

THE MARKETING OF INFORMATION IN THE INFORMATION AGE

CHARLES F. HOFACKER, Florida State University

RONALD E. GOLDSMITH, Florida State University

The long-standing distinction made between goods and services must now be joined by the distinction between these two categories and “information products.” The authors propose that marketing management, practice, and theory could benefit by broadening the scope of what marketers market by adding a third category besides tangible goods and intangible services. It is apparent that information is an unusual and fundamental physical and logical phenomenon from either of these. From this the authors propose that information products differ from both tangible goods and perishable services in that information products have three properties derived from their fundamental abstractness: they are scalable, mutable, and public. Moreover, an increasing number of goods and services now contain information as a distinct but integral element in the way they deliver benefits. Thus, the authors propose that marketing theory should revise the concept of “product” to explicitly include an informational component and that the implications of this revised concept be discussed. This paper presents some thoughts on the issues such discussions should address, focusing on strategic management implications for marketing information products in the information age.

INTRODUCTION

A major revolution in marketing management and theory occurred when scholars established that “products” should not be conceptualized solely as tangible goods, but also as intangible services. Owing to the efforts of Shostack (1977) and others, the services revolution transformed the nature of marketing from a narrow goods-focused discipline to a more complex academic specialty and practice. The evolution of digital technology is now ushering in a new revolution with the emergence of “information products.” Similar to the way in which the shift from a goods-oriented to a service-oriented economy revealed new opportunities and challenges to the marketing discipline (e.g., Grönroos, 2006; Vargo & Lusch, 2004), the increase in information product offerings now requires researchers’ and practitioners’ attention.

The purpose of this paper is to argue that marketing needs another revolution, perhaps nearly as pervasive as the services-inspired one. The field needs a re-thinking of what we mean by “product” to include a third type,

“information,” in addition to goods and services (originally proposed by Freiden et al. 1998), while identifying unique characteristics of pure information products. To support this position, the authors identify key attributes that set apart an information product from a good or a service; and how these differences affect marketing theory and practice. We put the term “information” in quotes in this instance to highlight how difficult it is to define to the satisfaction of all parties. For instance, James Gleick’s (2011) book, *The Information*, reviews the historical emergence of the concept of information without ever giving it a concise definition, but revealing how complex and pervasive information is in the physical, social, psychological, and commercial worlds. Our argument is that the concept, as it relates to products, is sufficiently important to the marketing discipline that it needs to be discussed and debated.

The remainder of the paper presents the argument for a new product concept and the implications it holds for marketing. We note that we do not use the term “information products” in the narrow sense proposed by Meyer and Zack (1996, p. 43) to refer to “information provided in either electronic or printed form and sold to external markets as well as that provided by information systems departments within firms to internal

‘customers’.” Our usage is broad enough to include all aspects of digital or analog signals, to all other media that transmit information, and implies that goods, services, and information are not perfectly distinguishable.

WHY DO WE NEED THIS CONCEPT?

We argue that marketing needs to rethink the concept of “product” for four reasons. First, the very issues raised by Gleick’s book suggest that if information is so pervasive an element in the commercial world, it is necessarily an important concern for marketing. Here we follow the same logic that states that economies dominated by service industries require services marketing. In Table 1 we attempt to quantify the scope and scale of the information economy. One particularly interesting new example of information product is what we choose to call “connection platforms.” Typically, these firms are vehicles that allow one or more groups to enter into an exchange. They include game platform marketers, who connect game developers and players, credit card companies who connect merchants and purchasers, and companies like Google that connect searchers with those wishing to be found. Marketing strategies of connection platforms are little studied outside of economics. The industries listed in Table are fairly pure examples of information companies. Our thesis, however, is that all products have an information component to a more or lesser degree. For example, it is clear that while e-tail often involves shipping a tangible good to the consumer’s home, much of the core benefit of the service is based on digital information and algorithms.

Second, certain anomalies have surfaced in the last few decades to suggest further thinking is needed to cope with the issues raised by information products. For example, the huge impact file sharing had on the film and recorded music business raises questions about what consumers buy when purchasing movies or music (Hennig-Thurau, Henning, & Sattler, 2007). If it isn’t a tangible plastic disk, then this implies it is a service. By the same token, it can’t be a service if the customer can give copies away. The same issue arises in the software industry where piracy is widespread (Givon, Mahajan, & Muller, 1995). Some argue

this is simply a legal problem requiring legislation and enforcement. But this approach does not seem to resolve the issue. Instead, it leads to the odd situation in which an industry is at war with its customers. Much like the problem of spam, perhaps a legal or technical solution is simply not possible (Greenemeier, 2011), and so re-thinking of how to manage such information products is needed.

