has been found, at least in Western societies, grants legal protection (patents, copyrights, ...) to the creators of ideas and, in exchange for the public disclosure of the ideas, requires producers who would like to use them to pay royalties to the authors. This solution aims at combining the creation of guaranteed rewards for the production of creative ideas and their wide dissemination for optimal use. The system is not perfect, but it does break the trap of market incentives for creative ideas. It also highlights that the innovation-based economic development requires a sound institutional architecture and respect for rights such as intellectual property rights.

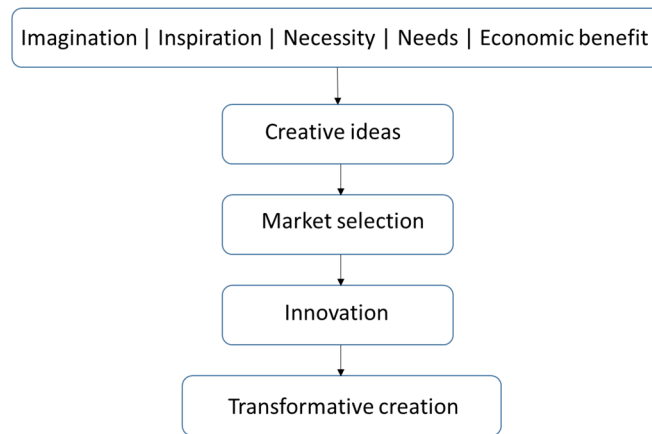


Figure 1. The genealogy of innovation

Innovation and the possible

Figure 1 represents the genealogy of innovation from its human brain origin to its macroeconomic effects. Creative ideas can be stimulated by necessity (finding the vaccine for a pandemic; adapting to climate change), needs or desires, (intentional) imagination, unintentional inspiration from life experiences or knowledge, potential economic benefit, or a combination of these different stimuli. Ideas are not made, they come to our mind. A creative idea is thinking about something that does not exist and that begins to exist (the abstract possible). Once expressed, creative ideas are added to the existing stock of knowledge and push back the (*a priori* infinite) limits of the abstract possible. Freedom of thought, the stock of knowledge, a creativity-friendly culture, technologies for the dissemination of ideas, and potential economic benefits can explain the quantity but also the quality of creative ideas expressed and thus made public. Some of these creative ideas may be in demand from individuals and firms, creating a market and selling prices. Then, they may turn into innovations (the real possible) and feed the transformative creation process. As soon as human creativity is unleashed or even promoted, the abstract possible generates the real possible under the constraints of feasibility, physical and financial resources and consumer demand. The question is then: does the real possible accomplish the progress of the human condition promised by the Enlightenment? In a democratic market economy, the economic system is decentralized: the real possible is the aggregation of a multitude of decisions made by individuals free to think, create and innovate. There is therefore no central command to set its destination, control its trajectory and modulate its speed of evolution. However, the finitude of Earth does not guarantee the sustainability of any real possible. Figure 2 characterizes the trilemma facing the humankind: unlimited growth in income per

capita and in population are incompatible with the limited amount of exhaustible natural resources essential to life. Therefore, the trajectory of our real possible that originated at the time of the industrial revolution is unsustainable. The humankind has been slow to become aware of this sustainability constraint. We can only hope that this constraint inspires the abstract possible in order to redirect the real possible in time.

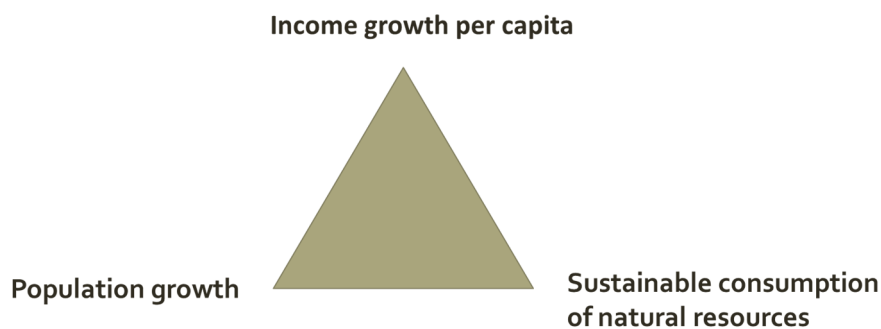


Figure 2: The trilemma of humankind

(Per capita income growth, population growth, and sustainable consumption of natural resources may be three desirable goals for a society. Unfortunately, these three goals are not achievable simultaneously. Society must therefore make a choice by eliminating one of these three goals. The goal that humankind is currently sacrificing is the sustainable consumption of natural resources for the other two. Given the environmental disruption that unreasonable consumption of these natural resources causes, this choice leads to a dead end in the medium or long term for life on earth.)

Conclusion

Innovation is today an economic concept and a state of mind that is praised at least in Western societies. Until the 18th century, the semantic field was restricted to the political and religious fields and its connotation was negative. The change took place with the Enlightenment and the new faith in the progress of the human condition. Innovation then became the instrument of disruptive change in the political, scientific, artistic and social fields. The economic growth resulting from industrial change during the 19th century highlighted the economic effects of innovation, which became one of the fundamental concepts of economics in the 20th century. At the origin of innovation is creativity, a human ability to push back the limits of the possible. This force capable of transforming the economic system and the condition of humanity is little controlled in a decentralized market

economy. The current trajectory of this force is physically unsustainable and therefore poses a risk to the future of humanity. It is up to mankind to prove that in this world, another is indeed possible.

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