

A Transdisciplinary Approach by Using Hybrid Input-Output Analysis to Evaluate Economic Impact on Local Economy

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論文内容の要旨

The introduction of a new industry certainly induces the change in a local economy such as the new consumption and production patterns, the competitiveness of resource procurement, the increase of resource's unit price and the additional demand, which consequences to the change of local economic structure. To quantify and identify the impacts on the local economy, a transdisciplinary method, the inclusive of many discipline knowledge, is necessary to observe and predict economic movement. The impacts of the new industry certainly exist in the real-world phenomena. For instance, when the electricity demand is cut-off from the conventional power generation to the biomass power plant's production process, the existing economic sectors such as crude oil and coal sector, and electricity sector will shrink from the deducted demand. Not only direct economic impacts, the indirect economic impacts on the relevant economic sectors should be determined. The unit price of relevant resource might change from the competitive purchase and from additional demand of biomass power plant. Besides, the impacts of the new product such as the electricity from biomass power plant, which the unit price is set higher compared to the conventional power generation. For these reasons, the hybrid input-output (I-O) analysis is used in regarding to science and technology, economics, and policy points of view. This method enables us to investigate the relationship among the new industry and the local economy and evaluate the consequence effects of the new industry. In relation to the environmental issue, the hybrid I-O analysis could identify the environmental impacts of the new industry in both physical and monetary terms. Furthermore, this advantage leads to the achievement to the pricing policy implementation of the cut-off function. The dissertation presents the series development of the hybrid I-O analysis, which are separately examined in

following paragraphs;

Firstly, the introduction of the biomass industry exerts influences that change the interactions among economic sectors by drawing the resources for generating electricity, pricing alterations from the existing market and competitively selling electricity to the power grid. We did precise analysis on the economic impact structure of the biomass power plant activities by utilizing a hybrid input-output (I-O) analysis. In this research, we utilize data from an existing biomass power plant located in Japan's Kochi Prefecture together with a hybrid I-O analysis and evaluated characteristics of the real impacts of inter-industry relationship within the local economy. It was investigated that simple cut-off of the existing economy, which is substituted by biomass power plant, has positive and negative effects either physically and monetarily. More importantly, this study proved that hybrid input-output (I-O) analysis could analyse pricing policy of raw material and final product by using the function of hybrid I-O analysis. In sum, The model shows that the biomass industry constitutes +0.04% of the Kochi Prefecture's total production; however, some negative effects are observed.

This second research presents a new improved method in hybrid input-output (I-O) to evaluate the economic impact of a biomass power plant's resource production and consumption. The effect of resource consumption induces change in an economy's production structure and alters the technical coefficient of the hybrid I-O table which should not be changed. Our study determines this problem based on two cases: a small cut-off ratio from the existing industry, where the change in the technical coefficient could be ignored, and a large cut-off ratio from the existing industry, where the technical coefficient is amended

using the pre-adjustment method. Consequently, the biomass power plant in the large cut-off ratio from the existing industry case contributes about 1,114 million yen to the local economy. A comparison of these two cases shows that the error caused by ignorance of the technical coefficient adjustment could result in 291.78 million yen less total economic production which is about 36% of the additional total production in the small cut-off ratio from the existing industry case. The losses in total economic production are apparently increasing in the economic sectors that relate to the resource consumption of biomass power plant.

Lastly, the third research is using hybrid I-O analysis to evaluate the economic effects appeared during the natural disaster impact. The flood scenario in Kochi prefecture simulated from inundation model is selected to demonstrate the analysis. We consider the flood damages into two stages, debris removal stage (rehabilitation process) and recovery stage (recovery process) and then categorise the damages to each associated economic sectors. In consequence, the result shows that the flood damages could stimulate the economic growth where the positive effect of recovery process is overthrown the negative effect of rehabilitation process. The damages from flood could stimulates the economic growth by 148.01 million ¥, or accounted for 0.004% of the overall economy production, while the expenditure first spent on recovery process is barely 63.6 million ¥. The direct loss for rehabilitation process depletes the economy's total production by -6.36 million ¥, where subsidiary loss arise by -3.93 million ¥.

In summary, this dissertation presents the capability and usefulness of the hybrid I-O analysis in the series of research. Notwithstanding these research results, the flexible of the hybrid I-O analysis could

enable us to adapt and adjust for the other specific purposes.