INNOVATION AND THEIR RISKS

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Abstract

J.A. Schumpeter laid the foundations of the scientific theory of innovation in his work Business Cycles (1939). Schumpeter's theory of innovation is linked to long-cycle theory. F. Valenta is an important Czech theoretician of innovation.

The innovation is not uniformly promoted in economies, but in clusters. The introduction of innovation reflects the different phases of economic cycles. Individual innovations are not of the same importance; there is a hierarchy of orders of innovation. The highest order is represented by basic innovations. It is generally accepted that innovation has all the positive effects. They lead to an increase in the productivity of production factors and increase the efficiency of economic processes. But with the advent of globalization, the negative effects of innovation are increasingly gaining ground. The expected arrival of the economy 4.0 will have a severe impact on labour markets and may lead to greater economic, social and technical disparities between regions of the world.

Key words: Innovations; Economic cycles; Globalization

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Introduction

Innovations belong to basic sources of technical or technological progress. This was known already in the ancient time when nothing like scientific economic theory existed. The more interesting is the fact, that after establishing economics as a scientific discipline it lasted a relatively long time before adequate attention started to be paid to the issue of innovation. It was only J.A. Schumpeter who laid the base for a real scientific theory of innovations in his work Business Cycles (1939). Schumpeter´s theory is closely connected with a theory of a long-term cycle, firstly created by V. Kondratiev (1920, the latest issue 1989), later elaborated into more detail by Schumpeter. Since then, many experts have focused on the issue of innovations and their role in the field of technical progress and such economic features like e.g. globalisation. One of the very important theoreticians of innovations is a Czech

economist F. Valenta (2001), whose contribution to the level of knowledge in the given field comes in for even the strictest international criteria.

1 Classification of innovations

At present, there is no single innovation theory, but there are several competing concepts. The primate naturally belongs to J Schumpeter, who, in his work "Die Theorie der wirtschaftlichen Entwicklung" (1912), in Slovak Teória hospodárskeho vývoja (1987) described an innovative firm as a destabilizing item, a co-called „creative destabiliser" (or creative destructor) creating dynamic disbalance in economy, or its industry. According to Schumpeter such a destructor is a driving force of progress capable of intended and target-driven abandonment of anything known, already established for the benefit of new, more sophisticated products, procedures or processes.

1.1 Innovation by Schumpeter

A systematic classification of innovations cannot be found by Schumpeter yet; in general, innovation for him is anything, which is still un-known, based on invention, which leads to improvement in production and its organisation or in the market. In his fundamental work, Business Cycles (1939, repeatedly published in 1989) Schumpeter distinguishes between major, or radical innovation, which, as he believes, triggers long-term Kondratiev waves (today these innovations are mostly called basic innovations – see subchapter 1.2) and common innovations. Based on this, he distinguished individual types of economic cycles as consequences of innovative waves and named them after the economists who first described them:

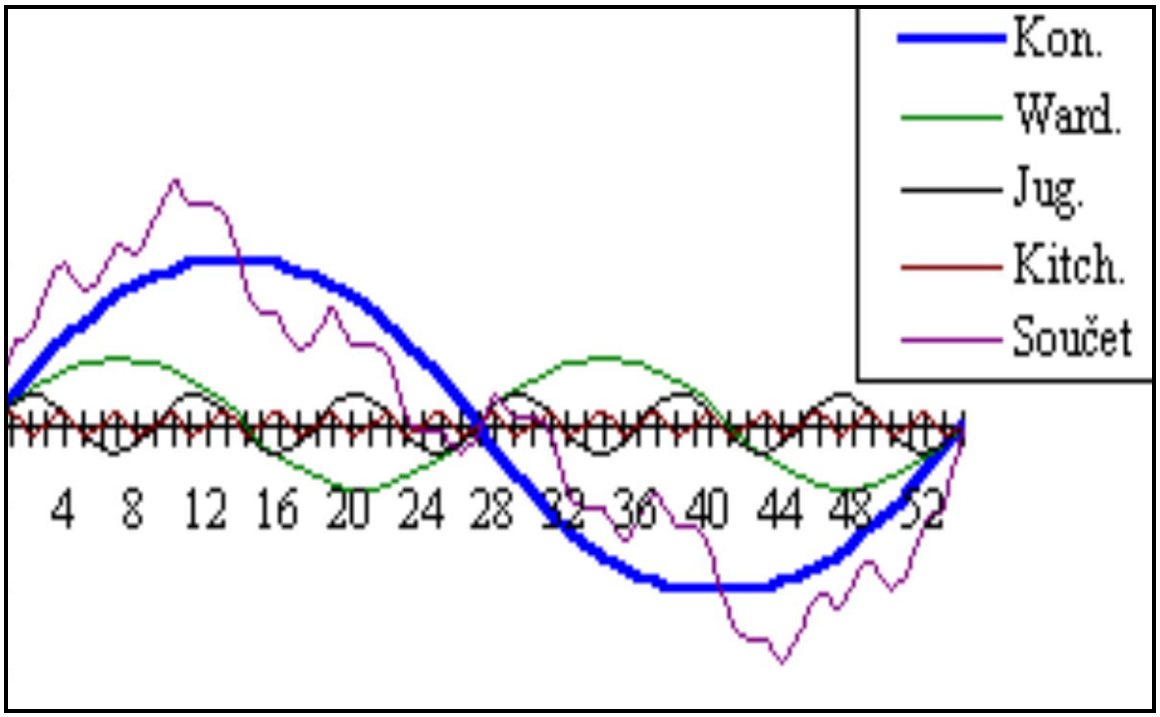
1. Kondratiev long-term cycles (K-waves)
2. Wardwellov long-term cycles (W-waves)
3. Juglar mid-term cycles
4. Kitchin short-term cycles

