

Global value chains and networks – who creates and who captures value from innovations

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Abstract: Global value chains undergo the process of continuous decomposition. Vertically integrated companies are gradually converted into network structures. Processes of value creation and value appropriation within networks may be explained using the PFI or IO frameworks. Thus, the value capture position of a firm depends, on one hand, upon existence of dominant design, appropriability regime and the need for complementary assets and on the other hand, upon the bargaining power of the firm

Keywords: value, global value chains, innovations

Introduction

Global competition has accelerated the speed of technological obsolescence for most of the products. The pace of innovation and international competition has quickened. Organizational boundaries have become more fluid. One of the effects of the increasing integration of the world economy is the rising importance of possibilities to offshore and outsource value-creating activities. In many industries firms are able to disaggregate their value chains into smaller parts. As a consequence firms disaggregate their value propositions and select components over which they want to maintain control. One implication is that firms should retain control over components or processes that enable it to create and appropriate the most value.

The purpose of the article is to discuss the process of deconstructing of global value chains and present, based on the available literature, the differences in the value appropriation mechanisms of two companies from the electronic industry.

1. The global value chains

In the 1990s the new framework of analysis of global organization of industries has been introduced to the literature and empirical work. It has been called ‘global commodity chains’ (GCCs). The GCC approach adopted what Dickens et al. call “a network methodology for understanding the global economy” (Dicken et al. 2001: 92). The objective is “to identify the actors in these networks, their power and capacities, and the ways through which they exercise their power association with network relationships” (Dicken et al. 2001: 93).

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This type of analysis linked the concept of value-added chain to the global organization of industries. One of the main insights of this approach was the highlight of the growing importance of global buyers, retailer and brand marketers, as key drivers in the process of formation of internationally dispersed production and trade networks. This has been contrasted with producer-driven chains, which are the production systems created by vertically integrated transnational manufacturers in capital- and technology-intensive industries such as automobiles, aircraft and advanced machinery.

Buyer-driven commodity chains were essential to the rise of East-Asia export-oriented economies. And they highlighted the significance of design and marketing in the activities of global production systems. The new framework drew attention to the diverse range of economic actors that could exercise significant power on both the supply and demand side of global production and distribution networks.

Since the early 2000s the global value chain (GVC) concept has gained popularity as a way to analyze the international expansion and geographical fragmentation of contemporary supply chains. This body of research – avoiding the limiting connotations of the word “commodity” – focuses on value creation and value capture across the full range of possible chain activities and end products (goods and services). Like the GCC framework, GVC analysis highlights the international expansion and geographic fragmentation of contemporary production networks and focuses primarily on the issues of industry organization, coordination, governance, and power in the chain.

The GVC framework has evolved from its academic origins and has become a major paradigm used by a wide range of international organizations, including the World Bank, The World Trade Organization and the International Labor Organization. The GVS approach analyzes the global economy from two contrasting perspectives: top down and bottom up. The key concept for top-down view is the “governance” of global value chains, which focuses mainly on lead firms and the organization of international industries; the main concept for the bottom-up perspective is “upgrading” which focuses on the strategies used by countries, regions, and other economic stakeholders.

2. The governance of global value chains

Power is the ability of a firm or an organization to make or shape strategic decisions that affect the configuration and direction of the value chain and thus influence and control other firms in the chain. Power can reside in any part of the value chain structure and it can take many forms.

Within the chain, power at the firm level is exerted by lead firms. Lead firms can be producers or buyers in the chain. In *producer-driven chains*, power is usually held by final-product manufactures; such chains include capital-, technology-, or skill-intensive industries. In *buyer-driven chains*, retailers or marketers of the final products exert the most power through their ability to shape mass consumption through strong brand names.

The connections between industry activities within a chain can take different forms. Gereffi et. al propose the five-element typology, covering the broad spectrum, ranging from market governance to hierarchical value chains, and network forms of inter governance in the middle (Gereffi et al. 2005: 89). Network style governance represents a situation in which the lead firm exercises power through coordination of production with suppliers, without any direct ownership of the firms.

