Supply security footprints on critical metals with a global link input-output model (for special session on MFA & IO modelling)

Topic: Material flow/stock analysis in input-output modelling II
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The decoupling of GHG emissions and energy consumption for economic growth in the future will necessitate the further spread of low carbon technologies. Low carbon technologies as PV, fuel cell and hybrid car use particular quantities of minor metals including rare-earth metal for important applications. In other words, without a stable supply of such critical materials, it will become impossible to spread green technologies reliably and smoothly throughout our society. Some critical metals have already been used widely in many products, and some are located eccentrically in deposits in various corners of our world. These circumstances lead us to question whether additional demand for the metals for use in low carbon technologies can be satisfied stably or not. For designing the strategic management of the procurement and use and recycle of the metals in the future, it is essential to understand the relation between a product and its dependence on such critical metal considering international trade.
Against this background, this study quantifies supply security footprints on critical metals of a Japanese product with a global link input-output model (GLIO). The GLIO is designed to reduce the labour required for data compilation by employing a simple accounting framework that differs from that of conventional multiregional input-output models. The accounting framework of GLIO enables the definition of about 400 sectors of the Japanese products, the inclusion of more than 200 nations and regions. This means those footprints is estimated based on the complete global system boundary. Our emphasized critical metals are neodymium (Nd), which is used for motors associated with wind power and EV, cobalt (Co), for electrodes in EV batteries and platinum (Pt) for catalysts in fuel cells. The data of the year of 2005 are used here. We show major Japanese products with the largest supply risk and their characteristics from the view point of relation to international trade of the metals. In addition, the difference from carbon footprint of those products is identified.