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Profit-seeking vs Innovation

Abstract. The goal of this work is a qualitative assessment of the relationship between technical growth and the economic well-being of the industry in its historical development. The most important conclusion of Marx's theory of capitalism is that the rate of profit would tend to decline over time as a result of technological change. The coal industry is like a laboratory in which a technological and economic experiment has been carried out during more than a century. The following idea was put forward: an increase in the level of production mechanization leads to a decrease in coal mining profitability. Assessment based on the coal mining of Great Britain, Germany, Ukraine, Poland, Australia, and the USA study and assuming the experience. Summarized that, coal mining is becoming more and more mechanized... and unprofitable. The results of long-term innovative development of the global coal industry do not contradict Marx's tendency of the rate of profit to decrease.

Keywords: innovation, mechanization, tendency profit rate to decrease, coal industry

<https://doi.org/10.58683/dnswsb.606>

Capital eschews no profit, or very small profit, just as Nature was formerly said to abhor a vacuum.

T.J. DUNNING

1. The Essence of the Problem

Innovation, according to Joseph Schumpeter, is the changes aimed to a new product or more efficient production creation. Schumpeter, who recognized innovation only at the level of technology, was one of the first to introduce this term into economic science at the beginning of the 20th century (Schumpeter, 1939). Nobel laureate Joseph Stiglitz considers innovation to be the only real source of increasing wealth in the modern world as a whole (Stiglitz, 2019). But some aspects make one think about the indisputability of the scientific and technological progress paradigm. Karl Marx discovered the tendency of the rate of profit to fall as a general phenomenon, which manifests itself against the background of the individual capitalist's desire to maximize his profits. According to Marx, the reason is the evolution of the organic composition of capital, which follows the decrease of its variable component used for labor power purchase. The increase in the capital intensity and the decline in the number of employees per unit of output determine the tendency for the rate of profit to fall (Marx, 1867).

2. Literature Review

Civilization is at a bifurcation point and this is associated with the transition to a new technological level. Smart Industry (Vishnevsky & Knyazev) gives rise to a large number of economic and social problems. Not only is management undergoing a transformation (Liboni et al., 2019), the game itself is changing (Haverkort & Zimmermann, 2017). But it's not about the level of technology, the mechanization of the labor process itself changes the economic component of society (Brown & Philips, 1986).

Disputes over technical progress, capital accumulation, and income distribution, begun in the time of Adam Smith, David Ricardo, and Karl Marx, do not subside to this day, they were attended by almost all eminent economists of his time, the same Toma Piketty from modern ones (Maito, 2014); Rockmore, 2017), there are serious scientific studies by Heinz D. Kurz, inspired, in particular, by the unpublished works of Piero Sraffa (Kurz, 2010). At the same time, organic changes in the composition of capital are taking place: the results of studies published in 1994 confirmed the growth of labor productivity in 17 OECD countries over the

period 1979-1988 and the impact of technological change, especially in the US and Japan (Färe et al., 1994). Therefore, no matter how paradoxical it may seem in the context of the industrial revolution paradigm “Industry 4.0”, the thesis expressed by Marx gives grounds to assume that one who multiplies innovations also multiplies unprofitability. Unless, of course, economic efficiency is associated with the rate of profit. And the prospects for an ever-increasing change in the ratio of “labor and capital” in favor of capital are almost unambiguous. Jeremy Rifkin at the end of the twentieth century called his book “The End of Labor” (Rifkin, 1996).

The goal of this work is a qualitative assessment of the relationship between technical growth and the economic well-being of coal mining enterprises. It is done not in quantitative but in qualitative manner, given the complexity of ensuring that indicators are comparable. The choice for the coal industry is due to its deep historical roots, which determined the main research method as a specific type of analysis of the coal mining industry development in the UK, Ukraine, Germany, Australia, Poland, and the USA. Historical logic in the context of this study makes it possible to equate innovation to the mechanization of production processes in the coal industry.