Gereffi et al discriminate between five types of value chain governance structures:

1. Market.
2. Modular.
3. Relational.
4. Captive.
5. Hierarchy.

Market. Market governance involves transactions that are relatively simple. Information on product specifications is easily transmitted, and suppliers can make products with minimal input from the buyers. The central governance mechanism is price rather than a lead firm.

Modular. Modular governance exists when complex transactions are relatively easy to codify. Typically, suppliers in modular chains make products to customers' specifications and take full responsibility for process technology. Relationships are more substantial than in simple markets because of the high volume of information flowing between the firms. Information technology and standards for exchanging information are crucial to the functioning of modular governance.

Relational. Relational governance exists when buyers and suppliers rely on complex information that is not readily transmitted or learned. This results in frequent interactions and knowledge sharing between parties. Such linkages require trust and generate mutual reliance. Producers in relational governance are more likely to supply differentiated goods based on quality, geographic origin, or unique characteristics.

Captive. In these chains, small suppliers are dependent on one or a few buyers that often have a lot of power. Such networks are characterized by a high degree of monitoring and control by the lead firm. The power asymmetry forces suppliers to operate under conditions set by particular buyers. In these chains the core competence of the lead firms usually is in areas outside manufacturing.

Hierarchy. Hierarchical governance describes chains characterized by vertical integration and managerial control within lead firms that develop and manufacture products in house.

The form of governance can change as an industry evolves and matures, and governance patterns within an industry can differ.

3. Deconstruction in global value chains

Many industries, in particular high-tech ones, are undergoing a radical transformation, New opportunities are being created and new challenges need to be faced, in particular in global B2B supply chain.

The rapid advances in information technology (IT) that have occurred in recent decades have resulted in innovations, such as the Internet, that triggered new thinking in respect of industrial organization theory and practice. Internet enabled quick electronic communication between customers and suppliers and between firms in value chains opens up opportunities for new channels of distribution and new business models that may threaten the activities of traditional channel intermediaries.

“Disintermediation” is a particular concern in Business-to-business markets (B2B), arising when current channel members become redundant and are replaced by the new intermediaries or simply by-passed. In this environment, traditional channel members will perish unless they offer a portfolio of services that add significant value for both their suppliers and customers. The development of electronic communication channels and markets provides

options for both sellers and buyers to omit intermediaries and capture value through reduced transaction costs.

In many industries, firms are able to disaggregate their value chains into smaller parts. This process allows for a less path-dependent approach to the firm's preferred location profile (through offshoring and reallocation) and control strategies (through outsourcing). The value chains are rapidly evolving into value networks with multiple entry and exit points.

4. Value and its distribution among value chain members

When firms operate within production and innovation networks that span national and firm boundaries, the question arises who actually benefits from innovation, who creates and who captures value. In the past, large, highly integrated companies created and captured a large share of the value of innovation. Since then supply chains in many high tech industries have steadily disaggregated across corporate and national boundaries. Companies that formerly manufactured most products in-house, as well as start-ups that never had manufacturing capabilities, have outsourced production and even product development to global networks of contract manufacturers (CMs) and original design manufacturers (ODMs).

Today creation of a successful product in most industries, in particular from high tech sector, spreads wealth far beyond the lead firm such as the company whose brand appears on the product. While the lead firm and its shareholders are expected to be main beneficiaries one has to take into consideration other beneficiaries as well, including partners in the firm's supply chain and firms that offer complementary products or services.

Measuring of the value created and captured by firms across value chain is a challenge from methodological standpoint. Dedrick et al. present interesting proposal in this respect (Dedrick et al. 2009: 81–116). Their analysis draws from two major business strategy traditions: profiting from innovation (PFI) and industrial organization (IO). As regards PFI, the focus of their approach, based on the criteria introduced by Tece (Tece 1986: 285–305), is to analyze the ability of the lead firms to profit from their own innovations. Within IO framework the bargaining power of participants in the supply chain is analyzed as a key determinant of how profits from innovation are divided (Porter 1980). The PFI framework is based on the perspective of a focal firm and is not directly concerned with the profitability of other participants in the supply chain. The IO approach, concerned primarily with industry structure, is well suited to thinking about the bargaining power that determines the share of profits appropriated along the supply chain.

