

Fredrick Soddy, Chemist, Economist, and Ecologist : His Concern about the Sustainable Development and Monetary Reform

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1. Introduction

Fredrick Soddy (1877-1956) was a very famous British chemist, a Nobel Prize laureate in chemistry in 1921, who developed radiochemistry and discovered isotope, and an economist who had studied energy problem and monetary economic system and published many works, but has been completely ignored by orthodox economists.

Soddy's economic theory is reevaluated by T. Murota in 1979 from the point of view on energy and entropy.^[1] It was pointed out that Soddy had recognized wealth as form of useful energy. “Wealth presents works to life activities, and it is convenient and practical to make a distinction between the internal energy of life, which maintains metabolism, and the external energy which an animal or plant can use in doing work on its environment and capital is not the accumulation of wealth, but the debt to the nature.”

In 1984, one of the authors (Katsuragi) introduced the essay of H.

E. Daly that pointed out Soddy's assertion from 1920's to 1930's to be the forerunner of the environmental economics. The following is the brief summary of the report : (i) From the financial point of view, in the currency circulation based on the inconvertible bank note or book money under the state control of currency system in the modern age, currency is increasingly financed to production capitals as the funds apart from the many regulations reflecting the reality of economics. (ii) It leads not only to surplus of purchasing power of market but also to excess spending of public works and to war. (iii) As a result it causes destruction of the environment and further deprives of opportunities for the development from the next generation ^[2].

M. Nakayama was interested in the process in which Soddy moved into the economic study apart from chemical one ^[3]. Before the World War I, Soddy advocated in his works that the scientific progress would solve problems such as the energy problem and so poverty based on optimistic scientism. Through the War, he came to think that the society was not mature enough to accept the scientific progress appropriately. After the War he began to study economics to answer this question, "why does scientific progress bring about not just bounty but also harm to people?" He concluded that it was because of the existing monetary economic system, and took a radical stance, appealing that all scientists must realize the social meaning of their scientific study.

Soddy's active stage was from the scientific view in the time of the scientific discoveries of atom and radioactivity that astonished scientists by the release of the vast energy, and socially speaking in the changing times through 30 years before and after the World War I. From

Soddy's biography recently published, we can see that he was an active scientist who communicated positively his opinions through lectures, pamphlets, or books to solve the social problems of his era.

Glasgow, where Soddy got his first academic post in Glasgow University in 1904, was the center of the development of the socialism and the labor party at the time. In the atmosphere of this university, he came to get interested in politics concerning poverty and inequality or suffragette movement. He recognized that huge nuclear energy of radioactive materials had the potential to be a new energy source so that it could replace finite resources like coal. Hoping that the power of science would solve social and political problems, he gave lectures at assemblies or issued pamphlets. However, he warned about the potential risk of nuclear energy to be used for a fatal bomb as the war came close to start. He also expressed his concern in his speech when he started his new post at the Aberdeen University in 1914.

In the postwar year 1919, he was invited by the Oxford University. Soon after the invitation, he became a representative of "National Union of Scientific Workers" from 1920 to 1921. The Union was established in 1917 by the main scientists of the Cambridge University. In the interview, he is reported to say "even the traditional usage of science shows how much it is necessary to have a new social discipline before the mighty power is released... Under the only idea supported by the Labor Party, the more wonderful gift from science is the only one thing to be entrusted to the world... Should the individualism compromise with socialism or cooperatism, or should science be stopped? Scientific discovery is the only way of development and the only way to increase the total happiness of human beings. These are

my reasons, as a scientist, why I support the ambition of today's labor movement: It supports various ideals beyond cheapness and offers to get away from evil assets of misfortunate era.”^[4]

As he inclined to be a strong leftist, he feuded with the authority of Oxford University. The government also considered him as a leader of the opposing group against the policy of industrial-academic cooperation. Respected members of the science organizations also thought him as a criticiger for social problems. All alone, he started to study economics around 1921 to explain the maladies afflicting the society, and then, published works one after another. However, the academic community of economics considered him as an amateur or outsider, and ignored him.

