



## Research Paper

# DEVELOPING BUSINESS MODELS FROM A KNOWLEDGE-BASED PERSPECTIVE

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## Abstract

*In the knowledge-based economy today, knowledge is recognized as the driver of firm competitiveness. However, how a firm can base on knowledge to develop its business model has yet been fully explored in academia. Using software and books as our cases to undertake historical research, we aim to shed light on the development of business models from a knowledge-based perspective. We reviewed past literature to explore the knowledge essence of software and books, contending that software, like books, is an artifact that embodies knowledge. Based on our historical analysis, we then illustrate how software firms and book publishers can develop their business models from a knowledge-based perspective. Three aspects, knowledge preservation, knowledge acquisition and dissemination, and knowledge application, are addressed. Today, firms from other industries also rely heavily on knowledge to do business, and they need to rejuvenate their business models, from a knowledge-based perspective as well. We further elaborate how our approach can be applied by firms in other industries, especially in the manufacturing industry. We conclude that, in the knowledge-based economy, developing new business models based on the knowledge perspective will allow firms to secure their long-term competitiveness.*

**Key Terms:** *Business models, knowledge-based, software, value creation and appropriation.*

## **1. Introduction**

Business model has become a buzzword since the dotcom rush. Numerous articles in newspapers and magazines have talked about business models, with scholars jumping on the wagon to publish academic papers (see Zott, Amit, & Massa, 2011 for a review). As the Internet bubble burst, people gave business model a bad name. For many, the term represents reckless business plans which promise wild profits, while not likely to realize.

In all fairness, it is not the concept of the business model to blame. It was the misunderstanding and abuse of the concept that led to the creation and collapse of the bubble. Enterprises since hundreds years ago have been applying the concept, without the fancy jargon of business model, to conduct their businesses (Shafer, Smith, & Linder, 2005). After the Internet boom subsided, most people have accepted the idea that good business models are crucial for companies to survive and succeed. But how to develop a good business model did not appear to be as intuitive.

Looking back on the past articles on business models, one can easily find that most of them have focused on the Internet or new technologies, elaborating how dotcom companies and conventional bricks and mortar firms alike can harness the Internet and latest technologies to stay competitive. But very seldom have business models been analyzed from the essence of a company's business. For an increasing number of companies, knowledge creation is the foundation of their business, in that the world economy is evolving toward knowledge-centric (Carrillo, Metaxiotis, & Yigitcanlar, 2010), where knowledge becomes the most important determinant of economic growth (Harris, 2001). In such an environment, it is imperative for firms to link their business models with knowledge. However, so far few articles have articulated how to develop business models from a knowledge-based perspective.

In this article, we aim to shed light on development of business models based on knowledge. We argue that software, like books, is an artifact that embodies knowledge. Both books and software suffer from the free rider problem, which cannot, and will never, be completely solved by the legal system of intellectual property rights alone. For these embodiments of knowledge to be economic goods for profit, a sound business model to compensate the insufficiency of legal system is necessary. Then we elaborate how software firms can develop their business models from a knowledge-based perspective. To avoid confusion and maximize the richness of information, we limited our scope of discussion to exclude recreational books and software, focusing on those related to knowledge only.

## **2. Literature Review**

### **2.1. The software industry**

Since its birth in the 1950s, the software industry has been evolving alongside the computing technologies, reaching a whopping size of \$600 billion (Cusumano, 2004). In the very beginning, software was separated from hardware to direct the operations of mainframe computers. It was later developed to work with various kinds of hardware devices, such as minicomputers, workstations, personal computers, laptops, network equipment and servers, and smartphone, as these devices became prevalent. Today, software is ubiquitous: it has become a part of our daily lives, an indispensable enabling mechanism for technological, economic and social processes. It also plays a crucial role in the global economy (Hoch, Roeding, Purkert, & Lindner, 2000).

However, the software industry has encountered unprecedented challenges since the dotcom bubble burst. Financial crisis in 2008 and consequent global economic slump further

brought on a dramatic decline in information technology and software spending. The industry stifled, and mergers and acquisitions have been carrying on. Numerous software firms went out of business, while many others struggled to barely survive. Many blame on sluggish technological advances or economic upheavals for the difficulty of software business, proven to be nothing more than a black sheep. It is actually the business model that determines the success or failure of a software firm (Cusumano, 2004). Yet, sound software business models require a thorough understanding of the nature of software.

