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Sustainable investments by multi stakeholders to improve sustainable scheme for medical and health services

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Abstract

Global crises such as Covid 19 pandemic and Climate Change probably bring problems beyond the present system of economies and societies. Provision of medical and health services is expected to mitigate problems of Climate Change exhibited as global public goods. Sustainable investments brought by cooperative initiatives with multi stakeholders such as some programs of SDGs (Sustainable Development Goals) have been advocating and proceeding to prevent or mitigate some serious problems [1-3]. This article theoretically explores that reform of multi stakeholder communication improves sustainable provision of medical and health services. The development of digital technologies accelerates medical and health sciences and contributes on enlarging global market and is expected to change fundamentally systems to provide medical and health services. It is conjectured theoretically that outside and external stakeholders dominant over inside stakeholders on sustainable scheme investments of medical and health services.

Keywords: Digital Industrial Revolutions, Global Public Goods, Sustainable Investment.

Introduction

Problems of Climate Change raise possibility to bring crises for sustainable provision of medical and health services. Sustainable scheme to provide medical and health services depends on contribution of many stakeholders. Profit and non-profit corporations or organizations are assumed to provide medical and health services by responding the information on stakeholders. Stakeholders evaluate the performance of corporations. However, asymmetric information restricts communication between corporations and stakeholders. Stakeholders as well as corporations try to improve communication systems.

Tanaka [4] argues that a decentralized scheme improves sustainability of global communities. As digital technologies develop, corporations become to communicate not only with domestic markets and residents but also directly with foreign stakeholders such as consumers, governments, financial funds and environmental organizations. Sustainable scheme for cooperation with multi stakeholder needs to develop both voluntary and legislative initiatives for corporations at the same time. This research originally presents an optimal combination of voluntary and legislative initiatives to improve social welfare. Multi stakeholders contribute sustainable investment to improve provision of medical and health services. Digital industrial revolution is expected to enhance evolvement of outside and external stakeholders. This article mainly discusses that innovative investments by outside and external stakeholders improve more effectively sustainable strategies in medical and health services than those of inside stakeholders.

The preceding research of this article is described as follows. Researchers in new institutional economics such as Coase [5], Williamson [6,7] fucus on reforms of legislation and institution by complement market failures. Theoretical economic approaches on issues of corporate social responsibility (CSR) are initiated by Arrow [8]. Tirole [9] develops incentive analysis with one stakeholder by shareholder value evaluating performance of CSR. Tanaka [10,11] argues that theoretical model analyses to employ legislative and institutional economics and incentive analyses are applicable to explore sustainability problems with multi stakeholders.

Global social and economic mechanisms form cooperative schemes with various stakeholders. This article fucuses on structural changes of multi stakeholders brought by digital industrial revolution. Digital economies have increased stakeholders in international frameworks, as Baldwin [12], Szalavetz [13], Yeung [14], Bangkok [15] state.

Investment on intelligence and communication contributes on providing network of economies and societies. Bergstrom, Blume and Varian [16], Roberts [17] provide theoretical research of provision public networks. Many articles such as Bernheim [18] and Sugden [19] explore incentives to provide public goods presenting voluntary contributing. Public goods are exemplified by enlargement of communication network. Andreoni [20] features altruistic structure of public goods provision. Tanaka [21-24] argues that improvement of digital technologies improves systems of green finance and raises efficiency in cooperative networks.

Sustainability scheme of medical and health services

It is assumed that profit and non-profit organizations provide medical and health services as global public goods x . Medical organizations perform effectively profit and non-profit projects to improve public health. This article denotes private profit by $\pi(x)$ and assumes that $\pi'(x) > 0$ $\pi''(x) < 0$hold.$\pi(x)$is subtracted inclusive costs in private transactions from the sale and presents payments for stakeholders in economic transactions. However, sustainable provision of medical and health services is funded on communication schemes beyond economic transactions. Sustainable mechanisms to provide health and medical services require cooperation with multi stakeholders. Provision of public goods should reform communication schemes to improve sustainability of communities. It is assumed in theoretical analysis that corporations collectively provide public goods x and payment t_i for every stakeholder *i*. Total payment *t* is defined by $t = \sum_{i=1}^{n} t_i$. Provision *x* of public goods brings different costs on stakeholder i. Stakeholders obtain different burdens for even an identical medical system. When corporations raise production$x$,various changes of evaluation occur for stakeholders. When $\frac{\partial V_i}{\partial x} \geq 0$ holds, stakeholder *i* is defined by a positive stakeholder. Negative stakeholders are stakeholders *i* satisfying inequality $\frac{\partial V_i}{\partial x} < 0$. Payment t_i is assumed to facilitate analyses on sustainability in social systems.

