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Open innovation under authoritarianism: The case of the Soviet Union

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Abstract

The Soviet Union was a productive and technologically developed economy. It achieved a remarkable transformation from a feudalistic society to an advanced industrial society. How was it able to do this? This article argues that such rapid industrialisation was possible because the Soviets invested in legal institutions that created a special kind of open and highly coordinated innovation system confined to national borders. These legal institutions remain underappreciated in Western intellectual property scholarship. The article reassesses the Soviet legal institutions, by explaining their functions and effects on knowledge flows. It also conceptualises the Soviet reward system as having elements of an 'economy of esteem'. The article is informative not only as a revisited historical account on the Soviet regulation of innovation, but also as one that teaches much about the modern models of innovation in market economies.

KEYWORDS

industrialisation, innovation, intellectual property, legal history, Soviet Union

1 | INTRODUCTION

In 1929, *Izobretatel'* (Inventor), the first Soviet journal devoted to innovation, came out in the press. It was an event of huge importance. Albert Einstein was invited to write a foreword to the first issue. 'Masses Instead of Units' was the title of this short but significant note, which summarised the main principles of the Soviet innovation system, its

strengths and weaknesses, and contrasted it with the market-based system. In Einstein's words, 'one cannot invent without knowledge, just as one cannot compose poetry without knowing the language'.[1] Einstein saw the new Soviet model as a serious attempt to democratise invention and avoid the traps of monopolisation.

After the collapse of the Soviet Union and the establishment of the apparent superiority of the U.S. model of capitalism, revisiting the Soviet innovation system may seem counterintuitive. Yet, it has much to offer in terms of thinking about innovation by design. The Soviet innovation system is a real-world example of an alternative system of knowledge production and diffusion, one not dependent on commodification, that is worth understanding in depth because it is an example of the 20th-century innovation system, one that dealt with modern technologies. Other studies, such as Schiff's work on Switzerland and the Netherlands, deal with states from a much earlier industrial period.[2]

The Soviet Union made important public sector-type advances in fundamental science, space, health care, and heavy industry production. Most importantly, the Soviet Union transformed itself from a deeply feudalistic society (probably, more feudalistic than any other European society at the time) into an advanced industrial society. It was the first in the world to create an artificial heart implant in 1937, to build a nuclear power plant in 1954 and the first nuclear-powered icebreaker in 1959, to launch the first Earth satellite, Sputnik 1, in 1957, and to send the first man into space, Yuri Gagarin, in 1961. It was also able to export this model of rapid industrialisation to other countries, most notably to China. Other countries learned from this experience and increased their investment in research and development of technology. Many of the ambitious U.S. innovation projects were a response to competition from the USSR.

There is no comprehensive history of innovation in the Soviet Union, and it is not the purpose of this article to fill that gap. Nevertheless, the broader context suggests that the Soviet system was highly productive. One of the most respected scholars of the Soviet economy, Joseph Berliner, notes that 'there is little doubt that the system has been effective in generating an enormous volume of new technology'.[3] And according to sociologist Manuel Castells, for most of the USSR's existence, the pace of Soviet economic growth and industrialisation was faster than that of market economies.[4] On a par with the United States, the Soviet system became one of the two most productive innovation systems in the world. In 1973, it published more first editions of books than the United States (73,564 vs. 71,503, respectively).[5] In 1987, it registered more inventions than the United States (83,700 and 82,900, respectively).[6]

As for the advantages of the Soviet model, one of its strengths was its ability to produce goods and services in the absence of private property rights. This feature eliminated problems that exist in the market-based economies such as monopolisation and duplication of research efforts. Compared to market-based systems operating in the context of commercial secrecy, the Soviet system limited the waste caused by duplication of research and reduced the opportunities for rent-seeking behaviour associated with the rush to capture a monopoly prize.

Despite these achievements, there was no shortage of criticism of the Soviet model. In terms of the efficiency of its economy, one of the main criticisms often made is that while it produced many technological advances, these were not sufficiently responsive to consumer demand, leaving the consumer goods and services sectors far behind in terms of technology. This is often contrasted with the ability of the U.S. model to satisfy consumer demand. But comparisons with the United States, while seemingly natural, are problematic because of the baseline problem. After the Russian Revolution of 1917, Russia's industrialisation started from a baseline that was in many ways feudalistically rural and that had to contend with a civil war. This is a very different baseline for the development of consumer welfare than the history of the United States.

Relatedly, there was a lot of criticism that the Soviet military was well resourced in terms of innovation spending and technological update at the expense of the civilian sector. However, the skewness of resources toward the military sector could not be attributed solely to the design of the system, but, rather, placed in a broader context of Cold War tensions that inflated military investment on both sides of the world.[7] Many important Western inventions came through the military too. Defence spending in the United States continues to be an important source of innovation.

Therefore, we need to understand the successes and failures of the Soviet innovation system in terms of this broader atmosphere and the goals that it set for itself in this historical context. Undoubtedly, the Soviet Union made a great leap in development and built a pragmatic system that survived and delivered technological innovation for a

long period of time. The key question in this article is how the Soviet Union was able to achieve such industrial development.

The answer to this question is especially relevant today because recent scholarship has demonstrated that Soviet legacies continue to influence the Russian legal system,[8] those of the countries of the former socialist block,[9] and, more generally, the international intellectual property system.[10] However, the existing explanations of the Soviet system have not been revised since the end of the Cold War. They are simply outdated because since then we have learned more about how innovation is produced and that it is hardly only a market phenomenon. Innovation systems theories emphasised that innovation is a product of the interaction of different actors, including government agencies, industry, universities, and firms.[11] We have learned more about the critical role of the U.S. government in financing some of the riskiest innovations, such as the Internet, GPS, cellular technology, for which public opinion praised only the private sector.[12] And we also learned that within the capitalist world itself, there are varying degrees of state coordination and its involvement in the economy, especially when it comes to science and technology.[13] This new knowledge enables us to see more in the Soviet approaches than mere communist maxims.

In this article, I show that the Soviet Union invested in legal institutions that it purposefully designed to achieve rapid industrialisation. My analysis is based on a new reading of primary sources, the Soviet regulatory acts on innovation, in which I deconstruct the functional meaning of the legal institutions. I illustrate that many of the solutions proposed by the Soviets had a strong rational basis and were constructed in a very pragmatic way. While the Soviet Union has often been portrayed as a secretive state, a closer look at the legal institutions for innovation reveals their emphasis on knowledge exchange between the networks composed of research organisations, industry, and government agencies. Overall, the analysis shows that the result of this regulatory intervention was the establishment of a special type of an open and highly coordinated innovation model confined to national borders.