Third, the spread of the Internet protocol and of the transformations it has brought to virtually every aspect of life highlight the fact that the digitized signal is rapidly becoming a central element of everything humans do. These transformations have resulted in a wide variety of new products created to provide, and to help people use and manage, information. Moreover, some traditional products, such as newspapers and bookstores, have been transformed by the Internet and need new business models and marketing theory to cope with these changes (Peterson, Balasubramanian, & Bronnenberg, 1997). Finally, scholars are recognizing this transformation and have begun to recommend ways to manage the new information services and products (e.g., Bergemann & Bonatti, 2019; Kannan, 2013).

Finally, more and more traditional goods and services now incorporate some connected, online, or digital feature that enables or improves delivery of benefits (Meuter et al., 2000). Thus, we feel justified in proposing that not only are there increasing numbers of products that should not be classified as either goods or services, but that many goods and services now contain a new element that demands marketing them in new ways.

DEFINING INFORMATION PRODUCTS

What is Information?

There are a variety of definitions of information. In fact, so diverse are these perspectives that Case (2002) delineates distinct “families” of information definitions. Thus, “information” can refer to objective descriptions of reality, subjective interpretations of that reality, or sense-making procedures and behaviors we use to move between these two. Other views have information as a resource or commodity,

**TABLE 1:
Size and Scope of the Information Economy**

Category	Total Revenue in Billions \$US
Computer and Packaged Software Wholesaling	\$326.60
Wireless Telecommunications Carriers	\$204.40
E-Commerce and Online Auctions	\$186.40
Software Publishing	\$170.90
Wired Telecommunications Carriers	\$141.40
Cable Providers	\$133.40
Motion Picture and Recording Sound Industries ^a	\$104.40
Operating Systems and Productivity Software Publishing	\$54.70
Credit Card Processing and Money Transferring	\$43.70
Computer Manufacturing	\$40.70
Video Games	\$40.70
Satellite TV Providers	\$38.20
Book Publishing	\$31.40
Book, Newspaper, and Newspaper Wholesaling	\$30.50
Movie and Video Production	\$30.00
Video Game Software Publishing	\$28.80
Business Analytics and Enterprise Software Publishing	\$27.30
Search Engines	\$24.50
Database, Storage and Backup Software Publishing	\$23.90
Book Stores	\$19.20
Computer Peripheral Manufacturing	\$18.20
Cable Networks	\$16.70
Radio Broadcasting	\$16.70
Movie Theatres	\$12.60
Telecommunication Equipment Manufacturing	\$10.20
Telecommunications Resellers	\$9.10
Printing and Related Support Activities ^a	\$8.60
Major Label Music Production	\$7.50
Music (including Digital)	\$6.80
Satellite Telecommunications Providers	\$5.10
Music Publishing	\$4.90
Video Postproduction Services	\$4.10
Movie and Video Distribution	\$2.10
Record Stores	\$1.80
Album Sales	\$0.33
Independent Label Music Production	\$0.32
Number of Cable TV Subscriptions	\$0.11
Total	\$1,826.26
United States GDP for 2010	\$14,582.40

Source: Data from IBISWorld Market Research, Forrester Research, the United States Bureau of Economic Analysis, and the World Bank

^aMotion Picture and Printing Data for 2009

something that is produced, purchased, replicated, distributed, sold, manipulated, passed along, or controlled (Case, 2002, p. 44), or as data in the environment. Generally, “information” can be analyzed in terms of a process, such as communication or storage, as the outcome of a process (that which is communicated, stored or computed), or as the mechanism through which the process is effected (the data or documents that contain the knowledge). Beyond this, information can include or describe algorithms that store dynamic processes, which is to say, software (See also, McKinney & Yoos, 2010).

Floridi (2010) also admits that information is “a conceptual labyrinth” (p. 19). He exposes the commonalities and differences among different types of information; mathematical, semantic, physical, biological, and so forth and suggests that information is, “data plus meaning” (See also Buckland, 1991). Following the founder of information theory, Claude Shannon, Floridi (2010) strongly emphasizes the distinction between the message and the medium.

For our purposes involving products, we too would like to emphasize that information is stored and communicated using some medium, and yet is logically and practically distinct from that medium. Information cannot exist without a medium to carry it, but it is (ever increasingly) transferable to or from any particular medium. Just as service scholars originally defined a service by what it was not (Judd, 1964), it is tempting to define information by what it is not; specifically, information is that which remains after the medium is subtracted. In order to create a positive definition, we start by pointing out that networked electronic devices are an increasingly important platform in which the message is (temporarily) embedded or carried in the form of a digital file consisting of a series of binary digits, that is, a string of 1's and 0's. Any such digital file therefore consists simply of a single natural number (nonnegative integer) expressed in base 2. Thus, we define information as *anything that can be converted into bits*. This definition seems to be consistent with how Gleick (2011) uses the term throughout his book, in which he starts with an example of African drummers and ends with a discussion of DNA. In this instance, the

stretched animal skins and the four nucleic acids are merely media that carry the information from one place and time to another.

