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# A SUSTAINABILITY TECHNOLOGICAL MODEL FOR COMMERCIAL ROUTES IN EARTH-MOON SERVICE VOLUME

**Abstract**

The renovated interest on the Moon and its resources has put several commercial and institutional actors on the verge of a virtuous escalation towards the exploitation of our satellite. Industries, such as mining and telecommunications, will need dedicated services in order to transfer the resources among the several nodes of the system, using the nature of our planetary system in order to maximise efficiency. Continuative prospection of the Moon surface and sub-surface characteristics has shown that the different amount of some minerals compared to Earth may make more affordable extracting raw materials and resources from our satellite. In addition to this, the transformation of resources into products may be performed in-situ, using the environmental and reduced gravity properties on lunar surface, or using the micro-gravity environments in Low Lunar Orbit (LLO) or in Low Earth Orbit (LEO). This would see an increase on human physical presence, although probably initially maintained to the minimum needed to maintain the operability and efficiency of non-completely automated installations and plants, in LEO, LLO and on lunar surface. This presence would represent the onset of the necessary flow of raw materials, goods and information across the nodes of the system, in a fashion similar to the ISS resupply missions of present days, but considering increasing numbers in time. The break-even of the different flows will depend on several factors, and evaluating this level is one of the intentions of this work. Having the presence of water ice been confirmed recently on the Moon, an assessment on the possible intra-system (i.e. Earth-Moon) water cycle will be investigated, considering also that places rich in water are the potential target for future human outposts on the Lunar surface. The scenario modelled in this work will foresee a developing system aiming to reach its maturity and sustainability, considering technical and engineering aspects of space systems. Therefore a regulatory framework based on the existing International and national space laws is thought to sustain the proposed model, and no further speculation on legal aspects is conducted in the study. In the intended hypothetical scenario resulting from the study, some key technological aspects will be highlighted, in order to offer a vision of mutual technical enablers considering the resources of the system limited.