2 Determinants of value capture

This study focuses on the distribution of value within the value chain, therefore, I follow prior research (Bowman and Ambrosini 2000; Dedrick et al. 2010; Lepak et al. 2007) in defining value—more specifically, "value created"—as the difference between the costs of producing a certain good or providing a certain service and the price that buyers pay for the end product. In this chapter, I review the pertinent literature on value appropriation and bargaining, industry or value chain architecture as a determinant of value capture, and game theory perspectives.

2.1 Profiting from innovation

The literature on profiting from innovation, building on the groundbreaking work of Teece (1986), emphasizes two key factors that determine a firm's value capture: the appropriability regime and the control over complementary assets. The first refers to the ability to protect the innovation from imitation or reproduction through legal mechanisms (e.g., patents, copyrights, trade secrets) and barriers resulting from the nature of the focal technology (e.g., secrecy, tacit knowledge) (Pisano and Teece 2007). The control over complementary assets (e.g., access to input materials, specialized complementary products), on the other hand, refers to assets and capabilities required for a successful commercialization of the innovation.

Naturally, firms aim to leverage these determinants to enhance value capture. Strategies described in the literature are based mostly on the idea of creating a "bottleneck", that is, on becoming the firm most difficult to replace in the value chain[4] (Baldwin 2014; Iansiti and Levien 2004; Jacobides and MacDuffie 2013; Jacobides et al. 2006; Morris and Ferguson 1993; Pisano and Teece 2007). Irreplaceability and inimitability may be due to various isolating mechanisms (Rumelt 1984), in particular causal ambiguity regarding the source of the respective resource and legal property

[4] Note that the notion of a bottleneck refers to replaceability relative to the other firms in the value chain, and as a result determines value capture relative to what the value chain as a whole captures. The latter, in contrast, is determined among other things by absolute replaceability by competing, substitutive value chains. That is, even a bottleneck firm might face low value capture in absolute terms if all firms in the value chain, including the bottleneck firm, are easily replaceable.

A. Hoffmann, *Value Capture in Disintegrated Value Chains,* Innovation und Entrepreneurship,
DOI 10.1007/978-3-658-11368-1_2,

rights. I refer to the approach to optimizing a firm's value capture by becoming the bottleneck in the value chain as the bottleneck strategy.

A firm can seek to create a bottleneck in different parts of the value chain, either by protecting the core innovation and product, or by having exclusive control of complementary assets. For example, a tight appropriability regime building on strong patent protection, secrecy of core functionalities, or a high level of tacit knowledge, prevents imitation of the core technology and impedes competition. Thus, the firm's contribution to the value creation process becomes valuable, rare, inimitable, and non-substitutable (Barney 1991). In case of weak appropriability regimes innovators can generate returns by leveraging the complementary assets even if the innovation itself does not directly ensure sufficient value capture (Pisano and Teece 2007).

A bottleneck position can significantly enhance bargaining power and value capture (Jacobides et al. 2006). Value is distributed among the firms that contribute to its creation through bargaining (Brandenburger and Stuart 1996); the value share a given firm can appropriate depends on its bargaining power relative to its negotiation partners (Porter 1980). Bargaining power, in turn, is driven by the availability of alternative providers of the same good or substitutes, the replacement costs to be borne by the remaining firms if a firm withdraws from negotiations, the switching costs for the focal firm if it needs to deploy its resources for other purposes, time pressure, and access to relevant information (Buvik and Reve 2002; Dedrick et al. 2010; Porter 1980). That is, bargaining power is driven by the replaceability in the value chain. Hence, a bottleneck position in the value chain (rooted in the focal product or complementary assets) translates into a bottleneck position in negotiations and results in increased value capture.

2.2 Value chain architecture

The literature discusses various approaches to attaining a bottleneck position. Many of these imply changes to industry or value chain architecture, that is, to the nested structure of firms circumscribing the division of labor (Jacobides et al. 2006).

