



Development of Innovation in Economics

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How to cite this paper: Kouam, H. and Kingsley, K.M. (2023) Development of Innovation in Economics. *Open Access Library Journal*, 10: e10236.
<https://doi.org/10.4236/oalib.1110236>

Received: May 10, 2023

Accepted: June 27, 2023

Published: June 30, 2023

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Abstract

This theory presents the theory of innovation in the attainment of economic sciences. It equally reviews economic literature and investigates innovation from different economic models. It first begins with the analysis of views on classical economics, including Adam Smith and David Ricardo. This is followed by discussions on theory in innovation today, as handled in the knowledge-based economy. Analyzing the achievements in economic thought outlines that innovation's importance and relevance has grown over the last decade.

Subject Areas

Economic System

Keywords

Innovation, Economic Growth, Progress, Economic Models

1. Introduction

Today, interest in innovation is growing in both economic theory and practice. This is due to the perception that innovation increases management efficiency and is viewed as a tool that can be used to achieve competitive advantage. Until the 1990's, economists did not view innovation as a useful or interesting topic even as it was largely viewed as a tool to increase management efficiency and a tool that enabled companies to develop a competitive advantage.

Until the 1990s, economists paid little attention to the topic of innovation. Recognized and defined in many ways, economists seem to underestimate their impact on economic growth. In the 1990s, the knowledge-based economic paradigm was introduced to draw attention to the features of the modern economy that increasingly benefit from knowledge capital. This knowledge is the source of all novelties on the market. An important step in the development of innovation

theory was the OECD Program (Technology/Economy Program-TEP), launched in 1988, which led to publications drawing attention to the important impacts of research and innovation on the economy and society.

The purpose of this article is to present a theory of innovation in economics, considering several important economic trends and models. Over the years, the development of economics as a science has evolved, some of which is tied to changing business conditions and a growing need for economic thought to accompany the energy transition and balanced and inclusive growth amongst others. Paradigm shifts require the creation of new theories or the reinterpretation of existing theories. Leading proponents of different economic models point to the importance of factors ranging from traditional factors such as land and capital to soft factors such as knowledge and information. In these changing models, the treatment of innovation and its role in the economy has been varied and long literally underestimated.

2. Material and Methods

These considerations are theoretical in nature. For this study, the literature begins with an analysis of the views of classical economics, from proponents including Adam Smith, David Ricardo, and Jean-Baptiste Say, on the importance of innovation in a variety of economic models, ranging from modern and knowledge models been reviewed. When analyzing the topic of innovation, particular attention should be paid to the views of Joseph Schumpeter, who first introduced the concept of innovation into the economics literature. Although unpopular at the time, his views had a great influence on later theories of economic growth. This article analyzes the outcomes of economic thinking and shows the growing importance of innovation, research, and science for socio-economic growth. A shift in approach to the importance of innovation for economic development has been accompanied by a shift in the definition of innovation. Innovation was initially primarily concerned with technical aspects and the first application of inventions. Organizational or Marketing Innovation is defined as anything that is emphasized and perceived as new by the individuals or other entities that adopt it, regardless of the objective novelty of a product, technology, or organizational solution.

3. Economic Theories and Models in the Context of Innovation

Initially, the terms innovation, invention, and novelty appeared occasionally. There are various economic theories, but generally, the importance of innovation in the economy has become marginalized. Development of an economic theory of innovation dates back to the 1950s and is relevant to the study and theory of economic growth. Proponents of classical economics did not consider innovation to be an important contributing factor to the economic process. Innovation has lagged behind other factors such as land, capital, and labor. Adam Smith believed that the division of labor in economics was one of the forces that

determined a nation's prosperity. According to Smith, broadening and deepening the division of labor encourages the creation of new inventions, and workers who can focus on narrow areas of the production process are more likely to think of ways to improve their work.

According to Smith, such processes created opportunities for innovation and novelty. Smith, however, treated inventions as the result of human curiosity and instead turned his attention to the effects of planned activity. He wrote that inventions (mainly machines) made labor easier and more efficient and enabled the production of commodities at less labor cost (Smith, 1904) [1]. At the same time, in his book *The Wealth of Nations*, he criticized banks for financing "crazy" projects. Another proponent of this economic trend, D. Ricardo, drew attention to technological progress but stressed that it is not essential for economic growth. In his book *On Principles of Political Economy and Taxation*, he devoted a chapter (On Machines) to the role of machines and new devices in the economy. He also emphasized the parallel increase in unemployment and mechanical labor mobility (Ricardo, 1821) [2]. We are being asked to slow the pace of progress to avoid layoffs.