In this study, we would like to verify Soddy's assertion of the social reform via monetary reform on the historical background, to introduce how his concepts of economy is depended on the law of physics and to reevaluate a present intent of his theory about “Wealth and Debt” by comparing with contemporary economists such as J.M. Keynes.^[5]



Fredrick Soddy's photo (donated by Herman E. Daly in 1984)

2. Ignored material base of economics: The Concepts of Wealth as Debt

When did people recognize the socio-scientific concept that “economy is exceeding abnormally” and see into the future? This awareness began in part at some time between the two world wars, that is the economic historical viewpoint of our 20-years studies^[6]. Regarding this aspect, Soddy had forecasted the unprecedented economic development by releasing of the nuclear energy on one hand, at the same time, he related the very likely nuclear war with the nightmare of “the destruction of the earth” due to “the limitless desire and economic growth” on the discussion about the economic system and its reform before the worldwide financial crisis. Then, he realized that the keyword was monetary system and control by the social management.

“Limits to Growth” issued in 1972 by MT Project of D.L. Meadows and others brought about a widespread awareness to us that the economic growth must be considered in conjunction with the earth's limited resources and materials and waste. It is suggested that we need to take the initiatives to taking policies of technology, culture and politics within “the ecological footprint” (resources and wastes for the economic growth) that could not exceed the capacity of the earth. It is important that growth should not necessarily lead to the destruction of the earth. In conjunction to the writing of the 3rd work of “Limits to Growth: The 30-Year Update” in 2004,^[7] Meadows said” the conditions of destruction after the growth would occur when the growth exceeds, that is, the demands of the source or sink of the earth increased to go

beyond the level of sustainability.” He wrote that human beings have proceeded to the stage of non-sustainability since 1992.

The basis of Soddy's thought is that though wealth follows the law of thermodynamics, debt follows the law of mathematics rather than physics and will not rot in the long term; neither will it be consumed in the daily life. Contrary, it increases yearly because of the well-known simple or compound interest. The process of compound interest is impractical in physics. Soddy said, “wealth is a positive physical quantity, but debt is a negative quantity. It has no concrete existence, and is to the physicist an imaginary quantity.”^[8]

Soddy emphasized that even if the accumulation of the present surplus has any physical significance, it will be not converted into the future profit, and that it can be converted into the future profit only under the social agreement. Debt is like an order form to the future benefit produced by solar light in the future. Soddy said “capital is only the unearned income, divided by an interest rate and centuplicated.”^[9]

Even if debt follows the law of the compound interest, the real future income, which is commensurate with debt of lien and the real energy produced from solar power in the future, will not increase by compound interest in the long run. However, real wealth, when converted into debt, “throws out its corrosive body and girds itself by what is not corrosive”^[10]. In this manner, the wealth can avoid the second law of thermodynamics, that is, random, destruction and corrosion, leading to production for the exploiting natural property^[11]. Debt increases by a compound interest, and will not face the limit that stops an expansion from the view point of pure mathematical quantity.

On the other hand, wealth will face the limit sooner or later after increasing with a compound interest for a while since it has the physical aspect. Debt can last forever, but wealth will not. The reason is that the physical aspect of wealth follows the destructive power of entropy. The *contra* account will collapse at some point. That is, some sort of relinquishment or canceling of the debt must be taken place. The positive feedback of the compound interest must be offset by the counteraction, such as inflation, bankruptcy, and seizure tax, against debt relinquishment. Furthermore, all of them would be accompanied with violence. According to common sense, this process is considered pathological and the compounding interest is accepted as normalcy. However, theoretically, Soddy pointed out that we should keep the compound manner in check somehow, and accept one or some of the collateral, such as canceling on another hand.