3. Main Results of the Study

In economic theory, there is a combination of the words ‘trend’ and ‘law’ through a hyphen (Law-tendency of the rate of profit to decrease), although the definition of the author himself was quite clear: “...Thus, the law acts only as a tendency. And it is only under certain circumstances and only after long periods that its effects become strikingly pronounced” (Marx, 1867).

The UK coal industry originated during the first industrial revolution: coal coke led to the rise of metallurgy, coal-fired steam engines — the development of mining and transport. At the turn of the 19th and 20th centuries, the British economy was a real-world economic and energetic leader. No country on the continent produced more coal. Even the United States did not differ dramatically: 351 million tons in 1905 against the British 236 million tons (Kernot, 1993). Germany mined 121 million tons of coal, and Russia — 19 million tons. The specificity of the coal industry was initially associated with a large amount of expenditure (because of its severity) on labor: the manual breaking of coal and fastening of faces, delivery of minerals from the face to transport workings by sleigh drivers, and then horse traction.

Based on the data from S.G. Strumilin (Strumilin, 1935, p. 76), timed at the beginning of the twentieth century, a modern scholar of energy economics

A.I. Dyakonova (Dyakonova, 1999, p. 114) reasonably challenged Soviet scientist G.D. Bakulev's findings that "essentially unlimited exploitation of workers in the coal mines of Donbass in the pre-reform period resulted in a very low cost of coal and high profits for owners and mine owners from a pood of production" (Bakulev, 1955, p. 55).

The profits of the oil industry in Russia at the same time, Dyakonova points out, were immeasurably higher due to lower labor costs. The shares of wages (of the cost price) in the oil and the coal mining industry were respectively: 10-15% and 50-60%. But if we consider the conditions of coal workers in the 70s and 90s, the famous pre-revolutionary (1917) researcher V.E. Den in his monograph "The Coal and Iron Industry" (1912) noted: "Meanwhile, our situation is much worse than in the West ... First of all, our wages are much lower" (cit. by Dyakonova, 1999, p. 115). It is true, he added, "there is virtually no industrial center in Russia, including the both capitals of the Empire, where such high wages would exist" (Dyakonova, 1999, p. 115). After the 1917 proletarian revolution, wages for miners declined from the pre-reform period. The real wages of a skilled worker in 1925 compared with 1909 decreased by 31.7%, of a semi-skilled worker by 11.8%, of an unskilled worker by 22.8%, of service personnel by 43.5% (Dyakonova, 1999, p. 145).

In post-war 1946, the share of wages in the cost of production averaged 60% for coal industry enterprises of the Ukrainian SSR, and depreciation — 4.5%, which indicates a low level of mechanization. But the situation underwent fairly rapid changes: if back in 1960 this ratio remained at the level of 60.2 and 7.1%, then already in 1965 it became 53.1 to 16.1%, and at the peak of the industry's development (1975) amounted to 45.0 and 21.6%.

In 1976, the absolute Ukrainian record was 218 million tons of coal mined (CNIEIugol', 1977). But they were obtained with the help of technology, which, compared with the primitive English equipment of 1905 mentioned above, was of a cosmic level. Electric sharers and roadheaders, scraper and belt conveyors, hydraulic roof supports, battery electric locomotives, not wooden racks, backs, sledges, horse-drawn haulage... And yet, the English result was never achieved, although the Soviet motto "the country needs coal" for the national economy was just as relevant.

The complete loss of the mines in 1949 pushed the UK to nationalize the coal industry (Bruce & Wright, 1994). The privatization of the mining industry carried out in the 1980s under the leadership of Prime Minister M. Thatcher, freed the country from the heavy burden of subsidies, but RJB Mining, eventually renamed UK Coal, being the country's largest owner of coal assets, was unable to manage on market principles, and in 2015 the last British mine, Kellingley, was closed (Beesley & McMillan, 2018).

In no coal basin in Europe after the end of the “era of coal” (the fifties of the twentieth century) was it possible to carry out the development of deposits by the mining method without budgetary subsidies. In France, the consistent policy of several governments ended at the beginning of the 21st century with the complete closure of the mines. At the end of the 20th and beginning of the 21st century, Belgium, Luxembourg, and Portugal took the path of decisive abandonment of national coal mining. Japan, although on the Asian continent, also stopped exploiting its own deposits.