4.1. PFI framework

As innovative product moves from concept to market, the lead firm must assess which technologies fit its own capabilities and can be provided internally and which must be outsourced from supply chain partners. The lead firm must also define its value proposition for customers and assess competitive environment for its offering. This should result in creating a comprehensive business model.

In dynamic, highly networked industries, such as information technology and electronics, additional factors must be taken into account. Each innovation is likely to require access to and coordination with other innovations to provide value to users. The technologies in high tech industries have high rate of change, so entry barriers are often short-lived and mana-

gement must be capable of recognizing and responding to changing market characteristics (Teece et al. 1997: 519).

In one of his seminal works David Teece identifies key factors that influence the distribution of profits from innovation. He enriched transaction costs theory with ideas from evolutionary economics, from Edith Penrose's pioneering work on behavioral theory of the firm. Taking into account earlier works on dominant design (e.g. by Abernathy and Utterback) Teece there are three decisive factors behind the process of capture of value from innovation: dominant design, appropriability and complementarity.

Dominant design

During the process of *industry evolution* one of the key issues is whether the market has embraced a *dominant design* for a new innovation. Abernathy and Utterback were among the first to hypothesize that the nature of competition amongst technologies alters with the emergence of "dominant design" (Abernathy, Utterback 1987). In the early stages of the industry, a variety of product solutions may be introduced with no clear leader. Once the market has a dominant design, less product characteristics heterogeneity is possible and competition becomes more price-based. As note by Teece, "at some point in time, and after considerable trial and error in the marketplace, one design or a narrow class of designs begins to emerge as promising" (Teece 1986: 282). The more a technology is employed, the greater its attraction relative to the alternatives.

Appropriability regime

This is defined by Teece as "the environmental factors, excluding firm and market structure, that govern an innovator's ability to capture the profits generated by the innovation." A key insight in PFI was that imitability of technology is a function of both legal instruments (patents, copyrights, etc) and the inherent replicability of technology which depends in part on whether know-how is tacit or codified.

Complementarity

For many high tech products, widespread acceptance depends on the availability of related goods that will enable or enhance their functionality. Given consumer expectations and the speed of change in the high tech industries, even the large firms must with widely distributed alliance networks to bring new ideas to the market. Innovative firms need to cooperate with a large number of firms, including competitors, to ensure the supply of compliments in order to maximize the total value proposition, while at the same time positioning themselves to capture as much as possible of the value that is created by the network.

A common thread linking dominant design, appropriability and complementarity is the presence of *standards*. The nature of standards which can differ in terms of technical openness, availability for licensing, and so on, helps to define the appropriability regime. Control of the key standards for a product can reside in different levels of product architecture, and there is competition to prevent control from shifting to another layer (West, Dedrick 2000: 202). A good example of such a change in the control level for the standard is the case of the PC, where the standards of now-dominant design were originally set by IBM at the system level, but then were usurped by Microsoft and Intel at the microprocessor and operating systems levels.

An important extension of the original PFI framework, particularly relevant for the analysis of high tech industries, is *system integration*. This capability has become a key strategic function as industries become decentralized. In such setting, innovation develops in different

parts of the industry. Hence, the lead firm must decide which technologies to incorporate into products and ensure that these technologies are compatible.

4.1. Bargaining power framework

According to Porter, the division of producer surplus among the supply chain partners depends upon the relative bargaining power of the participants. A lead firm must decide which activities undertake in-house and which outsource to outside suppliers (Jacobides et al. 2006: 1124). Once it has decided on the composition of supply chain, the lead firm bargains with its suppliers and partners in the supplier chain over the distribution of profits. The bargaining power of firms in the value chain depends upon a number of factors, including structure of the industry, high switching costs, access to proprietary information, access to specialized knowledge.

5. Which lead firm capture more value – the iPod and notebook PC compared

5.1. Some measures of value capture

Discussion concerning the processes of value creation and value capture is usually limited to theoretical considerations leaving the problem of actual value measurement unresolved.

