



Evaluation of fusion study from socio-economic aspects

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Abstract

A fusion research project was evaluated from the aspects of socio-economics and its possible economic benefit. Research project itself has large economic impacts and it appears in a different way in different time. Four categories were identified as such mechanisms; direct economic effect by purchase and employment, the growth of local community and its economy, an improvement of technical capability of the industry stimulated by the development, and fusion energy supply under environmental constraints. Industrial effects were analysed from actual R&D program and found to yield considerable economic outcome, although contribution by the research itself is far smaller than that required for industry before actual commercial products can be produced. Economic value of fusion energy could be huge, but appears several decades future, and should be reduced by discount rate and success probability. Its value is more important as a part of environmental policy. Value of the fusion research at present age cannot be estimated as actual benefit, but as the effectiveness in the policy, or benefit for public that is now regarded as a kind of Externality.

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1. Introduction

Effects of the research and development of fusion energy, “Value for Money” are requested to be evaluated and explained by funding government and public. Justification of resources spent for fusion, in com-

parison with other energy developments, scientific research projects or, in some cases, with other technology projects or investment, must be evaluated for the cost effectiveness when budget from tax is allocated. Research projects, particularly those involving large-scale technology, R&D itself have large impacts on the society, that public usually expects as the result of the investment. Fig. 1 illustrates the different aspects of the impact of the fusion research. In the past, researchers have tended to consider the funding for research were

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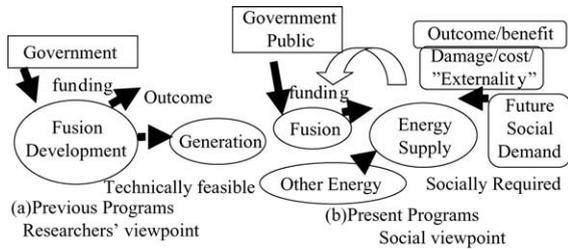


Fig. 1. Evaluation of fusion program: (a) from researchers' viewpoint and (b) from public.

given without asking the economical benefits to be returned to the public, and regarded only the academic knowledge and technical development as the measure of outcome as shown in Fig. 1(a). On the other hand, the final goal of this study is to measure the outcome of the fusion research from the actual social impact, regardless whether researchers intend it or not. Fig. 1(b) simplifies the social viewpoint for fusion research.

The authors attempted to evaluate a fusion development project in Japan from various aspects of Fig. 1(b), socio-economic study of fusion for its impacts on economy, public and society. A major part of such impact occurs outside the market mechanism, and methodology developed for the evaluation of "Externality" was used. In the consideration of the impact of energy development, many other influence paths were taken into account. Previous works on the Externality analysed environmental effects of energy technology through the emission that is suspected to cause public health problem [1]. Such an environmental Externality of fusion was also analysed and reported to be very low [2]. However, the larger social impact of the fusion is anticipated to come from its direct sales in the future energy market [3]. On the other hand, the near-term effect of research activity is more important than the long-term effect of fusion energy, because from the viewpoint of taxpayers, budget allocation is compared with other public investments that are expected to show results much sooner. The present study, thus, intend to analyse how fusion research affects the public. If the fusion research is expected to yield large benefit, it will be regarded as worth funding.

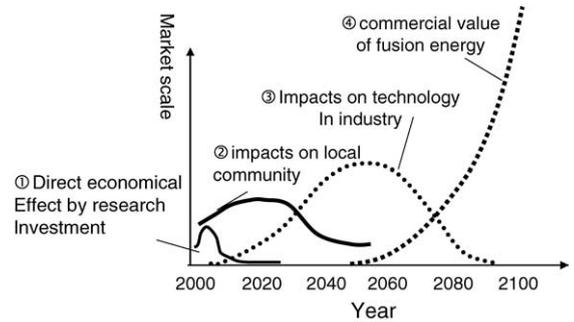


Fig. 2. Schematic of various economical impacts of fusion research to the public.

2. Impact pathways

In the consideration of the social effect of the research activity, impact pathways of the R&D were analysed. Here, four categories were identified as such mechanisms as shown in Fig. 2. First two effects are direct economic effects by the research investment spent for purchase and employment. The direct effect of the purchase and employment can be evaluated with input–output analysis and compared with other political investment. The increase of gross domestic production (GDP) is usually used as a measure of effectiveness by funding government. The second is its extension observed as the growth of local community and its economy. Such effects cannot be estimated with input–output table, while secondary and further effect of purchase can be, if primary community effect is identified. It is evaluated from prior local developments by case studies. These effects are always seen, and evaluation procedure is established. They are, however, seen in other construction projects and are not specific for scientific research, and is not reported in this paper. It may be interesting to point out that such an estimation was made for ITER, in Japan, and found to be effective as compared with other public constructions, but such a feature was not regarded as very important.

The third effect is an improvement of technical capability of the industry stimulated by the development of novel scientific equipments. Technical spin-offs are regarded as part of it as Externality, however, technical investments for research that does not yield immediate commercial products would benefit industrial society in various manners, and the results usually appear slow and occasional. Such an impact can be evaluated

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