Digital industrial revolution increases scope of stakeholders for corporations to bring relationships. Tanaka [25] discusses those analyses with three types of stakeholders: inside, outside, and external stakeholders focus closely on features of multi stakeholder communities. The inside stakeholders represented by regular employees and affiliated organizations are likely to share common interest with the corporation and are denoted by *i* (=*1,…,*n_0). The inside stakeholders have formed conventional connection with the corporation in repeated relationships. They can expect to share grater common interests with corporations than occasional benefits in market transactions. The outside stakeholders are represented by irregular employees and occasional customers They make competitive transaction in the markets and are written by *i* (=n_0+*1,…*,n_1). In many public or regional medical services corporations provide health care in cooperation with outside stakeholders. The external stakeholders are excluded from economic relations with corporations and suffers sometimes damage of external diseconomies from activities of corporations and written by *i* (=n_1+*1,…,n*). To focus on features of stakeholders, inside stakeholders are classified as positive stakeholders. Outside and external stakeholders are classified as negative stakeholders.

Tanaka [23,25] discusses the cooperative mechanism to improve communication scheme are effectively explored by using Equation (1). Decentralized scheme constructs social evaluation scheme under asymmetric information. Coefficients $\beta(x)$ and $\gamma(y)$ indicate the communication gaps($\beta(x) > \gamma(y)$ for any *x* and *y*). Efficient communication between corporations and inside stakeholders depends on scale of public goods *x*. Increment of production *x* raises connection between corporations and inside stakeholders; $\frac{d\beta}{dx} > 0$. Corporations bring different communication gaps among stakeholders. All stakeholders *i* invest y_i to improve communication environment ($y = \sum_{i=1}^{n} y_i$). Because digital industrial revolution requires inside stakeholders to raise investment of ICT (Intelligence Communication and Technologies), total investment y exhibits network effects of intelligence communication; $\frac{d\gamma}{dy} > 0$. Stakeholder i is supposed to require code or standard α_i that corporations should achieve. Increasing function $\varphi_i\{\alpha_i - V_i(x,t_i)\}$ exhibits incentive scheme; $\frac{d\varphi_i}{d(\alpha_i - V_i)} > 0$. When gap $\alpha_i - V_i(x,t_i)$ increases, all stakeholders *i* including even external stakeholders request to raise penalty for corporations. In the sustainable scheme, the social net benefit that corporations aim to maximize is presented by Equation (1).

$$NB_{\square} = \pi(x) + \beta(x)\sum_{i=1}^{n_0}\{V_i(x,t_i) - y_i\} + \gamma(y)\sum_{i=n_0+1}^{n_1}\{V_i(x,t_i) - y_i\} - \gamma(y)\sum_{i=n_1+1}^{n_{\square}} y_i - t - \sum_{i=1}^{n}\varphi_i\{\alpha_i - V_i(x,t_i)\}. \quad (1)$$

Inovation and cooperation with multi stakeholders.

Equation (2) means that optimal provision of medical and health services by the left side and marginal non-profits social cost exhibited by the right side. Because Equation (1) presents sustainable scheme of medical and health services, optimal condition (2) brings sustainable provision of medical and health services.

$$\frac{d\pi}{dx} = -\frac{d\beta}{dx}\sum_{i=1}^{n_0}\{V_i(x,t_i) - y_i\} - \beta(x)\sum_{i=1}^{n_0}\frac{\partial V_i}{\partial x} - \gamma(y)\sum_{i=n_0+1}^{n}\frac{\partial V_i}{\partial x} + \sum_{i=1}^{n_0}\frac{d\varphi_i}{d(\alpha_i - V_i)}\frac{\partial V_i}{\partial x} + \sum_{i=n_0+1}^{n}\frac{d\varphi_i}{d(\alpha_i - V_i)}\frac{\partial V_i}{\partial x}. \quad (2)$$

Innovation of digital technology structures economies as well as social systems. Digital industrial revolution in medical and health services brings changes in many fields. Every stakeholder decides voluntary contribution according to social cost and benefit analyses of innovation. Differentiating Equation (2) by y_i presents marginal social cost of innovation with stakeholder *i* and Equations (3) and (4).