## 2.2. The Nature of Software: Software as Embodiment of Knowledge

Software is a unique artifact, in that it possesses both characteristics of a service and a product. Software lacks physicality and thus fits the criterion of a service, while it resembles a product when it is stored on CDs, computers, or smartphones to be sold and delivered. The service-product duality makes it inappropriate to categorize the software business in either manufacturing or service industries. Hence, it is not adequate to analyze software via the service-product dichotomy. A more fundamental and higher abstraction level of analysis is imperative. This viewpoint logically leads us to the next question: what is the nature of software?

Software is, in essence, only algorithms with little physical apparatus, and can be stored on different media or loaded onto different devices. It is the software that confers significant values to the tangible media or devices (Kenney, 1996). In a shrink-wrapped software package, the box and discs account for only a trivial portion of the total value. A computer without any software is virtually useless and worthless, because users buy a computer to perform various functions, such as producing documents, doing calculations for their financial investments, or sending email. Without software, none of the functions can be carried out. It is the embodiment of knowledge in software that enriches the media or enables the devices, and thus creates value. The same logic also applies to a variety of artifacts that embody knowledge. Books is a good example.

## 2.3. The Resemblance of Books

Books may be the oldest form of knowledge embodiment. Before the invention of books in ancient civilizations, knowledge was preserved and disseminated by means of oral accounts such as word of mouth, tradition, and hearsay. Later in history, when writing systems developed, leaves, stones, clay tablets or parchment scrolls were used as the composing substances of books. Before printing prevailed, books were published in a very limited number and cost a lot. Writing a book was extremely painstaking, and making additional copies of the same book took no less efforts. In economic terms, production cost and reproduction cost of a book were both high. As a result, the material and knowledge are inseparable, and both are valuable for a book.

It was not until Johannes Gutenberg greatly improved the printing press in 1455 that books started to be affordable and widely available (Man, 2002). Paper later replaced other substances to be the main constituents of books and dramatically drove down the material cost. Reproduction cost became much lower in comparison with production cost, so a book's value soon shifted toward the intangible knowledge end. Today, the value of a book is not in paper or ink, but in the knowledge embodied.

## 2.4. Evolution of the Software Business

Software has a much shorter history than books. Before the 1950s, the term "software" was not even coined, while "hardware" had already become a household name. In the early 1950s, software programs were perceived as things without intrinsic value, because computer manufacturers sold hardware with complimentary software. But users still needed to write most of their programs in house to perform different tasks. Soon a shortage of program-writing manpower provoked the birth of software business, which began as programming services. At

that time, software contractors wrote one-of-a-kind programs for specific corporate or government customers (Campbell-Kelly, 2003).

Not until the 1960s did software transform from a service to a product. Software products companies started to produce programs which could be used, with little modifications required, by more than one single customer (Campbell-Kelly, 2003). Enhanced new versions of software were released constantly to extend the product lifecycle and thus generate ongoing revenues for software firms. This approach has since become the most common practice for the entire software product industry.

While some software programs are pre-installed on computer hardware and put up for use along with it, most software products are now stored on web sites or online app stores to be downloaded and licensed to consumers. The software product approach is essentially based on the protection of the intellectual property rights (IPRs) system, which encounters tremendous challenges in recent years.

## 2.5. The Free Rider Problem and the Insufficiency of IPRs

Artifacts embodying knowledge, such as books and software, are subject to the free rider problem. Once created, they can be easily accessed and acquired. Much lower reproduction cost, compared with the high production cost, makes it tempting for users to make copies on their own. Therefore, free riders can get a copy of a book or software at little or even no cost at all. In response, the IPRs system comes up as the institutional solution to the problem (Harris, 2001). Copyright provides the protection to exclude, for a certain period of time, people who do not pay from using the products, so producers can capture certain value created via the productions of the products.

However, enforcement of IPRs is far from perfect. Piracy has always been a serious problem, and is expected to remain one in the foreseeable future (Shin, Gopal, Sanders, & Whinston, 2004). Even for established software firms such as Microsoft, whose customer base has been large enough to enjoy monopoly power, piracy still causes huge losses, not to mention other software firms. The cost to go through the law enforcement and litigation process is too high, especially for small companies and firms with the majority of revenue coming from regions with rampant piracy issues. The impacts of piracy are huge and unbearable. The IPR system alone does not effectively protect value software firms create. They have to find supplementary approaches, or even alternatives, to capture value they create. Value creation and value capture are exactly what a business model is all about (Amit & Zott, 2001; Saloner & Spence, 2002; Shafer, Smith, & Linder, 2005; Zott et al., 2011).