The article continues as follows. Section 2 explains the key Soviet legal institutions for innovation, which included two parallel institutions for inventions (inventor's certificates and patents), efficiency proposals, discoveries, and copyright. Section 3 outlines how these rules were administered and illustrates the role of government agencies, research and development organisations, and enterprises in producing and diffusing technological knowledge. Section 4 conceptualises the Soviet reward system, composed of material and nonmaterial benefits, as an 'economy of esteem'. Section 5 concludes.

2 | SOVIET LEGAL INSTITUTIONS FOR INNOVATION

European states in the 19th century embraced intellectual property at different speeds and some went through industrialisation without patents.[14] Imperial Russia was not on its own. It moved from a system of privileges for inventions to patent law in 1896, following the trajectory of European patent culture.[15] Similarly, the Russian copyright law of 1828 was aligned with Western European principles.[16] In addition, Russia had some rules protecting producer's secrets, which was a prototype of the modern legal institution of trade secrets.[17] The intellectual property law of the Russian Empire therefore had quite conventional features.

Some of the Soviet legal institutions were similar to market-based institutions, i.e., patents and copyright, but others were specific to the Soviet Union. There were two legal institutions for inventions: inventor's certificates and patents. In addition, there were institutions for incremental innovation, such as technical improvements and efficiency proposals. Copyright had strong socialist features, with an emphasis on author's rights. Discoveries were delineated as a separate legal institution. There was no institution of trade secrets in the Soviet Union.

These legal institutions emerged as the antipode to Western intellectual property law. Soviet scholars closely analysed market-based intellectual property systems and agreed with their Western counterparts that technological progress is a central determinant of economic development. However, the Soviet view then diverged on the appropriate design of the economy and the means to achieve technological progress. The Soviet scholarship was

very critical in pointing out the shortcomings of market rules, which were used as guiding principles to design an alternative system.[18]

Moreover, concern about the technological race concern was reflected in Soviet strategy. It was believed that the Soviet Union would not be able to catch up with the West unless it lifted legal restrictions on the flow of knowledge. If barriers are raised outside the country, the last thing that country wants to do is to establish barriers inside the country. The goals were to achieve rapid industrialisation, to spread innovation across core industries, and to reward people for sharing useful ideas. To achieve these goals, one needs creativity and the audacity to take a different approach to what had been done before. The Soviet strategy was to accumulate, codify, and diffuse technological knowledge rapidly. Legal rules therefore had to be constructed to allow this to happen without barriers and delays.

2.1 | Inventions

From 1919 to 1924, inventor's certificates were the only legal form for inventions. During the New Economic Policy, which revived some market-based instruments, only patents were issued (1924–1931). However, in 1931, the dual system of inventor's certificates and patents for inventions was established, and most patents issued before 1931 were exchanged for inventor's certificates.[19] The dual system continued until 1991. Thus, the key feature of the Soviet innovation system was the management of two parallel legal institutions for inventions: inventor's certificates and patents. In theory, inventors could choose which of these legal institutions to use, but in practice, most applied for inventor's certificates. However, patents were a preferred form for foreign patent applicants.[20]

The standard of invention was the same for both. It included novelty and industrial application.[21] Inventions were also examined for usefulness. Improvements that made production cheaper were prioritised, as the country started industrialisation from a very primitive baseline. In 1959, the usefulness requirement was formalised and became part of the standard of invention. From then on, every invention had to be significantly new and have a positive effect.[22]

2.1.1 | Inventor's certificates

Under the system of inventor's certificates, the exclusive right to an invention was transferred to the state, which put it in the public domain, conferred within Soviet national borders. In return, inventors received monetary rewards and social benefits such as priority rights in promotion, education, and housing, etc. It was believed that such an allocation of rights and obligations between inventors and the state represented a good balance between public and individual interests.[23] As some Western commentators noted, inventor's certificates 'provided the inspired individual with recognition and financial reward, while avoiding the monopolistic features of the capitalist patent'.[24] Inventor's certificates were thought to better reflect the value of innovation and solve the problem of the public nature of production and the private nature of value extraction.[25] Einstein noted that in a planned economy, the disadvantage of monopolisation of inventions was eliminated because the activities of other enterprises were not restricted; an inventor was not distracted by the need to fight to protect their exclusive right.[26]

The transfer of an exclusive right to the state through the inventor's certificate activated the rule known as the 'liability rule'. The distinction between the liability rule, the exclusivity rule, and the inalienability rule is to be found in the classic article by Calabresi and Melamed.[27] The first category is based on the principle of liability and aims at compensating damages for infringement of the right. The Soviet system of inventor's certificates is an example of the liability rule. The second category is based on the principle of exclusivity and aims to prevent an infringement of the right. The market-based patent systems are based on the exclusivity rule. The third category is based on the

idea that some rights are inalienable. This applies, for example, to the authorship of inventions, but this matter is beyond the scope of this study.

In the context of inventions, a liability rule 'does not make it possible for the right holder to decide ex ante on access to the right and to have injunctions at its disposal to block access'.[28] The liability rule underlying the inventor's certificates meant that an inventor could not exclude third parties from using the invention but had to be compensated for such use. In the Soviet system, such compensation depended on the usefulness of the invention and was a combination of material rewards and social benefits.

In the Soviet understanding of technological progress, inventions were only one side of the problem. To achieve technological progress, the economy had to be organised in such a way as to allow the widespread use of inventions.[29] There are two ways in which the inventor's certificate system created the public domain of inventions, which differ from the ways in which the public domain of inventions is created by Western patent systems. What matters from an innovation point of view is, first, the ability to access information about inventions (the passive phase) and, second, the ability to use the inventions (the active phase). In Western patent systems, the passive phase is realised through the requirement that patents must be published.

For example, under the old U.S. patent system, the publication of patents was distorted by 'submarine patents', which refers to the practice of filing patent applications with broad claims that were repeatedly updated to delay the publication of a patent, sometimes for years. When the opportunity arose to file an infringement suit against an unsuspecting competitor who had begun production of an innovation that had not yet been patented, the submarine patent, having gained a profit appeal, would be brought to the surface.[30] Submarine patents are no longer used, but anticompetitive practices that distort the passive phase have not stopped and continue to evolve.