Distinct product solutions designed to satisfy the same customer need might have different value chain architectures. In particular, when a new market emerges, each product design may come with its own organization of the value chain; firms approach market needs and process difficulties differently and there is no common understanding of key performance criteria (Clark 1985). However, when a dominant product design emerges,[5] most firms will adopt the corresponding value chain organization in order to reduce transaction costs. Thus, one or a small number of stable “industry architectures” consisting of several value chains for core and complementing products, emerge in the formative years of an industry, each with its own members (Gawer and Cusumano 2002; Iansiti and Levien 2004).

Industry and value chain architectures can display significant inertia (Pisano and Teece 2007). In particular, when the industry becomes more mature and firms increasingly specialize, switching costs associated with changing the architecture increase. Nevertheless, architectures can change over time, triggered, for example, by significant technological and regulatory changes or demand shifts (Jacobides et al. 2006).

Scholars have studied how firms seek to influence the architecture of their respective value chain and industry for their own benefit with the goal of achieving a bottleneck position (Baldwin and Clark 2000; Chesbrough 2003; Iansiti and Levien 2004; Jacobides et al. 2006; Pisano and Teece 2007). Several studies indicate that innovators, entrepreneurs, and other key firms may be in a position to shape the value chain architecture to achieve a dominant position.

It often requires the collaboration of various firms to bring a product innovation to the market. Having the opportunity to strategically think about and shape the architecture of their value chain, innovators have the ability to decide on the boundaries of their firm, the division of labor along the value chain, and the relationships with suppliers and complementors (Jacobides et al. 2006). These decisions include, among others, whether to make or buy components, how to design interfaces for suppliers and complementors, how to divide roles among potential suppliers, and how to interact with other firms in the value chain. Thus, innovators not only decide on their own role but also have the opportunity to shape their value chain architecture.

Further, Santos and Eisenhardt (2009) show how entrepreneurial firms shape value chain and industry architecture to achieve a dominant position. They observed three mechanisms that entrepreneurs use to set their organization boundaries and demarcate

---

[5] According to Abernathy and Utterback (1978), in the beginning of a market product design is in flux as companies vary product characteristics and innovate to best meet the new or emerging needs of customers. Through standardization and focus on efficient production one or a small number of dominant product designs may emerge over time.

nascent markets. First, they aim to claim the market and become the “cognitive referent” through defining and promoting a separate identity for the firm and the market. Second, through the creation of alliances they aim to increase market power and draw a line to nascent markets. Third, over time, entrepreneurs attempt to adapt the boundaries of the firm to the boundaries of the market to reduce the competitive thread.

Last, key individuals can trigger architectural change through the use of their position and assets (e.g., resources, contacts). Ferraro and Gurses (2009) use the example of the U.S. motion picture industry to show how individual firms can leverage exogenous changes—in this case technological change outside the focal industry and governmental legislation—to reshape the value chain and industry architecture. Through linking unconnected domains and expertise, firms can create new opportunities and put themselves in a position to drive architectural change in the industry. Similarly, firms in a keystone position (Iansiti and Levien 2004) have the power to change the value chain architecture. These so-called keystone firms have an important role in the network of firms of an ecosystem[6] and through providing a stable and predictable environment (e.g., a platform) they aim to increase health and value creation throughout the ecosystem. Further, they share a large portion of the value with the rest of the ecosystem to strengthen their position.

Overall, three areas of determinants that can be potentially leveraged for shaping the value chain and industry architecture are discussed in the literature: distribution of capabilities, regulations and norms, and product architecture.

First, as it is the basis for strategic decisions when organizing the value chain, the knowledge and capability endowment of firms has a strong effect on value chain and industry architecture (Ferraro and Gurses 2009; Zirpoli and Camuffo 2009). Technical capabilities determine whether a firm can best produce a particular component in the desired specification. Hence, they influence the division of labor. Firms try to leverage their own capabilities to influence, for example, task partitioning and thus achieve a comfortable position in the value chain and control over suppliers. Technical competences and capabilities can be developed over time, however, this process is slow, uncertain, and costly (Hoetker 2006). Although it is an important strategic activity for

---

[6] An ecosystem consists not only of the firms involved in producing a given product but also the firms in the value chains of complementary products.

firms, the development of capabilities is a rather long-term oriented lever to gain an advantage.