Schumpeter´s classification of cycles can be considered as innovative classification sui generis, since Kondratiev long-term cycles are, as mentioned above, results of radical innovations. Other cycles then develop from these K-waves as a conceptual change within a given radical innovation usually comes in the middle of a K-wave and initiates a new W-wave. Mutual time ratio between K-waves and W-waves is thus 2:1. Then within the W-wave,

generations of production equipment are gradually replaced, which causes Juglar ´s cycles as investment waves and everything ends up with changes in generations of consumer products (three-year Kitchin cycles).

Of course, the given four types of cycles interfere among each other which subsequently leads to very different courses of economic activity in time (in Fig 1 the K-wave lasts 52 years):

Fig. 1: Interference of economic cycles



Source: Schumpeter, 1989, p. 175. Own processing.

1.2 Valenta´s innovative classification

In our country, Schumpeter´s theory of innovations was most elaborated by F. Valenta (Sirůček, 2005). For Valenta, innovation is any change which comes to light in the organization of a so-called "production organism" (according to Valenta this can be any unit – a company, workshop, research institution, etc) and influences its activity. As for Valenta, innovation factors are constructions (K), working items (S), technologies (T), working tools (P), energy €, qualification of labour (Kv) and organisation (O), so when this principle is applied, the total (V) of innovation activity can be described with the following function:

$$V = F\,(K; S; T; P; E; Kv; O) \qquad (1)$$

Valenta introduces orders of innovations where one order is negative (degeneration), one is neutral (regeneration, or simple recovery to the original state) and nine positive orders organized in three hierarchical categories:

- Rationalisation
- Qualitative innovation
- Technological breakthrough

Tab. 1: Valenta´s classification of innovations

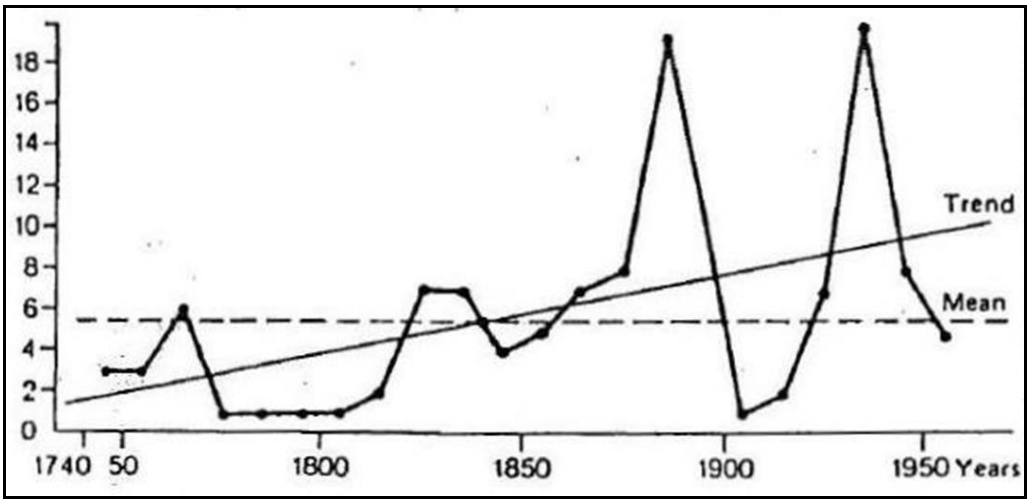
Order of innovation	Name	What persists	Object of the change
Rationalisation			
1	Change in the amount	All	Frequency of factors
2	Intensity	Quality and interconnection	Speed of operations
3	Reorganisation	Qualitative characteristics	Division of activities
4	Qualitative adaptation	Quality for a user	Links to other factors
Qualitative innovations			
5	Version	Constructional solution	Partial quality
6	Generation	Constructional concept	Constructional solution
7	Type	Principle of technology	Constructional concept
8	Genus	Affiliation to a strain	Principle of technology
Technological breakthrough			
9	Strain	Nothing	Approach to the nature