The full active phase in the Western patent systems begins with the expiration of the exclusive right to an invention, which opens the invention to use without the consent of the patent holder. Some Soviet critics of the Western system considered that the claim that an invention entered the public domain after the patent term expired was a fiction. In a 1934 book, the Soviet scholar Raevich argued that in practice, such entry was delayed by anticompetitive practices such as evergreening and lobbying for the expansion of the patent subject matter.[31] Modern practices to delay the active phase include evergreening of patents and 'pay for delay' agreements.[32] In the market-based patent system, therefore, there is a time lag of several years between the passive and active phases of the use of the invention, and market players engage in practices to widen this gap.

In contrast, the Soviet system of inventor's certificates aimed to bridge the gap between the passive and active phases of the use of the invention. The 1931 law stipulated that '*any* useful invention shall be implemented in *all* enterprises of industry, where it can be applied with the benefit'.[33] After the inventor's certificate was issued, inventions were immediately available for use by Soviet enterprises, unless an invention was a military secret.[34] This system of knowledge flows can be seen as an example of networked open-source collaboration, which anticipated the development of open-source innovation in the West.

Soviet scholars considered the inventor's certificates to be a better institutional solution than patents because the former allowed broader and faster diffusion of inventions in the economy.[35] The rate of diffusion of Soviet inventions was indeed high: in 1960, about 64% of all inventions and efficiency proposals (another legal institution for incremental innovation, explained later in the article) were implemented in Soviet production, and there was constant pressure to increase this rate.[36] Outside of the Soviet Union, inventor's certificates were licensed as if they were patents, making the active public domain an advantage confined to Soviet territory.

2.1.2 | Patents

Instead, if a patent was issued, an inventor obtained the exclusive right, which lasted 15 years, and was able to exclude others from using the invention and license it themselves. The Soviet regulation of patents was thus similar to the market-based systems, in which a patent does not confer a reward; rather, it allows its holder to exploit the

right to obtain the reward. In this case, the size of the reward depends on the ability to exploit the patent. Patent holders were not entitled to social benefits. The use and dissemination of the invention was the responsibility of the inventor, under threat of compulsory licensing.

There were several exceptions to patentability. For example, between 1924 and 1991, no product patents were issued on pharmaceutical inventions.[37] This exception cleared the way for other inventors to innovate around the pharmaceutical invention and to find more efficient ways to make the same substance (experiment with processes). The prohibition of patents on pharmaceutical products was a practice that was followed by many countries in the 20th century. These exceptions were an ex ante mechanism to prevent the abuse of the exclusive right to socially important innovations.

One might ask, if the system of inventor's certificates had a strong rationale, why were patents still an alternative legal institution for inventions in the Soviet Union? One plausible explanation could be that the Soviets wanted to preserve a legal institution that would facilitate the import of foreign technology. For foreign inventors, preserving the exclusive right was more familiar than navigating the system of inventor's certificates, which was embedded in the organisational structure of the centrally managed economy. Foreigners did not make much use of patents because their effectiveness was limited in the centrally managed economy.

Nevertheless, the management of parallel institutions, inventor's certificates and patents, was a creative legal design to achieve both national diffusion of inventions and to attract foreign technology transfers, which could be useful for developing countries in the catching-up phase. The Soviet experience shows that a patent system could be one of the institutional solutions for managing inventions, but it is by no means the only one and can coexist with other institutions for innovation.

If the inventor held both the patent and the inventor's certificate, the material rewards and social benefits of the latter were withdrawn. Arguably, this was a means against attempts to game the system, for example, by compromising the openness of some parts of the technology by keeping other parts exclusive. In general, the system was designed to make the inventor's certificate the preferred choice of inventors, thus encouraging faster accumulation of knowledge in the active public domain of inventions.

A remark on the absence of trade secrets in the Soviet Union is due. Trade secrets can include technical information about manufacturing and business processes. It is a commercially valuable information and is therefore kept secret. The institution of trade secrets did not exist in the Soviet Union. There were, of course, military inventions that were developed in closed academic cities or laboratories, but these were inventions that were relevant to national security. In a civilian part of economy, secrecy was seen as an obstacle to industrialisation, so the design of legal institutions for innovation reflected this goal of open exchange.

Given the Soviet system's emphasis on open knowledge flows, the existence of trade secrets in the civilian economy would run counter to the principle of active exchange. It was believed that trade secrets could be used to increase one's market power and strengthen the patent monopoly to the detriment of society. For example, they could be used to hide important knowledge about the patented invention and thus raise the price of access to that knowledge. In the market-based systems, if an employee proposed a technological improvement that did not meet the standard of an invention, that knowledge was likely to be protected as a trade secret.

2.2 | Efficiency proposals

The Soviet Union put a lot of emphasis on making work a creative exercise because it was expected that genuinely useful improvements would emerge from a nuanced understanding of a particular production site. A new type of legal institution was introduced for incremental results that did not meet the standard of invention. From 1931 to 1959, the legal institutions included technical improvements and efficiency proposals, although both referred to minor innovations and were based on the same legal principles, so the distinction between them was unclear.[38] In 1959, technical improvements were eliminated, and only efficiency proposals remained. For convenience, I will refer only to efficiency proposals.

An efficiency proposal could be any technical solution that aimed at improving equipment and goods, control, observation and testing methods, safety rules, labour efficiency, energy use, and so on.[39]

The introduction of efficiency proposals was part of a larger social experiment to create a new work culture. As the rural population without industrial experience moved to the cities, much emphasis was placed on their training. In the 1920s, the ideas of 'scientific management of labour' become very popular. At that time, more than 10 research institutes were dealing with the problems of work organisation and management, and 20 journals on social problems of work were published.[40]

Aleksey Gatsev, the main proponent of the ideas on the scientific management of work, considered a worker as an active factor of production. According to this system, a worker was expected not only to meet the established standards, but also to understand the equipment and technology enough to suggest improvements, in other words, to have a creative attitude toward their work. Gatsev headed the Central Institute of Labor, which prepared training materials and sent instructors to enterprises, so that ideas could be implemented. On a general level, this cultural underpinning of efficiency proposals illustrates that the Soviets viewed innovation as a constant improvement of existing systems, and innovation as an endogenous process of internal evolution of production. This was one of the ways in which innovation was democratised. Most efficiency proposals came from workers without engineering degrees.

