

Portland State University

PDXScholar

Business Faculty Publications and
Presentations

The School of Business

7-2021

From Early Curiosity to Space Wide Web: Emergence of the Small Satellite Innovation Ecosystem

Yue Song
Auburn University

Devi R. Gnyawali
Virginia Tech

Lihong Qian
Portland State University, lihongqian@pdx.edu

Follow this and additional works at: https://pdxscholar.library.pdx.edu/busadmin_fac



Part of the [Business Commons](#)

Let us know how access to this document benefits you.

Citation Details

Song, Yue; Gnyawali, Devi R.; and Qian, Lihong, "From Early Curiosity to Space Wide Web: Emergence of the Small Satellite Innovation Ecosystem" (2021). *Business Faculty Publications and Presentations*. 258. https://pdxscholar.library.pdx.edu/busadmin_fac/258

This Poster is brought to you for free and open access. It has been accepted for inclusion in Business Faculty Publications and Presentations by an authorized administrator of PDXScholar. Please contact us if we can make this document more accessible: pdxscholar@pdx.edu.

From Early Curiosity to Space Wide Web: Emergence of the Small Satellite Innovation Ecosystem

Yue Song, Auburn University; Devi Gnyawali, Virginia Tech; Lihong Qian, Portland State University

Research Questions:

- How did the small satellite ecosystem emerge and evolve?
- Although the first modern small satellite UoSat-1 was successfully launched in 1981, and the CubeSat dominant design was introduced in 1999, the sales takeoff of small satellites did not occur until the early 2010s. What explains this long time period?

Research Background: Innovation Ecosystem

Literature on innovation ecosystem has identified a few necessary conditions for a seed innovation to become an innovation ecosystem:

- Multilateral interdependency*: the value creation for one firm depends on value creation from other firms
- Non-generic investments*: firms make nonfungible investments into the specific technology
- Customer-centric, economic value proposition*: mass market, economic benefits

Key Findings:

- It took the small satellite more than 30 years to evolve from a seed innovation to a complete innovation ecosystem
- Our analysis reveals a long-time struggle to develop and materialize an economic value proposition, absence of which stalled the development of the small satellite ecosystem.
- Four stages of ecosystem evolution:
 - 1981 Technology demonstration. Only few firms making non-fungible investments into the technology
 - 1982~ early 1990s Technology reliability and non-commercial usefulness of the technology. Specialized components and buses start to emerge
 - Late 1990 ~ late 2000s Commercial usefulness of small satellites. Initial non-generic investments from launch vehicle providers
 - Early 2010s ~ now – Strong economic returns and establishment of the innovation ecosystem
- The incremental investments from a collective of actors contributed to the ecosystem formation

Number of Small Satellites Launched by Year and Key Events in the Modern Small Satellite History