Our definition of information is somewhat more inclusive than the typical English language usage of the word that implies “data” (Glazer, 1991). It seems possible that this language habit has influenced the literature on the economics of “information goods.” That literature pertains mostly to structured data used for some practical purpose.

What Are Information Products?

The ‘conceptual labyrinth’ evident in defining ‘information’ is reflected in the diverse way both scholars and practitioners present the concept. The few attempts to define ‘information products’ in the scholarly literature rarely seem to capture the essence of the concept we present here (see Table 2). One use of the term “information product” refers to selling of information that is valuable for making decisions, such as expert advice or opinions (Sarvary & Parker, 1997). A final, even narrower sense of an information product is that which offers useful data in specific formats, such as reports, tables, or lists (Shankaranarayan, Ziad, & Wang, 2003). Our definition closely matches Meyer and Zack (1996) and Tiwana and Ramesh (2001) who define information products as interdependent and intangible packages of information capable of distribution in digital form. This is quite similar to our notion presented below.

In addition to music, films, and software, our definition most certainly also includes newspapers and books. In addition, there are GPS location services and market-making services like eBay. There are algorithms that find the best price or a potential mate, or the bits owned by Eve Online that allow hundreds of thousands of people to play the same online game at the same time. Surely the economy is witnessing a huge growth in electronic services, which are in effect services that have been thusly transformed. In the case of e-service firms, like Google or Amazon, the bits code for and implement algorithms, which is the information theoretic term for a service process once it has been thusly transformed into bits. But these examples merely scratch the surface

TABLE 2:
Definitions of ‘Information Products’ from the Literature

We define information products broadly to include information provided in either electronic or printed form and sold to external markets as well as that provided by information systems departments within firms to internal “customers.” (Meyer & Zack, 1996)

I take this to be anything that can be digitized—a book, a movie, a record, a telephone conversation. (Varian, 1998)

Products that consist solely of information, that which is recorded about something, are information products. (Nezlet & Hidding, 2000)

An information product is defined as a highly interdependent package of information that is capable of being distributed in digital form. (Tiwana & Ramesh, 2001)

For example, information may be a private good or a public good, a raw “material”, intermediate or final product, it may be tangible or intangible, it may be confused with code or data or the systems delivering it, and the same information can be presented or versioned differently. (Raban, 2007)

Information good in economics and law is a type of commodity whose market value is derived from information it contains. Wikipedia https://en.wikipedia.org/wiki/Information_good.

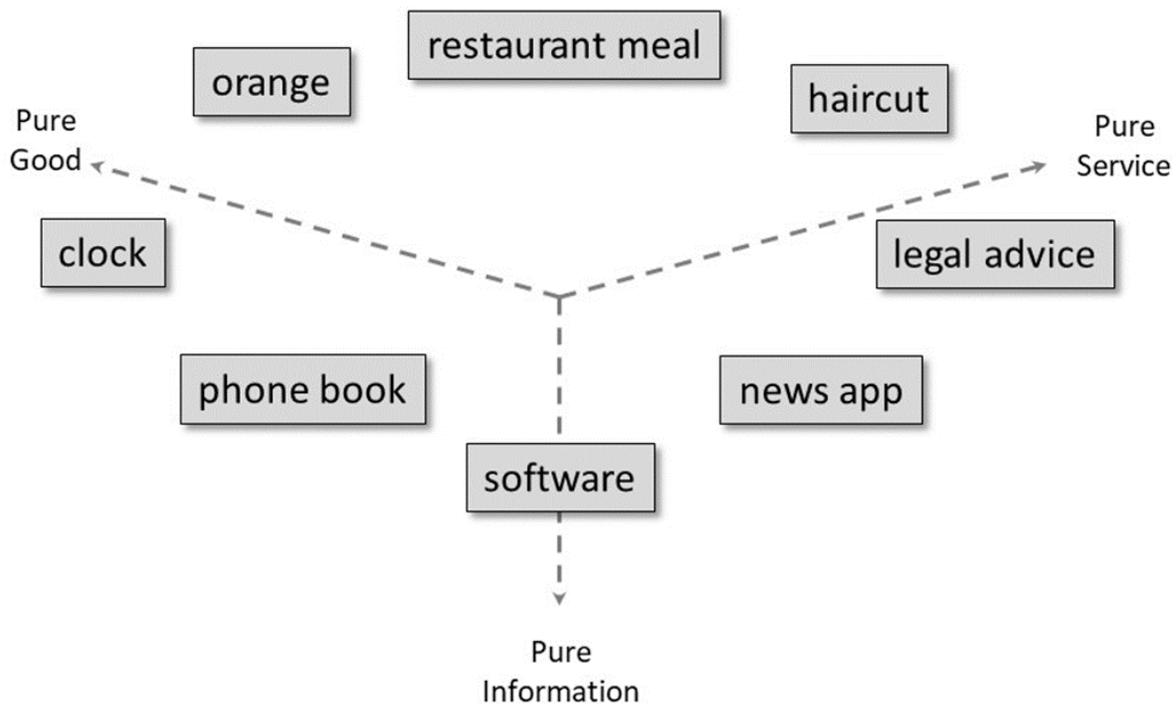
of the exploding information economy. The definition of an information product therefore becomes straightforward: *any product whose core value is capable of being converted to bits*. The mathematical basis for information products makes them uniquely abstract.