Marginal social innovation effect with inside stakeholder

$$= \frac{d\beta}{dx} - \frac{d\gamma}{dy_i}\sum_{i=n_0+1}^{n}\frac{\partial V_i}{\partial x}, \qquad for\ i(=1, \ldots, n_0)\,. \quad (3)$$

Marginal social innovation effect with outside and external stakeholder

$$= -\frac{d\gamma}{dy_i}\sum_{i=n_0+1}^{n}\frac{\partial V_i}{\partial x}, \quad for\ i(= n_0 + 1, \ldots, n)\,. \quad (4)$$

Considering that $\frac{d\beta}{dx} > 0$ is obtained marginal social innovation effect with inside stakeholders is greater than marginal social innovation effect with outside and external stakeholders. To simplify the analysis, we suppose that the marginal functions $\frac{d\gamma}{dy_i}\frac{\partial V_i}{\partial x}$ in Equations (3) and (4) are presented by liner function of x. Figure 1 illustrates this comparative analysis. The left side of Equation (1) is denoted Curve AF. The right side of Equation (1) is exhibited by Curves 0B or 0D by depending on which stakeholders lead digital transformation. Inside stakeholders enhance production by raising technologies and investment in medical and health services. However, outside and external stakeholders enlarge medical and health services by improving sustainable environment in medical and health services. Equation (1) presents medical and health services x_i of equilibrium point C brought by innovation led under inside stakeholders. The point of intersection E exhibits medical and health services x_o under innovation of outside and external stakeholders. By considering that Curve AF exhibits downward sloping curve, inequality $x_i < x_o$ is obtained. Because sustainable governance requires to involve multi stakeholders, x_o indicates to collect more investment from large member of stakeholders than investment x_i to be financed mainly from limited organizations. If more investment is required to expand medical and health services, initiatives to activate outside and external stakeholders to invest improve reform of services.

We explore the implication of Figure 1 in detail. When inside stakeholder increases sustainable effort y_i , marginal social cost curve the right side of Equation (2) is exhibited by Curve 0B. Outside and external stakeholder *i* denotes marginal social cost Curve 0D after rising y_i . Figure 1 presents Curve 0B higher than Curve 0D. When communities obtain sustainable social scheme. Initiatives to raise sustainable investments bring optimal points C and E for inside stakeholders and for outside and external stakeholders. The social marginal cost of outside and external stakeholders Curve 0D is lower than Curve 0B of internal stakeholders. In communication with inside stakeholders' corporations probably owe additional private network costs than costs to use open source systems. Gap between consumer's surpluses of two groups to be

denoted by area of triangle C0E makes corporations to prefer investment strategies of outside and external stakeholders than investment strategies of inside stakeholders.

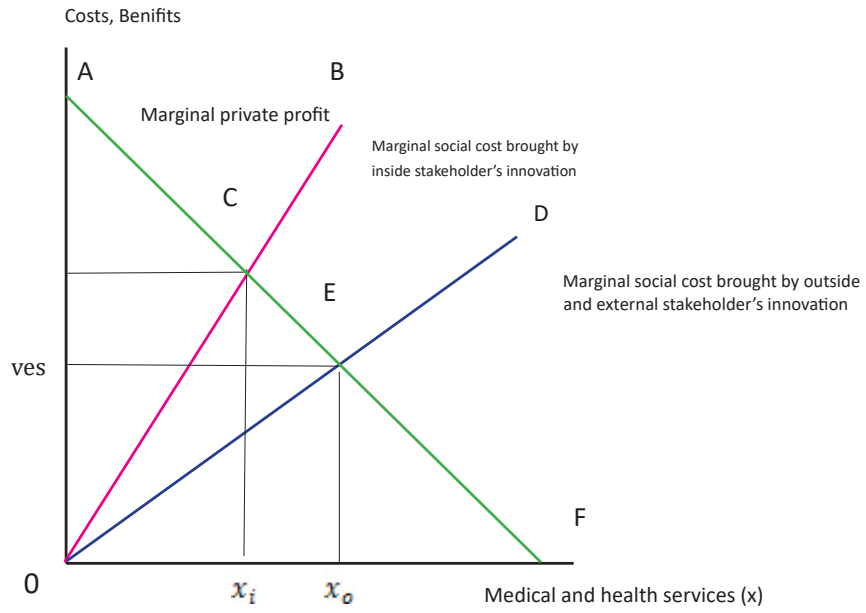

Figure 1: Medical and health services and innovation of stakeholders.

Concluding Remarks

Improvements of medical and health services depend on raising scientific research and development of governance and legislation schemes. Medical and health services as global public goods have been enhancing social responsibility for global communities. This article demonstrates that corporations have larger marginal social costs by improving investment of inside stakeholders than by raising investment of outside and external stakeholders. When outside and external stakeholders improve social medical systems, corporations use social medical and health system basing on a cooperation. Multi stakeholders aim to contribute voluntarily investment on medical and health services. However, reform of medical and health services brings additional benefits and costs for the corporations. Although investment costs for inside stakeholders are increasing, inside stakeholders are different according to locations and situations. If medical system reforms for some reginal communities might be higher than other regions, inside stakeholders are not willing to have incentives reform on medical systems. In this situation, innovative initiatives of outside and external stakeholders take main forces to improve medical system reform.

Conflict of Interest

No.

Acknowledgement

No.

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