Source: Valenta (2001)

Thus, according to Valenta´s classification, Schumpeter´s radical innovations can be identified with innovations of the highest order leading to crucial breakthrough in technology. A historical example of similar innovations may be introduction of steam engine, electricity, combustion motor, etc. As stated above, these innovations of the highest order are mostly called basic in modern terminology and typically do not turn up by accident in time, but they cluster into relatively short time intervals representing the beginnings of individual long-term Kondratiev waves.

The author of the concept of "basic innovation" is Gerhard D. Mensch (1979). The development of these basic innovations in time was investigated and elaborated by an economist Van Duijn (1983) in his work "The Long Wave in Economic Life" (in Fig 2):

Fig. 2: Clusters of basic innovations by Van Duijn



Source: Van Duijn (1983, p. 109)

1.3 Classification of Innovations by E. Gutenberg

In his classification of innovations, the German economist E. Gutenberg (1951) links the character of innovations (partly analogical with that by Valenta) to changes in costs which an innovation will bring after its introduction. In comparison with Valenta, Gutenberg´s classification emphasizes technological issues less, but the more it stresses economic context. Gutenberg distinguishes four types of changes, or innovations:

- Oscillating
- Continual
- Quantitative
- Mutative

An oscillating change is short-term and means immediate adaption to the situation in the process of production. A continual change results from improved mastering of the contemporary technology and so it is substantially more rational and leads to lower costs in production. A quantitative change relates to the increase in production capacities of the given firm, while the used technologies remain at an unchanged level. Finally, a mutative change

depends on essential changes in construction and technologies, which result in the short-term growth in (investment) costs as well as partial or total change in the process of production (depends on the extent of the mutative change).

It can be said that Valenta´s classification is more complex and more detailed. Nevertheless, various parallels can be found between Valenta and Gutenberg, e.g. it can be stated that the Valenta´s orders 1 and 2 coincide with Gutenberg´s concept of an oscillating change, and so on.

1.4 Innovation - a modern approach

Quantitative measurement of the effects of innovation is currently gaining ground (e.g. within the OECD). This also applies to areas such as investment in intangible assets and trademarks (OECD, 2010).

The Innovation Imperative (OECD, 2015) provides guidance on how to encourage economic actors to innovate

Since 2012, there has been an international reference guide for the collection and use of innovation data. In the current fourth edition, the handbook has been updated to take into account a wider range of innovation-related phenomena and the experience gained from recent rounds of innovation surveys in OECD (OECD / Eurostat, 2019).

2 Risks connected with a process of innovation

Although innovations as carriers of technological progress were always considered to be mostly positive features, risks and potential consequences of these innovations have never been questioned (e.g. Žídek, 2009, Czesaný, 2013). These risks can be typologically divided into the following categories:

1. Risks connected with the development of military technologies
2. Risks connected with uncontrolled industrialization
3. Risks of mankind´s gene pool degeneration
4. Risks connected with globalisation

2.1 Risks connected with the development of military technologies

As far as warfare, or development of military systems are concerned, these risks have never been questioned and all-round attention has been paid to them at least since the end of World War I. Disaster, which Europe suffered during this war, became a source of worries that

modern technologies might be misused. In the direct consequence, these worries led to signing of several treaties, some of which are valid even today. Firstly, it is a ban on warfare use of chemicals such as poison gas, etc. This is undoubtedly positive; however, we can´t neglect a very limited reach of these treaties and of the word collocation "warfare use" in particular. Yes, during World War II, gas was not used on the fronts, however, not from humanitarian reasons, but from fear, that the enemy might use the same weapon. However, in concentration camps, where it was not for "warfare use", gas was commonly used to kill human beings.

A new phenomenon immediately threatening the whole human civilisation, which means nuclear weapons, appeared during the World War II. Admittedly, even in this case several limiting agreements were successfully signed, however, similarly to poison gas, the main reason of non-use of these destructive means was mostly fear of revenge. A principle of mutual destruction, however, becomes a very weak guarantor of safety and security when there are already around 10 countries, nuclear weapon holders. At least.