We propose that all products have (or could have) an information component to a varying degree, much like Kotler and Levy (1969) proposed that all products are mix of goods, services, persons, and so forth (see also, Nezlet & Hidding, 2000). For example, it is clear that while online retail usually involves shipping a tangible good, much of the core benefit of the service is based on digital information and algorithms. Almost every product can be seen as some combination of tangible (good) elements, perishable service elements, and information elements. Freiden et al. (1998) posit, as a bundle of benefits, every product contains some degree of information located more or less central to the core benefit it provides. Figure 1 illustrates the principle with some examples.

To pick an example not featured in Figure 1, it is estimated that a modern luxury car has 100,000,000 lines of computer code (Charette, 2009). The fourth foundational premise (FP4)

of service-dominant logic (Vargo & Lusch, 2004) proposes that knowledge is the fundamental source of competitive advantage. More and more we see knowledge codified into software making FP4 true in the economy. As another example, consider the Amazon Kindle, which is clearly a combination of a good, service, and information. Since its introduction in 2007, it has already come to nearly dominate an industry that can be said to have started with the invention of moveable type in China in 1040 and 1450 in Europe. New information products are emerging that will further challenge the economic status quo: the self-driving car might radically change transportation services, automated essay grading may reshape education, and professional services may be disrupted by products that resemble IBM's Watson, the program that beat the best humans at *Jeopardy!*. The category of 3D printers, which are systems that translate code and diagrams into tangible goods, holds out the prospect of an even more fluid relationship between information, services, and goods. Finally, we note that the electronic devices that occupy daily life are nothing without information content and the instructions for what to do with that content. So, given the size of the information economy (See Table 1), the rising importance of the

FIGURE 1.
THE THREE COMPONENTS OF ALL PRODUCTS



information component of many products, and the ubiquity with which we already observe information products, we now highlight some of the marketing challenges.

UNIQUE CHALLENGES FOR INFORMATION PRODUCTS

At its heart, the services revolution in marketing succeeded because it argued that services had different properties than tangible goods, which is to say on both the firm side and the consumer side they had properties offering challenges that therefore required special attention. For example, the intangibility of services makes services difficult for consumers to think about while the perishability of services makes services difficult for marketers to manage. Managing information products likewise present unique challenges to marketers, especially those stuck in a product-centric world. For example, the problem of

sampling digital content can present a tricky situation when the sample contains the product itself (see Li, Jain, & Kannan, 2019).

So how is information different from goods or services? Table 3 uses a variety of constructs from the marketing literature (see Freiden et al., 1998) to highlight differences among goods, services, and information. The rows of the Table 3 are drawn from both the services marketing literature (tangibility, separability, heterogeneity, perishability, ownership), but also from digital marketing. As Table 3 illustrates, information products share some similarities with goods and some similarities with services. Yet, the complete makeup of information products’ characteristics reveals a distinct type of product offering. In our view, to label an information product as a good or as a service grossly oversimplifies its marketing challenges.

We see the leap from goods marketing to services marketing as being part of a longer-term progression towards a higher level of abstraction in the economy. Looking back in economic history mankind proceeds from hunting and gathering to agriculture, and then from agriculture to goods manufacturing, with increased complexity and abstractness involved in exchange. The transition from a goods-oriented to a service-oriented economy likewise increased the level of abstraction since exchange that deals with objects is easier to conceptualize than exchange dealing with acts, deeds, or performances. Finally, as we go from services to information, the level of abstraction increases yet again. Information is even more abstract and intangible than are traditional services.

Exchanges involving information are often defined as services (Vargo & Lusch, 2004). However, such a label masks the mathematical or abstract nature of information products. The concept of product abstractness illustrated by the example of a particular benefit a consumer receives with a photograph: the ability to capture, save, and share a moment or experience. Marketing tangible good products, such as a camera sold in a retail store, relies on well-accepted management philosophies, such as efficient supply chain management and retailing principles. Here, the tangible product is concrete and not particularly abstract, meaning greater physical resources need to be devoted to moving the good along the supply chain until it reaches the end consumer. The lack of abstractness can also enable consumers to determine the quality of the product more

easily. Instead of a consumer purchasing and using a camera to achieve the sought-after benefit, now a service provider in the form of a photographer can perform the service to capture, save, and share a moment. For the service provider, some marketing management principles may include managing the perishability and inseparability of an offering through efficient scheduling or the degree of customization available for each customer. The primary benefit sought to capture, save, and share a moment can be achieved with an information product offering, such as that offered by Instagram. Instead of a consumer purchasing a tangible product or hiring a service provider, the sought-after benefit can be achieved with easy-to-use downloadable software that is constructed, at its most basic level, with a series of bits in its program code. This information product then uses tangible media, in the form of a consumer’s mobile device, as well as other information products, such as social media sites, to achieve the sought-after benefit.