French economist Jean-Baptiste Say, in one of the chapters of his publication *Traité d'Économie Politique* showed the economic impact of introducing machinery into production. He wrote of the "advantages of innovation" achieved through the use of such machines. One of his advantages was that new machines would need to be developed, creating new jobs that never existed before. Say also emphasized the benefits that innovation brings to consumers, such as lower prices for more sophisticated and precise products (Say, 1855) [3].

Classical mainstream economists have been criticized for focusing too much on physical capital, emphasizing its role in management processes, and ignoring the role of intelligence and skills. These factors were the focus of Schumpeter, who theorized economic growth and business cycles driven by breakthrough innovations. He argued that the strength of economic growth lies in the important innovations that emerge regularly. His theory led to Schumpeter's economics, in which he believed that a "sound" economy was not one that was in balance (equilibrium) but one that was constantly being disrupted by technological innovation. He wrote that "capitalism (...) must never stand still" (Schumpeter, 1994) [4]. His theories mainly focus on technological innovations with dynamic character and potential for application in many fields. The view that innovation is only the first application of a solution and that its diffusion is called imitation is a defining feature of Schumpeterian economics. Schumpeter is also known for developing his theory of the business cycle, seeing innovation as the cause of the ups and downs of the cycle. According to him, every economic cycle is unique and can be assigned to very different industries. The recovery phase of the cycle begins with the widespread use of new innovations.

This model was demonstrated in the 18th-century hydroelectric, textile, and iron markets. As the technology matures and the resulting benefits begin to decline, recreation disappears entirely. This phase will be followed by an inevitable

recession, after which a new wave of innovation will begin, destroying old institutional structures and replacing them with new, more effective conditions for the next recovery cycle.

Schumpeter called this phenomenon “creative destruction”. This concept shows that corporate collapse does not necessarily have only negative economic and social consequences. This is because new, more efficient firms may emerge to replace ineffective and failed firms (Schumpeter, 1994) [4]. This has driven economic growth and has improved since the recession. Schumpeter’s theory is clearly related to the theory of competitiveness. While modifying various concepts and economic models of competitiveness, Siudek and Zawojka (2014) [5] point out Schumpeter’s theory that a firm’s ability to innovate is the key to gaining a competitive advantage over its competitors. In addition to the theory of innovation and entrepreneurship, Schumpeter’s economic theory builds on other concepts, such as Jugler’s theory of the medium-term economic cycle and Kondratiev’s theory of the long-term economic cycle. Schumpeter’s theory was not popular among economists in the first half of the 20th century. This is because the links between scientific, inventive, and productive activities were only apparent after a period of time. This relationship was not observed until the late 20th century (Fiedor, 1979) [6].

In the 1980s, inspired by Schumpeter’s theory and Darwin’s theory of evolution, Nelson and Winter developed an evolutionary theory of economics. Underlying this was a search for parallels between phenomena occurring in the natural world and economics. Survival is inherently supreme, and only the fittest can survive. Similarly, entrepreneurs compete with each other for a better position in the market, and to do so they must operate more efficiently than their competitors. Around the same time, in 1986, Paul Romer published a seminal article, increased earnings, and long-term growth, widely believed to have spawned a new theory of endogenous growth. Romer’s theory is a variation of Arrow’s “learning by doing” model. A key element of Romer’s model is to demonstrate how the creation of new knowledge by individual firms can create positive externalities related to the production capacity of other firms.

This is due to the fact that knowledge is not fully patentable (Romer, 1986) [7]. All companies engaged in business use technology that features bonds. As a result, investment in other industries produces new knowledge as a side effect, and it spreads (spillover effect). Because the knowledge accumulated in a single firm has the properties of a public good, other firms gain access to innovation thanks to investment decisions made by a single innovative firm. Such “external interests” increase the general level of knowledge of the economy as a whole. The new growth theory emphasizes the importance of technological progress as an endogenous variable and also draws attention to R&D, human capital, and investment. According to some economists, existing theories of economic growth do not allow more room for institutions and institutional change (Freeman 1994) [8]. Although the concept of the institution itself has not been articulated, another trend in economics that has emerged and can be seen in the context of

innovation is the attempt to institutionalize it. Proponents of new institutional economics argue that institutions are a key factor in differentiating economic performance. Their quality and character influence the pace of economic growth. The economic importance of institutions lies in the fact that they limit the freedom of action of individuals in order to reduce uncertainty and bring order to the entire economic structure. Institutions understood as common practices prevalent in the field of economics have a sociological character (Spychalski, 1999) [9].