Soviet scholarship classified innovative outcomes according to 'the intensity of creativity'.[41] Inventions were the most 'intense' outcome, while efficiency proposals were less sophisticated. Inventors and efficiency experts were collectively called the 'large-scale technical creativity class'; their training required the development of 'efficiency thinking'.[42] The idea was that every technical specialist was capable of innovating, only the significance of their proposal varied. It was felt that all improvements, no matter how small, should be implemented, even if they were not original and only added to what already existed.[43]

It can be argued that efficiency proposals are similar to second tier patents, a common term used for utility models and petty patents. Some jurisdictions, including Germany, Austria, and Japan have utility models, while the United States, the United Kingdom, and Canada have been sceptical of the idea.[44] Russia introduced utility model protection in 1992. Second tier patents differ from traditional patents, they have a lower standard of patentability and a shorter term of protection. They are not mentioned in the WTO TRIPS Agreement, leaving it up to the member states to decide whether they are worth introducing. The Paris Convention for the Protection of Industrial Property refers to utility models as one of the types of industrial property, making them subject to the principles of national treatment and a right of priority.[45]

Both efficiency proposals and utility models refer to incremental innovation, but efficiency proposals were based on the liability rule, while utility models are based on the exclusivity rule. Most of the criticism of utility models relates to their reliance on exclusivity, which can lead to the privatisation of already available knowledge and the so-called 'tragedy of the anticommons'. As Reichman argued, the liability rule may be a more appropriate regime for incremental innovation.[46] The liability regime provides incentives to generate knowledge that does not meet the standard of patentability, while at the same time removing barriers to its use.

Based on the same concern, the Soviet institutions for incremental innovation were designed as a liability rule; thus, in the Soviet system, this type of minor innovation entered the active public domain in the same way as inventions under the inventor's certificates system and was rewarded according to the same principle of usefulness. I discuss the Soviet principles of reward later in this article. The distinction between the active and passive phases of the use of inventions also applies to the use of incremental innovative results. The liability rule behind technical improvements and efficiency proposals facilitated the cumulative effect of incremental innovation, an effect that extended across an industry and sometimes across industries in the Soviet economy.

2.3 | Discoveries

The Soviet Union became the first country in the world to formally recognise scientific discoveries as a legal institution. This was introduced in 1959 and existed until 1991. A discovery was defined as the establishment of

previously unknown, objectively existing regularities, properties, and phenomena of the material world.[47] James Swanson's monograph 'Scientific Discoveries and Soviet Law' provides a comprehensive account of this legal institution.[48] The nature of the reward was reputation and prize based. A discoverer received a diploma and a cash prize of up to 5000 roubles.[49] Recognition of a discovery did not confer exclusivity.

The Soviet Union attempted to diffuse the institution of discoveries internationally and became the principal advocate in the WIPO for the conclusion of an international treaty on discoveries.[50] The idea was to make discoveries registered under the Treaty available for unrestricted use. Negotiations on the draft treaty faced opposition from a group of countries, led by the United States; the opposition group insisted on a reservation that the registration of discoveries would be voluntary with no legal effect attached to the fact of registration.[51] The Geneva Treaty on the International Recording of Scientific Discoveries was signed in 1978 by six countries (the Soviet Union, Bulgaria, Cameroon, Czechoslovakia, Hungary, and Morocco), but it never entered into force.[52] The diffusion of the institution of discoveries was limited; only a few countries of the Eastern bloc, namely Czechoslovakia, Bulgaria, Mongolia, and Cuba, incorporated it into their national laws.

In the Soviet Union, the expert evaluation of scientific achievements was strict; only about 1% of applications were successful.[53] About 400 discoveries were included in the state register, including those related to medicine, genetics, physiology, biophysics, cytology, oncology, and viruses. An institution of discovery could have been a solution for the growing problem of inventions, which embody basic scientific knowledge and commercially valuable knowledge. There are at least two problems with their patentability: one is the distortion of scientific interest toward commercially useful rather than welfare-enhancing solutions; another is the potential for controlling and blocking subsequent innovation.

Market-based economies, which had not introduced sufficient safeguards against this problem, saw the scope of patentability extended into the scientific field. They were unable to resist the acceleration of what Drahos and Braithwaite describe as 'the knowledge game', whose players strive 'to propertize as much knowledge as possible'.[54] How to prevent scientific information from being privatised is an ongoing concern.

Theoretical contributions include proposals to establish 'a positive intellectual commons in which the commoners can demarcate their use of knowledge through labor but cannot appropriate knowledge from the commons',[55] and 'recognizing a right to participate in science', requiring new mechanisms of active access, learning, and adaptation of the existing knowledge base.[56] Practically, the Soviet legal institution of discoveries was probably one of the last real-life institutional experiments that offered ways to mitigate the problem of the private capture of science. It ceased to exist along with the Soviet Union.

2.4 | Copyright

According to the first Russian copyright law (1828), the author had an exclusive right to their works. The copyright term was 25 years after the author's death, which was extended to 50 years in 1857.[57] After the Russian Revolution of 1917, some works that were considered 'national heritage' were nationalised.[58] It soon became clear that nationalisation was not a productive solution in the long run. The exclusive right of the author was reinstated, but copyright law was significantly reformed.

Despite some similarities with countries following the *droit d'auteur* tradition, such as the absence of formal requirements for copyright recognition, Soviet law differed in many respects. In fact, as legal and Sovietology scholar Dietrich A. Loeber points out, a novel feature of Soviet copyright was the combined effect of civil, labour, and administrative law provisions.[59] Like other sectors of the economy, printing was subject to the same logic of the centrally managed economy. In addition, the law established mandatory rates of remuneration that depended not on the commercial value of the work, but on its genre and length. In 1975, for example, the reward rate for a scientific monograph was 150–300 roubles per 40,000 typographical units (as a reference, the average salary in 1975 was about 134 roubles).[60]

Until 1928, the copyright term was 25 years, a significant reduction compared to the Russian Empire's rule of 50 years after the author's lifetime. From 1928 to 1973, it was extended to the lifetime of the author and an

additional 15 years. The Soviet approach to literary works differed from its approach to inventions. While the regulation of inventions aimed at limiting exclusivity, the regulation of copyright recognised the exclusive right of the author. It should be emphasised, however, that exclusivity was a right granted to authors, not to publishers.

The purpose of the law was to ensure that a Soviet author would not be worse off in negotiations with publishers. Any terms of a contract with a publisher that deviated from the statutory rules and put an author in a weaker position, such as reducing the statutory amount of royalties, were considered void and were automatically replaced by the statutory rules.[61] Complete alienation of the author's exclusive right was not allowed.