The notion of abstractness underlies what we refer to as the SMP properties: information products are more *scalable*, *mutable*, and *public* than services or goods. Products possessing these unique characteristics create many marketing challenges. The following sections elaborate on the SMP properties in a higher level of detail.

SCALABLE INFORMATION PRODUCTS

In simplest terms, scalability is an ability to grow (Varadarajan et al., 2010). In computer

**TABLE 3:
Characteristics of Three Types of Products: Goods, Services, and Information**

Goods	Services	Information
Tangible	Intangible	Intangible but need tangible media
Homogeneous	Heterogeneous	Homogeneous
Separable consumption	Inseparable consumption	Separable consumption
Can be inventoried	Cannot be inventoried	Can be inventoried
Owned or rented	Rented not owned	Owned or rented
Can be patented	Cannot be patented	Can be patented
Easy to price	Hard to price	Hard to price
Cannot be copied	Cannot be copied	Can be copied
Can be shared	Cannot be shared	Can be shared
Use = consumption	Use = consumption	Use ≠ consumption

science, it is most often used in the sense of multiple orders of magnitude; the ability of a solution to function in the face of inputs or outputs that change by a factor of 10, 100, 1,000 and so on. Information products are in effect infinitely renewable due to the low marginal cost of reproduction and copying. This is true for good-like information products (musical files) as it is for service-like information products (useful apps). Focusing on the latter for now, since service processes can be encoded as algorithms, self-service technology often requires minimal firm involvement. For instance, Facebook has slightly in excess of 43,000 employees and over 2.4 billion active users as of September 30, 2019 (<https://zephoria.com/top-15-valuable-facebook-statistics/>). Simple arithmetic reveals around 55,800 users per employee. Clearly Facebook's information service scales. How is this possible? To answer this question, we need to contemplate the non-intuitive meaning of low marginal costs.

The meaning of low marginal costs. The cost of copying a CD is currently on the order of \$.0001. While this sum is not zero, we note that even if we do this one million times, we end up with a total cost of one hundred dollars. In addition to reproduction, the cost of other sorts of manipulation of information products is also falling precipitously. Of course, this does not include the fixed cost of producing the information product, but the strategic distinction between fixed and marginal costs is critical, and in our view, information products can be usefully characterized as having a ratio of marginal to fixed cost that approaches zero. We note that in fact, the classic economic dictum that the producer sets a price such that marginal revenue is equal to marginal cost leads, in the case of information products, to a fundamental problem. Clearly, we must look elsewhere than the classical dictum.

In the physical, non-digital world, both intangible services and physical goods tend to have non-zero marginal costs, especially services. A traditional inseparable service requires the joint physical presence of service provider and service consumer, and by implication production tends to be costly to schedule or modify. Much is often made of the fact that air transportation service between two

cities has a zero marginal cost for the next customer in the sense that managers would prefer to fill a vacant seat at any price (Pfeifer, 1989). The airline example can be misleading because in this case the service cost function is merely a step function of quantity demanded, not a flat function. The cost function is in fact only flat within the fixed capacity of a specific aircraft. This argument is also made with hotel registration and with various other fixed capacity assets, such as stadia or theaters. The break-even point for filling an empty hotel room might be close to zero, but it is a very expensive proposition to add capacity above the capacity limits of the hotel. A more typical and therefore more illustrative example of the cost to serve would be the classic haircut. The marginal cost of cutting one more head is substantial. The cost function for tangible goods products necessarily involves non-zero marginal cost as well. The thing itself must be manufactured and distributed with a concurrent expenditure of raw materials and energy. It is only with information that we see marginal costs truly near zero. The zero marginal cost of copying an information product elevates the importance of demand factors above cost factors for pricing decisions and multiplies the impact of secondary phenomena, such as network effects. We will discuss this under the topics of externalities and standards.

Network externalities. The value of purchasing an information product often depends on the number of other purchasers, a phenomenon referred to variously as a consumption or network externality. For example, a larger customer base may lead to economies of scale for the producer (Economides, 1996), or may induce other firms to sell complements or other after-market add-ons (Kotabe, Sahay, & Aulakh, 1996). In addition, if the product requires some sort of additional investment on the part of the consumer, perhaps training or learning, this training becomes more valuable as more consumers buy the same product (Schilling, 1998).

