Chapter 3
Building Open Source Hardware Business Models

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ABSTRACT

Open source hardware (OSH) initiatives are collectively managed projects enabled by the internet and digital fabrication tools. They allow people to create products in a cheaper, faster, and more efficient manner. To date, there is no strategic and actionable framework using the commons theory for analyzing how these hardware initiatives develop economically effective and sustainable business models. Based on an analysis of the business models of 27 community-based and community-oriented OSH initiatives studied over a 3-year period, this chapter presents such a framework. The five-stages spiral framework offers to guide companies and startups involved in OSH to interact with their surrounding innovation ecosystems progressively, enrich their value propositions and grow in impact.

Over the past decade, despite research interest in Digital Commons (Fuster Morell, 2014; Acquier *et al.*, 2016; Benkler, 2017; Raworth, 2017; Litman, 2014), little information exists on how commons-based peer-production open source hardware (OSH) initiatives may monetize their innovations. The aim of this chapter is to investigate the business models used by open-source hardware entrepreneurs and

explore the nature of the value created in such initiatives. Question which continue to baffle researchers are:

- How can value creation and capture be based on a collective resource?
- Can a resource arrangement that works in practice work in theory?
- How can design documentation be commercially exploitable, freely editable and available concurrently?

Open Design, identified as critical for spreading the impact of the circular economy, has become the modus operandi for social design. Therefore, understanding it's growth patterns and deviations is important as this addresses the long-term viability in the context of the economic transformation needed to implement circular economy and the UN's SDG goals.

Open source hardware and peer production, both instances of Digital Commons applied to manufacturing, are believed to be the most radical, theoretical and organizational innovations to have emerged from the Internet (Raasch *et al*., 2009; Van Abel *et al.*, 2010; Bonvoisin, *et al*. 2016; Moritz *et al.,* 2016; Benkler, 2016; Sanguinetti, 2019).

To date, Commons research has focused on how Open Source and Knowledge Commons need to be purposefully protected from enclosure and kept open as raw material for ideas (Hess & Ostrom, 2011; Litman, 2014). Fuster Morell and Espelt, (2018) devised a much-needed holistic framework to assess the knowledge, governance and technological openness of commons-based cooperative platforms. Raworth (2017) explained that distributed and regenerative designs are novel configurations of value creation and capture in Digital Commons. Troxler, (2019) has adapted Ostrom's governance principles (1990) to Open Design.

Yet, to our knowledge, how Digital Knowledge Commons can be monetized, and what growth patterns could be aligned with distributed and generative value, have yet to be developed in literature. Thus, it is interesting to look closely at business models for open source hardware as this concept represents the orchestration of activities surrounding value creation, delivery and capture (Teece, 2010; Zott & Amit, 2010). The purpose of this chapter therefore, is to provide an actionable, strategic framework to help open source entrepreneurs in developing their business models. The 5-stage spiral framework is a creativity tool for brainstorming "what is right for us" solutions. OSH projects may use the modular nature of business model patterns, combining them like building blocks according to an organization's strategic needs. As organizations iterate through the stages, they are enriched from slightly different perspectives.

This chapter is structured as follows: the first section details the implications of OSH, with Digital Knowledge and Innovation Commons, on entrepreneurship and

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