In this context it is worthwhile to present methodology introduced by Dedrick et al. To estimate the value captured by the lead firm and its most important suppliers (Dedrick et al. 2009: 81–116). The authors analyze two products released in 2005: Apple's video iPod and notebook nc6230 produced by Hewlett-Packard. Value capture within the supply chain is considered as a two-level process: (i) the determination of producer surplus and (ii) the division of that surplus among the supply chain partners. Different analytical approach is applied to each level: the innovation PFI framework to the producer surplus and the bargaining perspective from IO economics for the division of the surplus across the supply chain. These concepts are used to explain why Apple is able to capture more value from its iPod innovation than PC makers are able to capture from notebooks.

To estimate value captured by the suppliers Dedrick et al. considered three firm-level measures of profit: gross margin (GM), operating margin (OM), and return on assets (ROA). GMs above a "normal" level reflect the ability to charge more than the competitive price level, which is a product's average variable cost. To estimate normal margin, the authors calculated the average GM, OM and ROA for 270 of the leading global electronics firms for 2004. The results were 32.8%, 11.5% and 5.2% respectively. Then calculating standard deviation and assuming normal distribution they calculated the, so called, "normal" range for these ratios. The results are presented in table 1. Any actual results above these ranges were then considered supernormal and result below were called subnormal. In tables 2 and 3 these results are highlighted as shaded cells.

The results of calculation of these three measures for the major supply chain members for the iPod and notebook are presented in tables 2 and 3, respectively.

Table 1

The normal ranges for three performance measures

Measure	Definition	“Normal” range, 2004
GM	Gross profit over sales	52.3 to 13.3%
OM	Operating profit over sales	25.0 to -2.0%
ROA	Net profit over total assets	12.3 to -1.9%

Source: Dedrick et al. 2009: 89.

Table 2

Profit margins of primary firms in the video iPod supply chain, 2005

Function	Supplier	GM (%)	OM (%)	ROA (%)
Controller chip	PortalPlayer	44.8	20.4	19.1
Lead firm	Apple	29.0	11.8	16.6
Video chip	Broadcom	52.5	10.9	9.8
Primary memory	Samsung	31.5	9.4	10.3
Battery	TDK	26.3	7.6	4.8
Retailer	Best Buy	25.0	5.3	9.6
Display	Toshiba Display	28.2	3.9	1.8
Hard drive	Toshiba	26.5	3.8	1.7
Assembly	Inventec appliances	8.50	3.1	6.1
Distribution	Ingram Micro	5.50	1.3	3.1
Minor memory	Elpida	17.6	0.1	-1.0
Minor memory	Spansion	9.6	-14.2	-9.2

Source: Dedrick et al. 2009: 92.

Table 3

Profit margins of firms in the HP nc6230 supply chain, 2005

Function	Supplier	GM (%)	OM (%)	ROA (%)
1	2	3	4	5
Operating system	Microsoft	84.8	36.6	17.3
Processor plus logic and wireless chips	Intel	59.4	31.1	17.9
DDR SDRAM (graphics memory)	Hynix Semiconductor	37.3	24.9	17.7
Cardbus and battery charge controllers	Texas Instruments	48.8	20.8	15.4
Ethernet controller	Broadcom	52.5	10.9	9.8
Memory board (main memory)	Samsung	31.5	9.4	10.3
Retailer	Best Buy	25.0	5.3	9.6
I/O controller	Standard Microsystems	46.0	4.2	2.7
DVD-ROM/CD-RW drive	Matsushita	30.8	4.1	1.9
Battery pack	Unknown	24.0	4.0	2.4
Lead firm	HP	23.4	4.0	3.1
Display assembly	Toshiba Matsushita	28.2	3.9	1.8
Hard drive	Fujitsu	26.5	3.8	1.8
Assembly	Unknown	6.1	2.4	4.6

1	2	3	4	5
Distributor	Unknown	7.7	1.5	1.9
Graphics processor	ATI Technologies	27.6	1.1	1.0

Source: Dedrick et al. 2009: 93.