Another feature of Soviet copyright was freedom of translation; any work could be translated and published without the author's consent. This rule was inherited from the Russian Empire and dated back to 1828. Translation rights were one of the main points of debate in several rounds of negotiations of the Berne Convention for the Protection of Literary and Artistic Works.[62] France, a major producer of literary works, argued that the exclusive right should be extended to the translation of works.[63] Countries such as Germany, Sweden, Norway, and Japan argued for a limited period of protection for translation rights to meet the educational needs of their populations.[64] At the Berlin Conference in 1908, translation rights were granted the same term as other rights.[65]

The Russian Empire, which was an observer at the Conference, noted that the exclusivity on translation would prevent its accession to the Berne Convention.[66] This freedom was the main reason why the Soviet Union had long remained outside international copyright conventions, including the 1886 Berne Convention for the Protection of Literary and Artistic Works and the 1952 Geneva Universal Copyright Convention, which recognised translation as an exclusive right of the author.[67]

Freedom of translation in the USSR was considered consistent with the principle of social welfare and was used to facilitate the broad cultural education of the multilingual population of the Russian Empire and then the Soviet Union. The purpose of freedom of translation was to avoid economically prohibitive royalties by allowing unrestricted free translation of any copyrighted work.[68] The Soviet Union took full advantage of this rule. Books were printed in 89 languages, including in 43 languages of nationalities that had no script before 1917. Book publishing in the Russian language multiplied by 13, and in other languages by 53.[69] Knowledge was brought to several linguistic groups of the Soviet Union at marginal cost. If not used predatorily, the freedom of translation could be one of the ways to bring knowledge to developing countries. The USSR was recognised as 'the world's largest producer and consumer of printed works'.[70] At the same time, critical voices nominated it as the world's leading 'pirate'. The issue was so hotly debated that it was raised at Yalta in 1945 during the meetings of Joseph Stalin, Winston Churchill, and Franklin Roosevelt.[71] The Soviets had a firm position on freedom of translation until 1973.

As the USSR became increasingly involved in international trade, it could not resist influences aimed at changing its regulations. Accession to the Universal Copyright Convention (UCC) in 1973 triggered important changes in Soviet copyright law. The copyright term was extended to 25 years after the author's death (an increase of 10 years from the previous rule). Before joining the UCC, a Soviet author's copyright was inalienable; after joining, a complete alienation of the author's rights became possible, and the exclusive right was no longer the prerogative of the authors but could also belong to publishers. It opened the door to the transfer of rights and related commercial transactions.

The USSR's adherence to the UCC quickly inspired a boom in conspiracy theories in Western scholarship as it tried to make sense of the rationale behind the Soviets' reasons for giving ground. One such theory was that the USSR wanted to use the international copyright system to censor samizdat (dissident literature that bypassed official printing).[72] At the same time that it joined the UCC, the Soviet Union changed its law to restrict the right of Soviet authors to publish abroad: they had to do so through a newly established central agency. The concern was reinforced by voices from within the Soviet Union itself. An open letter signed by the academic Sakharov warned: 'In the particular conditions of our country, the law on the monopoly of foreign trade could be manipulated to restrict, or even suppress entirely, the authors' rights—on an international basis—of Soviet citizens'.[73]

While this may be true to some extent, the main reason for Soviet adherence to the UCC seems to be less draconian. Michael Newcity suggests that it was the result of economic bargaining with the United States. He explains that the Soviets agreed to join the UCC in return for tax concessions from the United States.[74] Tax concessions opened the

long-awaited path for the export of Soviet equipment to the U.S. market, which had previously been excessively taxed. In 1986, for example, the USSR and Eastern Europe 'earned about $80 million in licensing fees and royalties from American businesses', pioneering in the export of electric welding and metal casting.[75] Accession to the UCC was perhaps a continuation of the earlier trend of increasing international technology transfer with Western countries, which began with the USSR's signing of the Paris Convention for the Protection of Industrial Property in 1965.[76]

Many Soviet copyright institutions clashed in meaning with the institutions of the UCC. Serge Levitsky, a scholar of Soviet law and legal culture, explained the divergence between the UCC and Soviet copyright concepts and demonstrated that formal equivalence did not translate into functional equivalence.[77] Adherence to the UCC was arguably the first to shake the foundations of Soviet copyright law. Confusion further increased with *Perestroika*, as more market elements were introduced into what had previously been socialist law. For example, mandatory remuneration rates were abolished, and authors were given the right to negotiate their own deals both within and outside the country. Previously, the central state agency had negotiated with foreign publishers on behalf of Soviet authors.

Socialist features prevailed in Soviet copyright until 1973. These included the prohibition of alienation of the author's copyright to publishers, mandatory statutory remuneration, statutory safeguards to mitigate the unequal bargaining power of authors and publishers, and freedom of translation. These features were consistent with the design of the Soviet innovation system and contributed to the rapid production and dissemination of literary works, including scientific monographs and journal articles. The opening of the Soviet economy to international exchanges initiated the process of external regulatory influences and bargaining. As some of the above-mentioned accounts show, the socialist features of copyright were probably exchanged for tax benefits for technology exports, which seemed to be a higher priority at the time. The mistake was felt immediately, especially in scientific publications.

By 1973, the Soviet Union reproduced 654 foreign scientific journals in the original language and translated about 20. At the same time, the United States reproduced and translated 150 Soviet scientific journals. It was reciprocal 'illegal' copying, which both parties were unhappy about, but which continued. The Soviet Union's accession to the UCC in 1973 put an end to these activities. According to Michael Newcity, Soviet publishers reached their U.S. counterparts to negotiate royalties, but had little success. Within a short time, Soviet scientists expressed deep regret over the emerged shortage of foreign scientific publications.[78]

On a systematic level, these legal institutions for innovation were forms of codification of knowledge in the public domain. Inventor's certificates codified a type of knowledge that met the standard of invention. Incremental innovations that did not meet this standard but were still useful were codified as efficiency proposals. Discoveries codified scientific breakthroughs. As Swanson notes, the USSR was the world leader in 'scientific information storage and retrieval', with the established system of directing 'the flow of information wherever it [was] needed in its vast network of research institutes'.[79] The Soviet system was thus a special kind of open innovation model, confined to national borders. Knowledge was treated as indivisible, as a common expertise to be shared for the advancement of industry as a whole.

A codified public domain of knowledge minimises the duplication of research efforts and helps to direct resources more efficiently for innovation funding. Knowledge accumulation becomes productive when the flow of new ideas is active. When knowledge is made transferable, it begins to be shared and generates feedback loops. It could be tested, and further improvements proposed. The overall competence of the specialists and the quality of the public domain of knowledge rise steadily. The whole becomes greater than the sum of its parts.

3 | THE SOVIET INNOVATION NETWORKS

We cannot explain what was happening only by referring to the state as the main actor in Soviet innovation. The nodal governance approach focuses on the actors of the network. Networks act through nodes. This section sheds light on some of the key nodes in the Soviet Union and shows how they interacted. It was not enough to create new rules. These legal institutions were embedded in the organisational structure of the Soviet economy. They became operational through the administrative functions of the state organisations.