Despite the high achievements in mine construction and the widespread introduction of mechanization of technological processes, the unprofitability of the Ukrainian coal industry became more and more, which predetermined the plans of the USSR leadership to curtail coal production in the Donets Basin and carry out mass closure of mines (Styrikovich & Sinjak, 1986).

In Ukraine, after the dissolution of the Soviet Union, an attempt was made to radically modernize the mining industry, the optimism of which was based on the arrival of a new generation of domestic equipment. The developers of innovations promised in 3-4 years the solution of the most daring tasks of the industry development, subject to the annual introduction of 15-20 new treatment facilities (Laptev, 2002). However, the powerful state program implemented during 2004-2008 did not give the expected economic and production effect. Moreover, the industry average daily load on longwall recorded in 2011 was 724 tons (Starychenko, 2012) turned out to be comparable with the average longwall loads in 1976 — 574 tons per day — despite the fact that out of 1502 longwalls operating at that time, only 30% were complex-mechanized. The economic situation of the industry has deteriorated significantly, although large funds were invested in the campaign, and the mines received a significant number of modern equipment and up-to-date technology.

Significantly, but for economic reasons, coal mining in Germany, rigged with the most efficient equipment in the world, ceased to exist. A masterpiece of German design thought — a plow complex built into a fully automated mine system with a capacity of 10 thousand tons of marketable coal per day (almost 20 thousand tons for row coal) with drive motors with a capacity of 3.6 MW (almost 4900 horsepower) — also did not lead to profitability. In 2018, the last German mine, Prosper-Haniel, was closed (Strasmann, 2019).

Poland. For the period from 1989 to 2006, almost 15 billion złoty (4.2 billion euros) in modern prices were spent on the transformation of the national coal industry in Poland, 37 large enterprises were closed, more than 300 thousand people were laid off. The mining industry regained financial liquidity and, starting in 2004, began to pay its current liabilities in full, paying off restructured debts in

stages. However, the profitability of the Polish mining industry, despite its positive dynamics, is now highly dependent on demand and prices in the global coal markets. The government continues to pay subsidies, albeit 2.5 times less than in the peak years (1999), but in 2006 they amounted to 190 million euros. The potential for efficiency gains through extensive measures has been exhausted. The depreciation of the main equipment is 40%, to renew the material base, about PLN 20 billion is needed by 2015. The enterprises do not have such resources, and the trade unions of the mining industry workers categorically deny investing in enterprises at their own expense, as well as the possibility of selling part of the mines to private hands. The state budget is again faced with the need to finance billions in investments, but already with the restrictions imposed by the legislative system of the European Union. Poland now has 33 fairly efficient enterprises producing 98 Mt of coal, employing 119000 people. But Polish coal is not competitive with Russian coal, the same SUEK — “Siberian Coal and Energy Company”, which produces as much as all Polish enterprises combined (Pashcha & Glishchins’kiy, 2008). The fundamental problems of the Polish coal industry, therefore, turned out to be insoluble. A series of difficult transformations turned into a palliative.

The economic instability of coal mining has also shown up in Australia, which is famous for its high technological level of mine mechanization and rich coal deposits. Thus, in February 2016, the report of the Queensland Resources Council (QRC — Council of Extractive Industries of the Australian state of Queensland) indicated that half of the Australian mines that produced a third of thermal coal operated at a loss, over the past two years, 21000 jobs have been lost, the government’s challenge was to protect the remaining 60000 jobs in the Queensland coal sector.