This latter point is important in both consumer marketing (B2C) and in many business-to-business (B2B) situations. A firm that invests time and training in a particular software system may become locked-in (Hill 1997). This is one of several reasons why markets with

network externalities tend to be winner-take-all, a critical strategic observation. In general, the presence of network externalities tends to work towards a single standard. This phenomenon can be described as a bandwagon effect (John, Weiss, and Dutta 1999; Katz and Shapiro, 1992; Shapiro & Varian, 1999), as exhibiting a tipping point (Frels, Shervani, & Srinivasan, 2003; Shapiro & Varian, 1999), or herding in the case of fads or fashion (Bikhchandani, Hirshleifer, & Welch, 1998). An important property of such markets is path-dependence (Schilling, 1998) meaning that the winner is sometimes determined on the basis of seemingly inconsequential historical events that lead to a small initial advantage. Clearly any tactics that tend to generate early leads in market share are called for in the presence of network externalities. Such tactics include being the first mover, penetration pricing, free trial, and early, heavy advertising spending to create awareness. Tactics such as these can also solve the chicken-and-egg problem (Dhebar & Oren, 1985; Srinivasan, Lilien, & Rangaswamy, 2004) inherent when there are no adoptions yet.

Standards. It is precisely the arbitrariness of the mathematical (bit) representation of an information product that leads to the importance of standards in this arena. Standards are necessary for production, encoding, distribution, decoding, and final delivery of information products. Niches exist and competitive advantage can be derived in all of those processes. Autodesk's product AutoCad has become the standard for producing engineering and architectural designs. It is possible that you are now reading this article thanks to an encoding-decoding standard from Adobe known as PDF. If so, the PDF file could well have been delivered to your desktop using the Ethernet standard originally developed, and famously not commercialized by, Xerox PARC.

Standards are inevitably as much a marketing question as an engineering problem, a fact made clear by the classic Betamax versus VCR battle of the 1980's. After reviewing a number of other historical standards battles, Shapiro and Varian (1999) list seven key company assets: an installed base of users, intellectual property rights, ability to innovate, first-mover advantages, manufacturing capabilities,

strength in complements, brand name, and reputation. Often customer-facing standards appear in the form of a metaphor, an understudied marketing phenomenon. In adopting a standard, a customer must frequently make an investment in it. In the case of consumer markets, this investment may be in the form of time spent learning (Johnson, Bellman, & Lohse, 2003; Zauberaman, 2003). In the case of businesses, the issue may pertain more to the nature of the assets required for the adoption of the standard (Rindfleisch & Heide, 1997). In either B2C or B2B markets, the existence of complementary products (Schilling, 1998) may be crucial. If the standard is owned by the firm, these investments create a barrier to imitation to other firms (Hill, 1997).

In summary, owing to the unique properties of information, scaling up production likely involves low marginal costs, network externalities become highly important, and setting standards for information products becomes a crucial managerial task.

MUTABLE INFORMATION PRODUCTS

The manipulation of information products takes place within the logical world of computers rather than in the physical world. Such manipulation includes a wide variety of activities such as storage, sorting, repurposing, aggregation, disaggregation, organization, distribution, packaging, reformatting, indexing, and connecting. Information products make it possible to do any of these things at a low cost. It also leads to the optimality of more dynamic and discriminatory pricing policies, a generalization that encompasses the use of auctions.

Mutability is due to extreme abstractness or intangibility – call it the essential lightness of information products. It allows for a freedom of design that is unconstrained by the physical world. On the one hand, this frees the firm to develop such products in a way that focuses on customers. On the other hand, both firms and customers are encumbered by increasing complexity. The firm has to manage a growing amount of intellectual property, while the impact of complexity, roughly the inverse of ease-of-use, encumbers the customer as well.

The design challenge is to innovate and bring the customer along, metaphor and all, for the ride. Versioning, bundling, and menu cost strategies are some ways for marketers to cope with the mutability of information products.

Versioning. The malleability of information allows firms to inexpensively create different versions of an information product, offering each one at a different price (Varian, 1997). A simple example of this occurs in the financial services sector where a firm might provide free data on the stock market with a certain time delay, while selling the same stream of data with minimal delay at a higher price. We pick as a second example, Adobe, a connection platform company that offers various versions of its software with different capabilities at different prices. The ability to write PDF files is sold at a relatively high price, while the Acrobat product that only reads PDFs is offered completely free. This means that Adobe generates revenue from content producers, who will tend to be less price-sensitive. Content readers, on the other hand, are given a free information product, which allows Adobe to generate demand in the market for PDF files and thus encourage providers to buy the write-capable version.

One motivation for versioning is the fact that an information product is an experience product (Wijnhoven, 2002) and as such, there is a "conceal versus reveal" dilemma. In order to evaluate an information product, the consumer must see it. But once he or she has seen it, he or she no longer needs to purchase the product. Versions can be used to get around this dilemma by allowing the consumer to sample and develop trust in the seller. Another way out of the problem is to turn the information product into a service. An example of turning the sale of software into a service is the case of application service providers, frequently known as ASPs. Instead of buying software, buyers can lease it one use at a time from another firm's servers.