Soddy's viewpoint is a criticism against the way of thinking of “economy as a permanently running machine”. The material problem of life for human beings is energy, just like a hot steam locomotive. Until 19th century, humans depended on the production of energy of solar light captured by plant which is “a primary capitalist” for life. At present, people discuss the energy production by consuming energy capital such as coal that is “the stored solar light in the summer time of Paleozoic Era”. To reduce labor, humans can supply internal fires, depending only on new solar light, as long as he can use a fuel-supplying machine. Instead, the new solar light can be converted with the help of the plants. Thus, life depends on the continuous flow of energy. Therefore, to obtain daily necessities, we need, not only stock, but rather flow of nature. The main part of the daily necessities should

be supplied as the circulating flow or profit. That is never converted into stock in any physical sense, nor is it stored for utility for the next generations ^[12]. The capital stock will be a help and aid to further our capacity to obtain the production of energy until the limit maintained against the destruction of entropy. However, the production itself is not multiplied proliferously, meaningfully, nor is it stored more than limited. Certainly, to maintain the accumulated stock of our material wealth, the recuperative power of the “production” flow of low entropy is necessary against destruction of entropy. To be more accurate, nature has the energy stored in coal. The energy has gone through several eras geologically. We only convert it into the non stored-form. In addition, we, following Soddy, can grip this “era of fire” when we exhaust the capital stock such as coal, just as we are passing beyond this stage and understand exactly that a binding of the energy production imposed on living things will be finally clear^[13].

The basic problem of economy for Soddy is “how human beings should live.” His answer was “by solar light.” The laws, that human beings should follow to live by depending on the solar light, immediately, or using one from the ancient eras are the first and second principle of thermodynamics. In short, this is the question of “relationship of physics to an international stewardship.” According to Soddy, wealth is “a way of human utilization of raw materials and energy”. Wealth has bilateral phases: one is a material phase, which is the material-energy following the laws of mechanistic theory of inanimate world, and the other one is a useful and teleological phase, which follows an objective imposed by spirituality and humans' will. Soddy's concept of wealth is his specific of “dualistic theory”. Briefly, the

intermediate area between livelihood and wealth depends on an interaction of the ultimate world of materials and spirituality in a phase of “from day to day”.

3. Monetary Reform and the Financial Policies

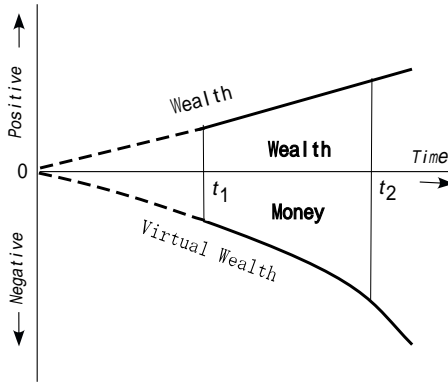
Our discussion focuses on the Soddy's view which later developed into the warnings against “the fictional system” of the social wealth as a Debt, comparing to J.M.Keynes's positive introducing of his theory over creating effective demand, related to the multiple effects, and the controlled currency system. Soddy proposed a road map of reform to bring peace and economic freedom to the world on the age of science and mechanization.^[14]

The basis of his thought is the “multiplied constitution by the types of wealth, which are the real wealth by the material flow and the virtual wealth produced by the fictional credit economy,” as we see below.

His concepts based on the law of conservation of mass - matter and energy - led him to take an action claiming that the virtual wealth was missing as long as the fictional credit economic part functioned away from its material constraint.^[15]

Who's view as a concerning the sustainability - environmental problems - is on going off “the gold standard”? Who argued the way of “key currency under economic control” by the managed currency system in 1920 s' to 30s'? Is he Keynes, Soddy, or S. Gesell ? As B.A. Rieter, a propounder of the regional currency and the proposal of “EU” in the European economic region, has already pointed it out

that what they thought was to set a new key currency after abolishing the gold standard, compensate the nation's purchasing power by assuring the money circulation and put the economy on the sustainable path as opposed to the reduction of production and shortage of foods poverty.