That, however, did not turn away the Chinese coal ideologists from the concept of increasing the provisioning of mines with modern machines and mechanisms, computers, and automated systems. The absence of highly mechanized unprofitable mines in China, including state-owned ones, is quite consistent with the provisions of the Marxist theory — the wages of the workers serving them are significantly lower than in Australia and the United States. American miners of the UCC company (West Virginia, Appalachian coal basin), owned by the Ukrainian Metinvest, in 2012 received wages 12 times higher than the miners of the same Metinvest from Krasnodon (\$132000 per person per year against \$11000 per year (Amosha, Zaloznova & Cherevatskyi, 2017), not to mention the Chinese workers of that period. The Affinity Mine, before it was acquired by Metinvest in 2009, was more than a quarter of a century stood abandoned, powerful, shallow with large reserves of premium coking coal, fully mechanized, with a staff of about 7 times less than at a Ukrainian enterprise of comparable capacity.

The current restructuring of the US coal industry, as the leaders of large companies expected, will force many coal mining entities to leave the market, but their enterprises will wait for the market situation to improve. However, in 2016, Peabody Energy, the world's largest private coal company, and other giants of American coal mining also declared themselves bankrupt.

Objectively, we have to recognize that in the process of mining, there is a natural deterioration in mining and geological conditions and an increase in the cost of mine operation, due primarily to the transition to deeper horizons. There are long-term changes in the prices of coal and resources. But within isolated periods, one can observe both the intensification of production, due to the ridging of underground enterprises with more and more sophisticated equipment, and the deterioration of their economic situation, which, at least, does not refute the logic of the theoretical position about the tendency of the rate of profit to fall, put forward by Marx in the 19th century.

4. Conclusion

The goal of the research was a qualitative assessment of the relationship between technical growth and the economic well-being of coal mining enterprises. In the nineteenth century, Marx discovered the tendency of the rate of profit to fall. He explained this by changing the organic structure of capital at the expense of labor, but in favor of capital. However, this theoretical construct remains unproven. But the development of production in the world, indeed, became more and more mechanized, innovative, labor productivity grew, the number of employees decreased. The coal industry is like a laboratory in which a technological and economic experiment has been carried out during more than a century. Coal mining is becoming more and more mechanized... and unprofitable. This happened in Great Britain, Germany, Poland, and Ukraine, the coal industry was completely liquidated in France, Belgium, Luxembourg, Spain, Portugal and other European countries. Even in the coal-rich Australia, it requires government support to protect the industry. Bankruptcy befell the largest coal corporations in the United States.

In the meanwhile, mining and geological conditions have been deteriorating (mining operations went to deeper horizons), in the middle of the 20th century, the “era of coal” ended, prices for coal products have fallen, and environmental requirements have become more stringent. It has also impacted the global coal industry dramatically. But the mechanization of mining is indisputable.

Further studies of the economic consequences of innovative development are important and relevant — human civilization is increasingly involved in the

implantation of the “Industry 4.0” ideology... but is terrified that the bloom of it would become the “end of labor”.

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Poszukiwanie zysków a innowacje

Streszczenie. Celem artykułu jest jakościowa ocena związku pomiędzy rozwojem technologicznym a koniunkturą ekonomiczną przemysłu w perspektywie historycznej.

Najważniejszym wnioskiem Marksowskiej teorii kapitalizmu jest to, że stopa zysku będzie z czasem się zmniejszać w wyniku zmian technologicznych. Przemysł węglowy jest jak laboratorium, w którym od ponad stulecia przeprowadza się eksperyment technologiczny i ekonomiczny. Wysunięto następującą tezę: wzrost poziomu mechanizacji produkcji prowadzi do zmniejszenia wskaźnika wydobycia węgla. Oceny dokonano na podstawie badań górnictwa węgla kamiennego w Wielkiej Brytanii, Niemczech, Ukrainie, Polsce, Australii i USA oraz uwzględniając znaczenie doświadczenia.

Okazuje się, że wydobycie węgla staje się coraz bardziej zmechanizowane... i nieopłacalne. Wyniki długotrwałego innowacyjnego rozwoju światowego przemysłu węglowego nie przeczą Marksowskiej tendencji do zmniejszania się stopy zysku.

Słowa kluczowe: innowacja, mechanizacja, tendencja spadkowa stopy zysku, przemysł węglowy