The national innovation systems is a theory that seeks to explain the overall system of knowledge production and distribution. This theory assumes that a country's innovative performance depends on the interaction between institutional actors and their relationship with institutions.[80] In particular, the national innovation system 'is constituted by elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge and that a national system encompasses elements and relationships, either located within or rooted inside the borders of a nation state'.[81]

The national innovation systems theory was originally developed to analyse market-based innovation systems. It has often been criticised for not considering the global dimension; the influence of the international knowledge transfer on a country's performance. This 'shortcoming' ultimately makes the national innovation systems theory particularly useful for understanding the Soviet system which was deeply national and had limited access to technologies developed elsewhere. During the existence of the Soviet Union, various organisations were established, reformed, and abolished. Therefore, it is not an easy task to compose a snapshot that is representative of the 70 years of innovation management on the national level. This part offers a schema of the most important and long-lasting institutional actors that produced innovation in the Soviet Union.

As noted above, except for military innovation and patented inventions, most innovation in the Soviet Union was openly shared among the nodes of government agencies, research institutes, and industrial enterprises. Entrepreneurship in the state-planned economy was restricted, and an alternative mechanism was implemented to make innovation flow in the country. The Soviet innovation system was the first system of management of national scientific-technical policy by government and party agencies together with research institutes and enterprises.[82]

The Soviet innovation system was usually perceived as a centrally managed economy in which plans were imposed on enterprises in a strictly vertical fashion. However, the system was more complex and consisted of downstream and upstream information flows. Through the network of organisations, the state was simultaneously playing the role of an efficient entrepreneur and an informed consumer, exercising preferences to implement only those innovations that it deemed useful. The familiar concern about the planned economies is a divide between military and civilian economies to the detriment of the latter. Yet, what is often overlooked in this line of argument is that within a civilian economy, no distinction was made between a mainstream (commercial) economy and a social economy, which is a common problem in the market-based systems.

The Soviet government experimented with centralised and decentralised approaches to managing the innovation system and undertook numerous administrative reforms. The article continues with the types of organisations involved in the innovation process, including government agencies, R&D organisations, and enterprises.

3.1 | Government agencies

Innovation planning and economic planning were closely linked. As Berliner noted, innovation planning relied on 'an extensive body of ongoing technological analysis and economic planning'.[83] The 5-year plans consisted of a list of proposals for the development of science and technology, and the major scientific and technological problems that needed to be solved.[84] Every 3 months, the State Planning Committee, the main organisation in charge of national economic planning, collected information from other state authorities, such as the State Committee on Science and Technology and the USSR Academy of Sciences, about new inventor's certificates. The State Planning Committee then distributed the list of new inventions to the industrial ministries. The industrial ministries transformed this list into specific plans for the enterprises within a given industry.[85] In 1970, the plan-driven system was reformed. Twenty-year forecasts were introduced. They provided a vision of scientific and technological development and were reviewed every 5 years.[86]

The main agency responsible for the scientific and technological policy in the USSR was the State Committee on Science of Technology, which operated between 1948 and 1991. Its main functions were to advise the government, coordinate R&D activities in the research institutions, distribute research funds, establish new

scientific organisations, supervise major research projects, and guide them toward industrial application.[87] The Committee selected major research advances from the republican Academies of Sciences, assessed their potential for industrial application, and handed them over to the industrial ministries for further preparations as concrete solutions for the industry.[88] It launched union-wide scientific competitions to solve major research and technological problems.

The State Committee on Science and Technology was composed of highly qualified professionals with advanced scientific degrees and vast industrial experience. It had enormous power and authority and was perceived as a superior body in relation to other executive bodies such as the industrial ministries. After the break-up of the Soviet Union, the Committee was abolished. In Russia, the Ministry of Science and Education became its formal successor; however, it was not given the same functions.

The Soviet Union did not have a traditional patent office as understood in the market economies. Instead, institutional experiments were conducted with centralised and decentralised approaches to the examination of inventions. Between 1918 and 1936, this task was entrusted to the Committee for Inventions Affairs within the Supreme Council of the National Economy and then to the Committee on Inventiveness within the Council of Labour and Defence. Between 1936 and 1947, inventions were registered by the industrial people's commissariats, and between 1951 and 1955 by the industrial ministries.

Industrial ministries were created to oversee each major industry. For example, there were ministries of aviation, automobile production, nuclear energy, gas, machine building, metallurgy, etc. The industrial ministries had their own scientific and technical councils to advise on innovation policy within the industry. Members of the councils were prominent scientists, innovators, and representatives of various agencies.[89] The industrial ministries often established research institutes specifically for the needs of their industry.

For the most part, a centralised approach was preferred. The new State Committee for Inventions and Discoveries within the Council of Ministers of the USSR examined applications for inventor's certificates and patents, determined the amount of the reward to an inventor, and coordinated the network of research institutes and research departments within ministries. The Patent Office of modern Russia is the successor of this Committee, but its functions are much narrower. Modern patent offices are registration offices, while the Committee was an active manager of innovation, facilitating its implementation in the national economy. It can even be considered a de facto state-based entrepreneur of innovation, even though this term was ideologically verboten.

In his article 'Masses instead of Units', Einstein remarked that the planned system eliminated the disadvantages of monopoly rights to an invention, but he also anticipated that the new system might create new types of obstacles such as bureaucracy and intrigue.[90] One of the most cited examples in the Western literature is how Trofim Lysenko 'buried' the Soviet genetic industry; however, this episode could hardly be attributed to the system's design. As Kojevnikov remarks: 'thousands of references to this selectively chosen example established the standard trope of connecting the failures and problems of Soviet science and technology to the pernicious influences of politics and ideology, while refusing to see the very same forces at work in the cases of achievements and triumphs'.[91]

The Communist Party had de facto equal, if not superior, status to the government agencies described above. Many of the regulatory acts in the area of innovation policy were coenacted by the Central Committee of the Communist Party. Some scholars refer to the Soviet model as one that was based on 'party-state science and technology policy'.[92] The Communist Party of the USSR transcended the various institutional levels of innovation management and often acted as a supervisory authority. The government agencies and the Communist Party essentially enforced the open innovation model, ensuring that barriers to knowledge flows were removed wherever they arose in the process.