Second, the norm-based and legal framework including reputation, regulation, technology, and industry standards are factors that influence value chain architectures (Jacobides and MacDuffie 2013). For example, technical standards are essential for the development and commercialization of some technologies such as mobile communication, as they define interfaces and thus enable compatibility and specialization of firms (Anton and Yao 1995). Defining interface standards implicitly sets the boundaries of modules. Thus, standards foster competition in some parts of the value chain by enabling "plug and play" of modules while they potentially restrict competition in other parts of the technical system (Pisano and Teece 2007). Hence, standards play an important role in the development of the value chain and industry architecture and firms aim to influence them (Jacobides et al. 2006).

Third, product architecture, in particular modular product architecture, affects value chain architecture. Modular product architectures are characterized by a low level of interdependencies among subsystems (Baldwin and Clark 1997; Sanchez and Mahoney 1996; Simon 1962) and therefore enable and shape the division of labor within an industry (Baldwin and Clark 1997; Langlois 2003; Langlois and Robertson 1992; Sturgeon 2002).[7] More precisely, because of the low level of interdependencies, a change in a single subsystem has (almost) no effect on other parts of the system. Coupled with standardized interfaces it allows firms to offer greater product variety with little incremental complexity as modules can easily be exchanged or updated (Sanchez and Mahoney 1996). As modules can be designed and produced independently of the rest of the system, modular product architecture not only shapes and enables the division of labor but also promotes and facilitates the specialization of firms (Colfer and Baldwin 2010; Langlois and Garzarelli 2008). It is important to note that, in this context, the architecture of a newly introduced product is to a good extent under the control of the innovator who may design it purposefully to influence value chain architecture and value capture. In this context, Thomas et al. (2014) highlight the role of platform

---

[7] Similarly, focusing on the transactional character of an industry, the coupling between product and supply chain architectures has been noted in the supply chain literature (Lee and Sasser 1995; Simchi-Levi et al. 2008). Further, a source of additional benefits is the concurrent design of product and supply chain architecture, which results in lower costs and greater performance (Gan and Grunow 2013).

architecture and the logic of "architectural leverage." For example, firms can stimulate competition in other segments of the value chain through the design of open interfaces (Eisenmann et al. 2009). At the same time, firms seek to restrict competition in their own fields by strengthening the appropriability regime, for example, through a product design that is modular with regard to intellectual property (Henkel et al. 2013). Hence, firms can leverage product architecture to attain a bottleneck position.

2.3 Game theoretic perspective

Game theory has often been used to shed light on fundamental questions in business strategy: how winners emerge, how to succeed in competition, and how competition affects value capture. The two fields of game theory, cooperative and non-cooperative, approach these questions from different angles. While non-cooperative game theory studies the strategic moves and interactions among a set of players, the cooperative branch focuses on the power of players, possible outcomes and how the payoffs are allocated. Note that the terms "cooperative" and "non-cooperative" can be misleading as cooperative game theory is used to analyze competitive environments as well, and non-cooperative game theory also incorporates cooperative aspects (Brandenburger and Stuart 2007).

Non-cooperative game theory studies the effects of strategies and actions of a player and aims to identify plausible outcomes. However, non-cooperative models require detailed specifications of the process, possible moves and countermoves, and information available to players.[8] The analytical results of a non-cooperative game model heavily depend on the precise specification of the particular setting, the process, and the rules (Aumann and Shapley 1994; Kreps 1990). Therefore, generalization of results is limited to very similar settings (Camerer 1991). Nevertheless, non-cooperative game theory is a powerful tool used to understand the strategic moves of firms.

Cooperative game theory takes a different perspective. It focuses on possible outcomes, studies potential coalitions of players, and how players allocate the value that was generated cooperatively. In particular, cooperative approaches are suitable for situations in which binding contracts among players are made and adhered to (Aumann

8 In the context of Nash equilibrium it is assumed that players are aware of the potential strategies of other players as they observed a similar game beforehand (Gul 1989).

and Shapley 1994). In contrast to non-cooperative game theory, there is no restriction on the process of how players get to the focal setup. It can rather be seen as a free-form interaction between players and hence fits into the realistic business process of value creation and appropriation (Brandenburger and Stuart 1996; Winter 2002).