Versioning is logically related to the notion of repurposing information, where the fixed cost of development can be spread out over various product line offerings derived from the same initial investment. In the film industry you can have different versions of a movie created for

television, video, and theatres. In the music business, a song will appear in various forms on CD, DVD, or as a music video. From the basic investment required to create a database of words and definitions, Merriam-Webster produces books, a Web site, CD-based products, and games.

This ability to create economies of scope from the development of information products has led Meyer and Zack (1996) to transfer lessons learned in the production and manufacturing of physical products to the realm of information products. Thus, according to those authors, information product design should utilize common architectures and subsystems. Information products generally have two categories of direct inputs: other information products and human creativity (Benkler, 2002). Both should be optimally managed, nurtured, and leveraged.

Given the low cost of manipulating an information product, it is feasible to produce versions of products designed for a single individual. Information products are prototypical examples of trends based on this strategy, alternatively called mass-customization (Wind & Rangaswamy, 2001), one-to-one marketing (Peppers & Rogers, 1993), or personalization (Goldsmith, 1999). Another feature of information products that is related to versioning, which describes how the 'producer' of the information creates different versions for users, stems from the unique ability of users to create information products themselves or co-create them in an alliance with the producer. This 'user-generated content' adds another aspect to information products that make them unique and different from goods and services. Examples include games and Facebook applications, help for other users, advertising and branding ideas, media uploads and digital content to YouTube, reviews, or wikies (see Krumm, Davies, & Narayanaswami, 2009). Consequently, consumers can take an active role in product and branding management not only for goods and services, but for purely information products as well.

Bundling. The basic phenomenon of bundling has been studied for more than 40 years, first in economics and then in marketing, and forms a

core sub-topic that often appears in writings on pricing (Nagle & Holden, 1995). The advantage of bundling comes into play under certain distributions of consumer valuation or under certain cost structures (Stremersch & Tellis, 2002). The relevance of bundling to the marketing of information products lies largely in the fact that separate information products can indeed be bundled with minimal or no additional cost to the seller. For example, in a market characterized by high levels of consumer uncertainty or risk, a firm might choose to bundle separate information products so as to reduce the perceived risk of the elements in the bundle (Sarin, Seigo, & Chanvarasuth, 2003). However, the classic motivation to bundle occurs when a negative correlation exists in reservation prices.

The fact that one can easily manipulate information products implies that it should be possible to create extremely large bundles, and Bakos and Brynjolfsson (1999) have demonstrated the effectiveness of bundles containing large quantities of products. What's more, the flexibility of information products that are ordered and delivered over electronic networks implies that customers themselves might be allowed to design their own bundles (Hitt & Chen, 2003).

While much of the economic analysis of bundling assumes a monopolist trying to maximize profit over a single time period, an often missed benefit of bundling is that of entry deterrence (Nalebuff, 2004). Bundles allow companies with more products to compete more effectively against companies with only a subset of those products. Moreover, a marketer of product A and product B can make it more difficult for a rival firm to compete in the market with only one of these products. In addition, this advantage makes it possible for the incumbent firm to defend market share more easily without relying on a lower price than competitors.

Finally, we could point out that one competitive disadvantage of open electronic selling and distribution of goods on the Internet is that costs and prices become more transparent to the customer and to the competition (Sinha, 2000). Bundling can mitigate this problem by making the costs of the individual information products

in the bundle more difficult to impute. Not only do information products lend themselves to bundling, but also are easily unbundled if that presents an advantage, a tactic known as price partitioning.

Menu Costs. A general property of electronic commerce whether the item being sold is an information product or not, is the relatively low cost of changing prices, usually termed *menu costs*. While low menu costs can apply to purely physical goods or services, we will discuss this topic for two reasons. First, information products are ideally suited to electronically-mediated selling, where menu costs are lowest. Second, the low marginal cost of producing an information product makes it ideal for frequent price changes as its cost tends to be entirely sunk (Nagle & Holden, 1995), given the vanishing ratio of marginal to fixed cost.

We can then characterize two implications of low menu costs. First, we note that frequent price changes are feasible allowing management to adapt rapidly to changing consumer demand or preferences, or to changes over time in the value of a product (Biswas, 2004). Second, lowered menu costs create opportunities to implement price discrimination across segments or individuals at a reduced cost. Working against the ability to offer the same item at different prices is the above-mentioned transparency of electronic media. Amazon discovered this problem (Garbarino & Lee, 2003) when it became known that it was charging different amounts to different customers, and it ended up having to offer refunds to some customers.

The ease with which digital DNA can be modified implies an important shift from managing products to managing product ecologies with their associated dynamics and complexities. In addition, the high degree of abstractness of information, its lightness and transportability, allow for easier participation between larger numbers of stakeholders than might be feasible with goods or services. One example of this ecological perspective is Android. There are users (i.e., consumers), app developers, open source contributors, handset makers, mobile service providers, Google, and so forth. Each of these stakeholders co-creates value. A large number of stakeholders exist in many goods and service markets whenever

there is specialization, but information technology and costless mutability allows for more complex exchange patterns among larger numbers of players. In general, the number of stakeholders is likely to be greater for information products than for traditional goods or services, thus creating more complex exchange systems than marketers are accustomed to.