2.2 Risks connected with uncontrolled industrialisation

Industrialisation and subsequent dynamic economic development in countries of the so-called West from the Industrial Revolution to the second half of the 20th century is the most visible manifestation of targeted enforcement of innovations. Here it is important to say that all innovations and particularly innovations of higher orders, have significantly ambivalent effects. On the one hand they undoubtedly improve technologies, and thanks to this they ensure economic growth. The difficulty is that this growth is often accompanied by impacts in non-economic field both on persons participating in this industrialisation process (risk of serious work accidents of all kinds) and on the overall environment.

In principle nobody questions the impacts of economic development on the environment, however, two approaches to the solution to this issue can be traced.

Both approaches are based on objectively valid fact that the regions which used to have matchlessly the worst environment on the global scale some 30-50 years ago (mainly developed countries of West and Central Europe and particularly Ruhr-Westphalia complex, North Bohemia and other regions hit by extreme industrial activity) have already got over the worst situation now. Nature in these regions has been regenerating, purity of water resources has improved, etc. However, on the other hand the environment is simultaneously sharply

worsening in newly industrialised regions of the world such as in China, India and other countries.

Proponents of the first approach usually claim that it is a question of the economic level of a given country which can afford to invest into improvement of the environment only when a certain GDP per capita. Today, the most affected regions will set out on the same path as Europe at the end of the 20th century, once they have reached a reasonable economic level.

It is true that proponents of the second approach do agree that in principle this is possible, but at the same time they point out that disbalance of economic level of individual world regions is a long lasting unchanging reality. Instead of investing in improving the environment, it will always be cheaper to pass on these negative externalities to the poorer regions of the world, whose administrations will charge developed countries reasonable fees. In other words, corruptible behaviour postpones global improvement of the environment de facto until indefinite future.

According to F. Valenta´s classification of innovations (subchapter 1.2) the solution is not a mere increase in economic level. A real and comprehensive, not only apparent or partial improvement of the environment is connected exclusively with the highest, nineth order of innovations; all innovations of a lower order lead only to partial improvement, very often in form of transferring negative externalities on other stakeholders (regions, states).

2.3 Risks of mankind´s gene pool degeneration

It is indisputable that technical progress initiated by innovations and the change in the life style connected with this progress, development of urban settlements and damaging the environment have backward effects on a human. It manifests itself in diseases of civilization - obesity, various allergies, all kinds of mental illnesses and finally degenerative changes associated with old age (senility, etc.).

In this context, optimists point out that this is a kind of a “tax of luxury”, that despite all these problems longer average length of human life is an indisputable truth and that medicine (e.g. genetic engineering) will surely manage to solve even these above-mentioned problems in future. It is not impossible, but it will be a very long-distance run. Dysgenic development of current mankind resulting from limited nature choice cannot be denied and it is a question whether the above-mentioned genetic engineering will not cause more damage than benefit.

2.4 Risks connected with globalisation

In the last decades other sources of innovation risks and threats connected with globalisation, or creation of a so-called "global village" have been discussed more and more often. These threats would not lose their validity even in case of global disarmament, victory of stable peace and prosperity worldwide and in case that problems of the environment were successfully solved not only locally or regionally, but globally. Threats connected with globalisation have been studied very poorly so far which refers to the fact that these problems have been trivialized and globalisation has even been claimed to be a remedy against all ailments of the mankind.

However, even globalisation risks have recently been discussed with more and more concerns, and some of these risks are so big, that they threaten stability of states, security of their inhabitants, and existence of the civilisation as such. Examples of these threats are international terrorism and mass migration leading in its consequences to a complete exchange of population. The coronavirus pandemic and devastating economy crisis which subsequently closed in upon the whole world stroke a final blow against all idealised visions of globalisation. Nevertheless, it is too early for any complex assessment of this issue.

Conclusion

Innovations, for whose description and ranking many classifications have been created over years, are key means of technical and economic development. In not very far history innovations were considered exclusively positive feature and potential damage resulting from them just temporary side effects.

Depending on how human activity becomes one of the most decisive factors, if not the most important one, influencing the whole planet, various for a long time neglected or even not considered problems have come to the fore. As it can be seen, innovations may have also very negative impacts on individuals, human society as a whole and on the whole environment which surrounds us.

It is a question which hasn´t been investigated yet and it still remains insolvable, whether it is possible to implement a systematic change within a given system, which means whether problems caused by innovations in one way or another can be reformed or eliminated by other innovations again.

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