Both game theories, non-cooperative and cooperative, are relevant for analyzing business settings; however, each takes an individual perspective. Since my research focus is to understand the drivers of value capture without specifying or assuming a particular procedure of how agreements are reached, the use of cooperative game theory is a better fit for this study.

The introduction of cooperative game theory to management literature started with the seminal article by Brandenburger and Stuart (1996), who employed it to develop the added-value concept. Later, MacDonald and Ryall (2004) used a formal cooperative approach to assess how competition and replaceability drive value appropriation and derive strategies for innovators. Furthermore, Brandenburger and Stuart (2007) developed a powerful approach for analyzing business strategies combining non-cooperative and cooperative approaches, so-called biform games. Other contributions are the results of research by Adegbesan (2009), Adner and Zemsky (2006), Bennett (2013), Chatain and Zemsky (2007), Lippman and Rumelt (2003), and Ryall and Sorenson (2007).

The most prominent concepts in cooperative game theory are the Shapley value (Shapley 1953) and the Core (Gillies 1953; Shapley 1952). While the Core theory provides a set of value distributions that no group of players can unilaterally improve upon, the Shapley value provides a single distribution that can be perceived as a "fair" allocation (see Sections 4.1.1 and 4.4 for a detailed discussion of the concepts). The Shapley value is part of the set of acceptable solutions provided by the Core if the game is convex (Shapley 1971), that is, if the participating firms complement each other and create complementarity effects.[9] In the meta-analysis of Michener et al. (1983) covering more than 1,400 observations in six separate studies, the Shapley value consistently

[9] That is, the value collectively (created and) captured by the group of firms is larger than the sum of values (created and) captured individually.

showed relatively high predictive accuracy compared to the Core and outperformed all other tested cooperative concepts as well.[10]

Because of its advantageous properties, the Shapley value has been applied in numerous studies. Although it has been extensively used in economics and political sciences, there are, thus far, only a few applications in the field of management studies. Granot and Sošić (2005), among others, use the Shapley value to model the incentive of firms to take part in supply alliances; Layne-Farrar et al. (2007) apply the Shapley value to the pricing of patents in standard setting organizations, suggesting it can be seen as a possible benchmark for fair, reasonable, and non-discriminatory (FRAND) pricing; Hendrikse (2011) uses it to model the distribution of revenues to analyze governance structure changes in the fruit and vegetable business; and, Kattuman et al. (2011) use variance decomposition based on the Shapley value regression to study the influence of corporate groups on affiliate profitability. Further, Cachon and Netessine (2004) and Nagarajan and Sošić (2008) provide an extensive overview of supply chain literature applying the Shapley value.

Further, the Shapley value has a non-cooperative interpretation. Gul (1989) shows that the expected profit from sequential trade, that is, the utility in the equilibrium, is the Shapley value when time intervals between bargaining are arbitrary small. Conversely, a couple of bargaining methods that lead to a value allocation according to the Shapley value have been developed and specified (Inderst and Wey 2001; Pérez-Castrillo and Wettstein 2001).

---

10 Besides the Shapley value and the Core, Michener et al. (1983) test the Nucleolus, the Disruption Nucleolus, the 2-Center solution, and the Equality solution. In the comparison of different concepts with the Core, the Shapley value is the only concept that in all tests shows a significant higher predictive accuracy. Predictive accuracy is indicated by the mean goodness-of-fit score. For imputation theories, that is, theories that suggest a point solution, goodness-of-fit scores measure the Euclidian distance between the observed and predicted results. In addition, the goodness-of-fit score used for the Core takes the size of the predicted solution space into account.

http://www.springer.com/978-3-658-11367-4

Value Capture in Disintegrated Value Chains
The Hierarchy Strategy
Hoffmann, A.
2015, XX, 138 p. 16 illus., 11 illus. in color., Softcover
ISBN: 978-3-658-11367-4