3.2 | Research and development organisations

By 1969, there were around 1700 research institutes in the Soviet Union.[93] Basic research was carried out by the USSR Academy of Sciences and its 200 research organisations. Thirty thousand scientists worked in this network.[94]

Research institutes participated in the state planning of innovation by submitting proposals to the State Committee on Science and Technology.[95] The role of R&D institutes was crucial; as Kojevnikov points out, in the Soviet Union, production was subordinated to research institutes and not vice versa.[96]

Applied research took place in applied research institutes, engineering-design organisations, and construction-engineering organisations. Large research institutes established a complete innovation cycle consisting of facilities that produced prototypes. Smaller institutes relied on the capacity of the network when they needed equipment or other resources. By 1964, about 1000 engineering-design organisations were operating.[97] They developed product and process designs for enterprises, including specifications of the final results, and procedures for production and quality control. Construction-engineering organisations developed design and manufacturing processes for newly constructed plants.

Innovation thrived in places where knowledge was abundant and interaction among various nodes was vigorous. During World War II, the Paton Electric Welding Institute in Kyiv guided the Ural Automotive Plant in Chelyabinsk Oblast on upgrading and increasing the mass production of T-34 tanks under the conditions of a severe labour shortage.[98] After the war, the Paton Institute and Leningrad's 'Elektrik' Plant developed a unique welding machine (a technology for connecting different materials) and were awarded the Stalin Prize of the USSR in the field of science and technology. The Institute's technology for producing high-capacity gas pipes was applied by multiple plants throughout the USSR.

Later, Paton's invention of a new process for welding was used in the construction of massive bridges across the Dnieper River in Kyiv and the Volga River in Saratov. The Paton Institute, the Novokramatorsky Engineering Plant in Kramatorsk (Donetsk Oblast), and the Krasnyi Kotelshchik Plant in Taganrog developed the electroslag welding process, which was awarded the Lenin Prize. In 1958, this technology won the Grand Prix of the International Exhibition in Brussels and was licensed to several foreign companies.[99] In 1969, the Institute's welding technology was applied in space.

The New York Times reported in 1986 that 'the Washington Metro runs on rails welded by the Holland Company of Chicago Heights, Ill, using about two dozen Soviet flash butt welding machines modified for the job. One Soviet official observed with a smirk that "even your [U.S.] generals and Star Warriors ride to work at the Pentagon on Soviet welding"'.[100] In 1990, it was proposed that the welding processes developed at the Institute be used to join living tissue during surgery, an innovative technology used in Ukraine and Russia.[101]

3.3 | Enterprises

The average size of a Soviet enterprise was larger than that of the market economies. In 1963, for example, Soviet enterprises with more than 500 employees accounted for 24% of all enterprises, compared with 1,4% in the United States and 0,3% in Japan. There were significantly fewer small enterprises, those with fewer than 50 employees, in the Soviet Union than in the United States and Japan; 15%, 85%, and 95%, respectively.[102]

Enterprises in a centrally planned economy are perceived as playing little or no role in the innovation process, merely carrying out the instructions of the planners. However, as Joseph Berliner has shown, Soviet enterprises actively participated in economic and innovation planning: 'a great deal of central decision making [turned] out to be enterprise-level decision making: the enterprise [was] commanded to do what it had originally decided to do'.[103] The typical structure of a Soviet enterprise included a design department, a technological department, and bureaus of efficiency and inventiveness. Arriving at an innovative solution required the cooperation of all three departments. The internal structure of enterprises depended on their size and specialisation.

Large enterprises established their R&D institutes to address specific scientific-technical problems relevant to a production process, including achieving more efficient use of materials and preventing quality defects. Smaller enterprises often established in-house laboratories; in 1967, there were approximately 33,000 laboratories in enterprises throughout the country.

The internal departments of enterprises for the facilitation of inventiveness conducted an initial examination of inventions, provided technical and legal assistance to innovators, distributed bonuses, and, if necessary, connected inventors with the upstream nodes of the network.[104] The upstream nodes operated at the level of the administrative-territorial units as part of the councils of the national economy, and at the level of industrial people's commissariats (and later, industrial ministries).

These upstream bodies evaluated the technical and economic value of inventions, facilitated their registration in the Soviet Union and abroad, and conducted a systematic analysis of the state of inventiveness in each industry. They established their own laboratories and experimental fields, which cooperated with technical universities, organisations of engineers, and independent inventors.[105] Through the interconnected system of nodes, the information on new inventions and efficiency proposals travelled in upstream and downstream directions between the central, local, and enterprise levels. This system of information flows made invention and innovation a highly endogenous phenomenon.

4 | INCENTIVES AND THE ECONOMY OF ESTEEM

The previous sections dealt with the legal institutions (rules) and the organisational structure (systems) for innovation. They showed the pragmatism of the ruling elites in achieving the goals that they set for themselves in the historical context. But this is not the whole story. Incentives and the nature of rewards are important elements in the functioning of the innovation system. The incentives in a state-planned economy are different from those in a market economy. By depriving individuals of the monopoly right to the invention, the state had to offer them something in return. The nature of the inventor's reward changed, and the characteristics of the 'economy of esteem' were introduced. Einstein understood this trade-off early on: 'In a planned economy [the monopoly right of the inventor] must be replaced by systematic rewards and incentives'.[106]

The concept of the economy of esteem, developed by Brannan and Pettit, transcends the dichotomy of a state versus market regulation and distinguishes a third form of regulation, which is based on people's natural desire for esteem, the regulation that shapes human behaviour and influences the entire social order.[107] Recent behavioural research agrees with this theory and challenges neoclassical economics and some of our basic assumptions about rational choice, egoism, and the profit motive.[108] Today, this kind of research is forcing many governments to think creatively about regulation by taking into account this more complex picture of human motivation.[109]

The economy of esteem in the Soviet Union was a combination of material rewards tied to the usefulness of the invention or efficiency proposal (financial rewards) and nonmaterial reputation-based rewards, which were made tangible in various ways (social benefits). These rewards were mainly welfare enhancing. They complemented the inclination of legal institutions for innovation toward openness and the free exchange of knowledge.

4.1 | Financial rewards

Inventors who applied for inventor's certificates and efficiency experts received financial rewards. By 1970, more than 76 million innovators had been rewarded.[110] Not every innovation was rewarded, only those deemed useful. Useful meant economical, one that helped meet production needs in the most efficient way. The amount of the reward was calculated as a percentage of the expenses saved by the enterprise using the invention in the first year of its implementation.[111] The Soviet economy was based on fixed prices, and when innovation reduced the cost value of goods, these 'free' resources were redirected to reward innovators.

As can be seen, inventions under inventor's certificates, technical improvements, and efficient proposals were rewarded according to the same principles. Even minimal savings were rewarded. The nature of the reward in the Soviet system was therefore very different from the nature of the reward in the market-based patent systems. The latter involve

the potential but uncertain reward of exploiting one's monopoly right, the likelihood of which depended on market power and other conditions, such as the availability of capital, competitors' strategies, and so on.