Thus, the mutability of information products enables marketers to use unique strategies not common for tangible goods, and only partially so for services. Different versions of the product may be created while avoiding the problems of bloated product lines that can beset tangible goods companies. Marketers can create unique bundles of information products and alter prices easily to adapt to changes in the marketplace, consumer tastes, or competition.

PUBLIC INFORMATION PRODUCTS

Information offerings are public products in the economic sense. They have two key properties: they are non-rivalrous in demand and non-excludable in supply (Sinha & Mandel, 2008). The former property means that the consumption of the product by one consumer does not preclude its consumption by another consumer. Non-excludability is the inability of firms to control the supply, another implication of the low/zero marginal cost of copying such products.

The public property of information products means that any firm trying to generate revenue from them shares many of the same challenges faced by a firm attempting to generate revenue from the air, the classic example of a public product. Despite substantial research on the economics of piracy, it remains unclear if piracy is a detriment or a benefit for firms (Givon, Mahajan, & Muller, 1995). Nor is it clear why the case of piracy in film, for example, involves criminalization and yet it is implicitly encouraged in fashion (Sprigman & Raustiala, 2006).

From our point of view, we note that the most successful case studies involve firms leveraging the public property of information products while simultaneously turning their offering into a service. Examples of this servitization

approach abound. Musicians often give away recorded music, but then charge for live concerts. Game makers give away the game while using a service platform to control access to other players. There is also an opposite strategy of tangibilization. Some musicians offer free concerts, but charge for recorded versions. Film studios generate revenue from selling toys associated with a movie. The ease with which information products can be servitized or tangibilized makes this an interesting strategy area. Consequently, marketing information products that easily can be copied and shared and that can morph back and forth between something that looks like a good vs. something that looks like a service requires new thinking and new strategies, as illustrated by Papies, Dominik, and van Heerde (2017).

CONCLUSIONS

We begin our conclusion by suggesting again that information products take their place along with tangible goods and intangible services as part of the marketing canon. Just as the services revolution showed marketers that products are not just goods, we propose that the information revolution reveals that products consisting of information are not quite the same as goods or services. Moreover, the abstractness associated with information products creates unique challenges for buyers and sellers hence opportunities for marketers that are not present with either goods or services.

We have proposed that information products are taking on a larger role in the economy and that a growing number of market offerings -- be it a tangible good product or a service product -- now feature an information component. Note that this trend calls into question the very tangibility of goods. The category of 3D printer will further blur the distinction between information and tangible good, leading to manufacturers needing to use the strategies we have outlined above. Those changes are important, but the blurring of the distinction between service and information will be just as important.

Services more often are delivered as e-services, and human-delivered service is more often enhanced via information technology. As

algorithms get better, new automated offerings will invade professional services. We note that Philip Parker has created an algorithm to write books, IBM's Watson service will be used in medical, legal, and other professional fields, and even teaching will see the automation of essays.

Since information products include software, which is information that operates on other information, the life of an information product can take on an autonomous trajectory, modifying itself with experience. A distinction has historically been made between codifiable knowledge and tacit or implicit knowledge (e.g., Nonaka 1994), sometimes called know-how. The classical example of know-how is riding a bicycle. Advances in algorithms have now demolished this distinction as robots are capable of riding bikes. Machine learning is being applied in many contexts, either as a supplementary service (in the context of a recommendation agent for an e-tailer) or sometimes as a core service (automated essay grading).

What is interesting about these examples is that the service as originally developed by the firm may be quite different from the service as experienced by the buyer, who benefits from the machine learning. Nor will it be straightforward for the marketer, or the customer for that matter, to predict the eventual outcome of the service. We note that more than 75 years ago Alan Turing (1936) proved that it is impossible in general to know the outcome of a program.

Just as the introduction of the concept of services as a product alongside tangible goods was met at first by skepticism on the part of both practitioners and academics, we expect that the concept of information as a product will meet a similar fate. The difficulty in arriving at a universally accepted definition of information contributes to the difficulty in viewing information as a product. Consequently alternative points of view or perspectives on this topic can arise. Healthy discussion of this topic can only benefit marketing theory and marketing practice. Over time, we predict that as more and more of the economy becomes based on information products as we have defined them, the idea that

goods and services as products contain an informational component and that purely informational products (even those that have a tangible good or service element in them) will become part of the marketing canon.

Consequently, marketers and managers of all stripes should determine if their products are primarily informational in nature. If so, they should consider marketing and management in a unique way that focuses on the SMP properties and emphasizes the strategic techniques we discuss here. Marketing in the future must focus more on managing externalities and standards, with marketers using tactics such as versioning, bundling, price partitioning, dynamic changes to menu costs, autonomous software offerings, servitization, and tangibilization strategies.

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