These include specific rules of the game, applicable social regulations, legal solutions of various kinds, norms, rules and regulations, codes of conduct, and moral and ethical rules that impose specific lines of conduct on individuals in the leadership process. According to Boland (1979) [10], institutions are specific forms of knowledge. Institutionalists have emphasized the importance of the relationship between institutions and innovation. The creation, selection, and dissemination of new solutions and technologies will lead to the need for changes in institutional procedures and standards. A proponent of such change is Veblen (2008) [11], who believes that institutions need to change, adapt and evolve in response to every change in technology and socioeconomic conditions. It combines both technology and the quality of technical equipment and technical know-how or skills (qualifications). The existence of this relationship and its strong emphasis on the influence of the technological field on institutions form the basis of Veblen's theory of economic growth. The problem of innovation manifests itself in a variety of economic models, but in practice it was difficult to identify the relationship between economic growth, research, and innovation until the late 1980s. The International OECD Program (Technology/Economy Program—TEP), launched in 1988, brought about a major shift in thinking.

It has led to publications that emphasize the need to seek sources of technological progress through economic, scientific, and innovation policies, and to the development of new methodologies for measuring the results of scientific research and the application of technology that have become major handbooks (Oslo Handbook) used by researchers and statistical offices. Thanks to the implementation of the TEP program, more and more publications point to the importance of research and innovation for business and society (Grzelak, 2011) [12]. The emergence of a range of OECD publications in the fields of science, technology, innovation, and economics is consistent with the demand for a knowledge-based development economy.

Economists have begun to understand that cost and price alone are not enough to determine a firm's competitiveness and that knowledge and innovation should be seen as drivers of modern economic growth. The theme of the role of innovation was also reflected in Polish literature. People who have emphasized the relationship between innovation and economic growth include: Poznański, Fiedor, Gomułka, Romer, and Kalecki (Fiedor, 1979 [6]; Poznański, 1981 [13]; Kalecki, 1986 [14]; Romer, 1990 [15]; Gomułka, 1998 [16]). The lite-

rature on innovation is extensive and heterogeneous. The concept appears in a variety of sources, including encyclopedias, dictionaries, economics literature, and studies of economic (business) practice. As a result, there are many interpretations and no single universally accepted definition. Even though innovation is so important to economic growth, it has not been subject to detailed study in economic theory, and his landmark work by J. Schumpeter on the economic aspects of innovation has been the subject of a later study. It did not have a significant impact on people (Skawińska, 2009) [17]. However, Schumpeter is widely regarded as a pioneer of innovation theory and is credited with five of his cases (Schumpeter, 1994) [4].

- *Introduction of new products. H. Products not yet explored by consumers.*
- *Introduction of new manufacturing methods. H. An untested industry method.*
- *Develop new markets. H. A market in which a particular type of domestic industry has not previously operated, whether or not such a market has existed.*
- *Acquisition of new sources (existing or newly created) of raw materials or semi-finished products.*
- *Introduction of new organizations in specific industries. Creation or dissolution of monopolies.*

Schumpeter's approach to innovation is strongly tied to a "new" concept that associates innovation with the first application of a solution. He did not see the process of dissemination of solutions as part of innovation, calling it imitation.

Economics today offers many definitions of innovation. Much stems from Schumpeter's approach. However, they have different attitudes towards novelty, the extent of change, and its impact on the company and the market. Kornalia Karcz (1997) [18] explains that different attitudes towards innovation result from different research objectives, different scopes of analysis, choice of approaches, and interpretations of the concept of novelty. The current understanding of innovation goes beyond technical aspects and is reflected in definitions that include the relationship between organizational innovation (related to the domain of "organization and management") and the environment (Brzeziński, 2001) [19].