If the innovation did not save resources but improved the quality of goods, working conditions, or safety measures, the head of the enterprise could determine the amount of the reward within a similar statutory range.[112] In addition, rewards were paid when inventions were licensed abroad.[113] Bonuses were also paid to employees who helped implement an innovative result. Such help included facilitating the development of technical solutions that led to the invention, assisting inventors in applying for inventor's certificates, implementing inventions and efficiency proposals, or introducing innovations developed elsewhere into the enterprise.[114] The system of financial rewards created an environment of strong stimulation of economic activity aimed at improvement.

4.2 | Social benefits and public recognition

In one of his many letters to Stalin, the physicist Kapitsa noted that the Soviet Union could not inspire a scientist with money as the United States did. Instead, he suggested that a scientist should be honoured, 'as if he were a Patriarch'.[115] Kapitsa's point was a critique of the system at the time, which had not always delivered. Scientific elites were preoccupied with how the innovation system, based on principles other than the profit motive, could stimulate creative work.

There was a continuous effort to introduce social benefits that appealed to esteem and improved the quality of life. For example, inventors were given priority in obtaining state-funded housing, admission to higher education institutions, and promotion to scientific and research positions.[116] They were also entitled to the sanatorium and medical treatment.[117]

The Soviet Union was the first country to create research institutes where scientists could concentrate on their research without teaching obligations, thus creating the profession of research scientist, whose status was more prestigious than anywhere else in the world.[118] Innovators were praised with awards and lapel pins 'Honoured Inventor' and 'Honoured Efficiency Expert'. Inventors could give their name to an invention and earn a scientific degree (Candidate or Doctor of Science) without having to defend a dissertation.[119] From 1950, a national holiday was established to celebrate the profession of the inventor and efficiency expert.

The Soviet example of 'socialist competition' shows that competition is not exclusively a market phenomenon. Alexey Ivanov and Elena Voinikanis defined this approach as 'an elaborate process aimed at unleashing human competitive forces based on a whole range of incentives … a special form of competition that generates reputation-building behavior'.[120] The market is only one form of competition. Esteem generates another form of competition and the process of selecting the best ideas. Later, this approach manifested itself in the open software movements, and to some extent, the incentive systems are used at the corporate level in the United States and some European countries.

The difference between the Soviet economy of esteem from the enterprise-level initiatives in market economies was that the Soviet model was applied on a larger scale, across industries and across the types of innovation outcomes. Both inventions under inventor's certificates and efficiency proposals were subject to this model. For the economy of esteem to work on a national scale, it could not be left to the discretion of enterprise managers. Therefore, the rewards were embedded in the regulated process of innovation management, and there was no need for an army of lawyers to enforce these rules.

5 | CONCLUSION

The key practical idea of the Soviet innovation system was an emphasis on the flow of knowledge. It was designed to avoid the problems of market-based innovation systems. With few exceptions, the system relied on the open exchange of innovative results and brought innovations to end users faster than in the market systems. Under the system of inventor's certificates, inventions entered the public domain more quickly and were used simultaneously

by more enterprises than under the patent system. Broad exceptions to patentability and the regulation of discoveries created safeguards against locking in future innovation and preventing the privatisation of socially important inventions and basic science.

Copyright rules ensured that authors were rewarded, while limiting the period of exclusivity and ensuring the freedom of translation. The institution of trade secrets did not exist because it contradicted the logic of the free flow of knowledge. The esteem-based incentives were put in place as an alternative to the profit motive. The system did not rely on entrepreneurial capital. Instead, the rules for innovation were imbedded in the functions of the networks of organisations. The result of these rules was a highly coordinated system of open knowledge flows. It was not without deficiencies but its advantages of quickly advancing public-sector innovation remain highly underappreciated.

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DATA AVAILABILITY STATEMENT

Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

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APPENDIX A: Albert Einstein, 'Masses Instead of Units', Izobretatel', no. 1 (1929): 4. (Translation from Russian to English by Svitlana Lebedenko).

I consider an inventor to be a person who has found a new combination of already known equipment for the most economical fulfilment of human needs.

I consider the capacity for free constructive and combinative thought, as well as the enthusiasm and passion for this endeavour, to be inborn. One cannot invent without knowledge, just as one cannot compose poetry without knowing the language. Since knowledge in most cases depends on favourable circumstances in life, not only on education, but also on familiarity with industry and its problems, natural ability is a necessary but by no means the only condition for the creation of new inventions useful to society.

The inventor needs innate ambition, passion, patience, knowledge and familiarity with economic problems. The inventor does not depend on the 'circle' he comes from, but on his scientific experience and mindset.

In my opinion, it does not matter at all to which category, to which social stratum the inventor belongs. It is only important to single out a real inventor from the crowd of illusionist fanatics and give him the opportunity to realise the ideas that are worth it.

I would not advise forming a collective of inventors, because of the difficulty of identifying the real inventor. I think that this would only result in a society of idlers hiding from work. The formation of a small commission to test and encourage inventions is much more advisable. I think that in a country where the people manage their own economy this is quite possible.

To invent is to increase the numerator in the following fraction: the goods produced 'divided' by the labour expended.

The monopoly right of exploitation is necessary in a free economy because it is an incentive for inventive activity and a reward for money and labour expended. On the other hand, it is often very harmful to prohibit the production of newly invented technical improvements by restricting the work of other enterprises or individuals. Patenting on a large scale the products of large and wealthy enterprises is highly undesirable and hinders the activities of small and financially weak inventors and enterprises. Often an inventor is unable to pursue his activities and give himself to his vocation because he has to expend all his energy, time and resources in defence of his monopoly right. The monopoly right of the inventor is an inevitable evil in a free economy. In a planned economy it must be replaced by systematic rewards and incentives. In a planned economy, the monopoly right of invention is only of national importance in relation to other countries. In this case, the disadvantages of monopoly rights are eliminated. The task of encouraging and assisting inventors is transferred to the state, but there is the possibility of a number of other disadvantages and obstacles (stagnation, due to the absence of the need to fight, bureaucracy, intrigue, jealousy, etc.).

The best form of remuneration in a free economy is for the inventor to share in the profits and to be given a managerial position in which to exercise his abilities. In a planned economy it is the same, but instead of sharing in the profits, exemption from all other duties and work should be introduced.

Better organisation and specialisation of work cause a reversal—the gradual replacement of individual outstanding geniuses by levelled mass forces.

–Albert Einstein

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