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RESOLVING THE "CHICKEN-OR-EGG" PROBLEM IN SPACE RESOURCE DEVELOPMENT: AN ECOSYSTEM DESIGN APPROACH

Abstract

The development of the space resource industry is characterised by a structural obstacle in the form of lacking physical infrastructure and institutional infrastructure in the legal, political and economic domains. The provision of these infrastructures depends on multiple stakeholders, whose supply decision is activated by a tangible or prospective value received in exchange for their output. The stakeholders are thus mutually constraining as each is positioned as an output supplier of another and potential returns are variable due to technological uncertainty. This is a "chicken-or-egg" strategy problem. As current policy proposals approach space resource development disparately by focusing on either the legal, political or economic stakeholder, this interdependency problem is rarely addressed explicitly. Policy recommendations thus pinpoint what needs to be done but face implementation difficulty without resolving the willingness-to-do inhibition. Through ecosystem mapping, this paper first identifies the value delivery loops that face this constraint problem during the initial industry development phase. Then, each stakeholder's willingness to supply is quantitatively assessed as a ratio of expected value received (a function of both the intensity of their need for the delivered goods and the certainty of delivery) and output cost. Stakeholders who are most willing to supply are identified as initiators to activate the delivery loop. A roadmap of service provision is then established. Beyond defining an industry development workflow, a roadmap that is actionably feasible increases certainty in the delivery of output for stakeholders with a lower endogenous willingness to supply, thus increasing their ultimate willingness to contribute to the value loop. Overall then, this paper hopes to reduce the lag in the development of the space resource industry due to policy inactivation.