Table 1 shows definitions of innovation by various authors. An analysis of these definitions reveals that while they vary in terms of novelty, the extent of change, and organizational and market impact, some remain true to her Schumpeter approach. This is probably because theorists who define innovation differently represent different disciplines, such as management, marketing, economics, and management, and their interest in issues related to innovation is not uniform. An analysis of these definitions suggests a common feature of all innovations: the fact that they always refer to something new. At the same time, the development of this concept also stands out. Initially, the definition emphasized

Table 1. Definitions of innovation according to different authors.

Author (Year)	Definition of innovation
J. A. Allen (1966) [20]	Introduction of new products, processes or procedures to widespread use.
L. Białoń (1976) [21]	Introduction of new products and new technological process to production, and introduction of new organizational systems in order to achieve higher economic efficiency.
J. Bogdanienko (2004) [22]	Turning an invention intention into material reality; first application of a new idea in practice.
J. Brilman (2002) [23]	Application of a creative idea, which is a factor contributing to the development of a company and enabling it to meet challenges posed by competitors.
H. G. Burnett (1953) [24]	Every idea or thing that is new, as it is qualitatively different from the existing, well-known standards.
F. Damanpour (1991) [25]	Product, service, process, programme or device that is new to the organization adopting or implementing it.
P. F. Drucker (1992) [26]	A specific tool used by entrepreneurs in order to introduce changes giving rise to new economic activity or new services. Changes to product design, marketing methods, prices and services offered to the customer, and changes to the organization and management methods.
Ch. Freeman (1982) [27]	The first commercial introduction (application) of a new product, process, system or device.
Ph. Kotler (1994) [28]	Goods, services or ideas which are perceived by someone as new.
E. Mansfield (1968) [29]	The first application of an invention.
<i>Oslo Manual</i> (2005) [30]	Introduction of a new or significantly improved product (goods or services); a new or significantly improved process; a new marketing method; or a new organizational method in terms of business practice, organization of the workplace or relationship with the external environment.
Z. Pietrasiński (1971) [31]	Changes deliberately introduced by man or designed by cyber systems, involving substitution of the existing state of affairs by another which has been positively evaluated in terms of specific criteria and which ultimately constitutes progress.
A. Pomykalski (2001) [32]	A process including all activities related to the creation of an idea, development of an invention, and its subsequent implementation in the form of a product or process.
E. M. Rogers (2003) [33]	Anything that is perceived by a person, or another entity adopting it, as new, regardless of the objective novelty of the idea or thing.

the technical aspects very much. However, in modern definitions of innovation, the technical aspect has given way to organizational and marketing terms.

Today, special attention is paid to the dynamics of the economic system, especially the flow of creativity, knowledge, and learning. As the definition of innovation has changed, its typology has inevitably changed. Taking the subject of innovation as the basic criterion, it distinguishes between innovations in terms of product, technology, organization, and marketing. Another important criterion for distinguishing different types of innovation is the degree of change after implementation. With this criterion in mind, we can distinguish breakthrough innovations that result from long-term research and development and can lead to changes in the nature of the economy as a whole.

Moderate incremental innovations lead to changes in the company's characteristics, while small-scale innovations help improve the quality and functionality

of a product or process and are essential to the continued operation of a company. This criterion also relates to the degree of originality of such changes. So there are design innovations that create entirely new situations. False innovations often mislead users by proposing novelty when in fact they are not.

4. Conclusion

A review of the economics literature conducted for the purposes of this article shows that the role of innovation has increased significantly, starting with classical economic models in which innovation was not discussed, to modern knowledge-based economic models. Clearly shown that there is today, one of the basic conditions for gaining a competitive advantage and a prerequisite for maintaining a company's competitiveness is a commitment to innovative activities. Every company that wants to go further needs innovation in the form of new products, technologies, and organizational systems. The concept of innovation is directly related to activities aimed at implementing changes to make an organization more modern and competitive. Attitudes toward innovation and how companies create it change regularly, as do the meanings, definitions, and theoretical approaches to innovation. These changes are directly related to the emergence of new concepts and methods that increasingly define innovation processes and assess their impact on business development and economic growth. These new innovation trends stem from market developments and are related not only to the process of creating new products but also to changes in corporate structures (from an organizational and marketing perspective, this includes non-technical innovations). These new forms of innovation (non-technical innovation, user-driven innovation, open innovation, social innovation) require new skills by economic operators as well as to facilitate the creation of this type of innovation needs a proactive innovation policy.

Conflicts of Interest

The authors declare no conflicts of interest.

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