[figure] Existing Wealth and “Virtual Wealth” due to Credit Economy
 Cf. Soddy, Virtual Wealth, Fig.1 The Principle of Virtual Wealth

Back to that time, France and England had War Debts to the USA and reparations of Germany, which was on economic depression, was reduced. The world economy recovered temporarily by the afflux of the private capital from the USA (“Dors Bond”). In 1924 Germany reverted to the gold standard of the new parity, and England in 1925. It can be also noted that issuing the war debt, proposed by T. Johnson (a member of the Labor Party), who was sent to the all-nation cabinet of Lloyd-George from the Labor Party and showed complete support for the policy, was influenced by Soddy's Virtual Wealth.

Then, in 1929, the second Labor government of MacDonald was organized with the cooperation of Freedom Party. With a serious

problem of unemployment due to the world depression, social perplexity arose over pros and cons of cutback of unemployment benefits and responses for the shrinking market economy. In order to overcome these problems, attentions were focused on the nationalization of the central bank and the financial reform. Soddy advocated that the gold standard, which was the criterion of the monetary value, should be abolished and replaced by a key currency by “the index number,” indicating the needs of daily necessities and living expenses of laborers' households. Gesell, an advocator of the currency reformer, insisted “the currency to be applied for matching the value change in the standard basket of the primary commodity” on the key currency. Then, Keynes established “*Vancore exchange accounts*” with the permission of the central bank, propound measures not to withdraw the purchasing power from the circulation market by the same effects as import of gold, and thought there was a solution for unemployment in “investing the government capitals” (public works expenditure), namely, issuing the government bonds. It is not clear whether Keynes knew Soddy, but Gesell and Soddy got involved in Social Credit Movement from 1924 to 1938. Furthermore, Keynes highly appreciated the significance of Gesell's proposal. By the way, in England complete abolishment of the gold standard in 1931 and the managed currency system of the national credit currency by the central bank were institutionalized after Keynes assumed the England Bank's Trustee.

We can see the Soddy's financial and currency reform in the “22 conclusions (proposals) of the financial reform,” summarized in the reference ^[16]. Followings are main points.

- The production of Wealth, as distinct from Debt, obeys the physical

laws of conservation and the exact reasoning of the physical sciences can be applied. Wealth cannot be produced without expenditure.

- Capital, by saving to an indefinite extent the expenditure of human time in production, appears to afford a continuous revenue of wealth without further work, but the origin of wealth produced is in the continued use of capital by human agents, not in the capital itself.
- Money's value or purchasing power is not directly determined by any positive or existing quantity of wealth, but by the negative quantity, or deficit of wealth. The aggregate of this deficit is called the Virtual Wealth of the community and this virtual wealth does not obey the laws of conservation, but is of psychological origin.
- When the quantity of money is constant, its value or purchasing power is proportional to the Virtual Wealth. The issue of money should be regulated by its purchasing power, so as to maintain the purchasing power constant.
- To initiate the system some 20 billion pounds of National interest-bearing Debt should be cancelled and same sum of national money (non-interest-bearing National Debt) issued to replace the credit created by the banks. The taxpayer would thereby be relieved of the payment of 100 millions pounds a year interest on purely fictitious loans.
- Taxation, as hitherto confined to the purpose of defraying Government expenditure, is entirely futile as an instrument of permanent social amelioration, and should be used in conjunction with the issue of Government loans, for other specific purpose.
- The national reserve of gold, acting as a barometer indicating the ratio of imports to exports, should be maintained by suitable means.

It is suggested that on information supplied by the national statistical authority.

- It is claimed that these suggested reforms are necessary steps if an individualistic society is to continue and the nation in the future is to be in a position to deal with a further displacement of men by machinery and the methods of mass production.

Soddy, as it has been explained above, tried to be an innovative economist and wanted the whole world to enjoy the works of science through the financial reform and so he got involved in various activities of the Labor Party and social circles.

From around 1928, he got disappointed with depoliticization of the organization of scientist and the policy of the Labor Party to maintain the status quo. He started working with the New Europe Group, whose aim was to establish a new peaceful society by combining of the financial reform and the Europe union till 1950's.^[17]

4. Conclusion

From above consideration, we'll advocate that Soddy's economics is a forerunner of modern environmental and ecological economics and has a profound substantial content for us. We should to learn more hints to construct the sustainable economics for the coming next generations.

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