5.2. Differences and their explanation

One of the most striking differences between the iPod and the notebook is how high Apple ranks in terms of OM within its supply chain (second of twelve), compared to HP (eleventh of sixteen).

The iPod is not just a hardware innovation but also an integrated system comprising the iPod product family and closely integrated with its iTunes software and iTunes store. The iTunes store uses an exclusive system of digital rights management (DRM), which limited the number of computers on which the purchased tracks can be played. Apple's control of the DRM added switching costs to the iPod business model. The same logic applies to any iPod specific accessories.

In contrast, notebook computers are sold without any particular associate method of content delivery and brand-specific accessories. The manufacturer may pre-install software or services, but the customer ultimately decides which applications to use and which networks to join for accessing content.

The difference in value capture between iPods and notebooks can be explained using the framework proposed by Teece (Dedrick et al. 2009: 100).

As regards the issue of *dominant design* for notebooks it has been established by the early-1990s (Dedrick et al. 2009: 100). Since then innovation shifted to the components level and to process innovation. It was incremental innovation and the gradual transition was controlled by incumbent firms, in particular Intel and Microsoft. It was very difficult for PC maker to differentiate their products and, as a result, the competition has driven margins down. In contrast, Apple was innovating in an emerging market for music players. The iPod was introduced before a dominant design was established for music players, which contrasts with the situation faced by HP.

Numerous electronic products have strong appropriability regimes due to patents and other barriers to imitation. This is however more relevant in the case of components rather than system firms like Apple, HP or IBM. Apple was able to keep control over key elements of the iPod, in particular the user interface, and the user interfaces between the iPod, iTunes software, and the online iTunes store (Dedrick et al. 2009: 81–101). Through this strategy Apple has been able to capture the large share of profits from its innovation in the iPod. It has defended its position through *appropriability regime* that includes extreme secrecy and the possession of great deal of tacit knowledge in the areas of industrial design and user interfaces.

For many electronics products, a key factor is the availability of *complementary goods* and services that enable or enhance their functionality. For the iPod, Apple has employed a range of strategies to secure the necessary complements. The specialized software in the iPod and iTunes client software are developed by Apple internally. The iPod most important complementary asset, content, is mostly generic and comes from variety of sources. Apple provided a free encoder allowing the iPod owners “transfer” of music tracks from their CD collections. Apple also provides access to millions of tracks of music and other restricted

content for paid download through its iTunes store. Another of the iPod's complementary assets is creation of its own retail channel

Conclusions

In the initial iPod models, there was little technology that was unique to Apple. Apple even paid licensing fees to Singapore's Creative Technology for its method of navigating through song lists. However Apple understood the iPod needed to be very appealing aesthetically and functionally, and drew on its strengths in industrial design and software to bring the technology elements together in a unique way.

High margins enjoyed by Apple are not unusual for brand names in the electronics industry. Analysis of iPod highlights some of the ways that lead firms profit from innovation when most core technologies are available to competitors from global supply base. Apple's success was driven by a combination of marketing, design innovation, and a strategy of building an ecosystem for the iPod while raising barriers for competitors.

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GLOBALNE SIECI I ŁAŃCUCHY WARTOŚCI – KTO TWORZY I KTO ZAWŁASZCZA WARTOŚĆ Z INNOWACJI

Streszczenie: Globalne łańcuchy wartości podlegają procesom dekompozycji. Pionowo zintegrowane struktury są stopniowo zastępowane strukturami sieciowymi. Procesy kreowania i zawłaszczania wartości w sieciach przedsiębiorstw są w istotnym stopniu determinowane mechanizmami koordynacji i nadzoru (*governance*). Zawłaszczenie wartości z produktów innowacyjnych jest uwarunkowane stopniem zaawansowania rozwoju standardu technologicznego, reżimem zawłaszczenia, komplementarnością produktów i usług, a także siłą przetargową uczestników sieci wartości.

Słowa kluczowe: wartość, globalne łańcuchy wartości, innowacje

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