## 2.6. Business Models

Even with the absence of consensus on business model's definition and scope, researchers generally consider business model a firm's underlying logic of value creation and value capture when doing business (Zott et al., 2011). In practice, a business model encompasses different components, such as participating business actors and their roles, the scope of offerings, connecting activities, revenue sources, pricing scheme, and mechanisms to develop complement goods and safeguard against substitutes to sustain. Various types of business models are created by means of altering these components or modifying combinations of these components. But before a company develops and arranges components in its business model, the most fundamental and important is to think thoroughly in advance what the logic of value creation and value capture should be: is the current logic relevant or applicable? If not, what a new one should be?

## 3. Research Design and Methodology

We adopt historical method (Gottschalk, 1969; Golder, 2000; Mason, 1997) to undertake this research. The historical method uses a process of collecting, verifying,

interpreting, and presenting evidence from the past (Golder, 2000). It offers perspectives on phenomena that are unavailable by any other methodological means, and provides a channel for researchers to understand the present and possible future from the past (Shafer, 1980).

We follow the procedures suggested by Golder (2000) to collect evidence, critically evaluate the sources of the evidence, including primary sources and secondary sources, critically evaluate the evidence, and analyze and interpret the evidence with external criticism and internal criticism. External criticism and internal criticism revealed high reliability and validity of the data. We present the results below by elaborating the fundamentals of the need of knowledge, and how software firms and book publishers can develop business models based on customers' need of knowledge.

## **4. Results and Discussion**

### **4.1. Fundamentals of the need of knowledge**

For artifacts that embody knowledge to be an economic good for profit, fundamental questions come up naturally: Why do people need knowledge? What are they going to do with the knowledge? To answer these questions, we first take a look at books. Why do people buy books? What can books do for them? Books preserve knowledge, and, except for antique and gift books, most people buy books for the knowledge kept within. They want to acquire, disseminate, or apply the knowledge. Once they learn from books (i.e., acquire knowledge), they can teach somebody else (i.e., disseminate knowledge), or use what they have learned to solve problems (i.e., apply knowledge).

People buy software for the similar reason, but the mechanism of knowledge embodiment in software is much more complicated. Software comes with various forms and functions. Some software, similar to books, simply preserve knowledge, such as Encarta, a digital multimedia encyclopedia published and updated by Microsoft, while most software, such as Intuit's financial application software "Quicken", SAP's enterprise resource planning (ERP) and customer relationship management (CRM) software, and SAS' statistic and analytic software, preserve both knowledge and the actions or processes of acquiring, disseminating, or applying knowledge. These actions are, or can be, undertaken by software programmers rather than software users, and embodied in software codes. In the following paragraphs, we will elaborate more details from the three different aspects—knowledge preservation, knowledge acquisition and dissemination, and knowledge application, and explain how software firms can develop their business models in the three areas respectively.

### **4.2. Knowledge Preservation**

Both books and software preserve knowledge for their readers or users. Book publishers and software firms can thus develop business models based on how knowledge is preserved. For example, preservation of knowledge can take different forms and utilize different media. Traditionally, books were made of paper and ink; as technology advanced, they appeared in new forms and in new media such as multimedia CDs (books turned into software in this form), e-papers, online books, or digital databases. These new forms and new media bring new values for readers or users, such as imperishability, interactions, and ease of search.

Similarly, software professionals can exploit new technologies to change software's forms of expression and thus creates new values for users. Most software programs we used earlier appeared in the form of "software package" or "executable program". Once the program is "installed" or "loaded" to a computer, the machines can interpret it and "execute" it to perform certain tasks. However, standard software packages or executable programs are not the only choice of software forms. Other candidates include class libraries, mobile agents, byte-code for use with an interpreter, platform-specific binary executables, permanently loaded firmware, applications that mix software and content, or even icons, UI string, and source codes.

These forms are basically components, half-finished goods or raw materials in the world of software.

These semi-products can, however, create different values for different users. The so-called “component-based software development” and “software component licensing” are making progresses toward this direction (Chavez , Tornabene, & Wiederhold, 1998). For instance, SynCFusion and /n software inc., two software firms specializing in software component licensing, develop and license various software components to Fortune 500 companies and technology vendors such as Microsoft, Sony, Xerox, Cisco, Dell, and Intel, etc. Software developers in those companies then, based on the component licensed, build Internet enabled web and desktop applications targeting various platforms and functions. Although the software component licensing business is still in its early stage, which calls for a lot more cooperation and integration among firms to overcome certain technical and legal issues, yet its potential is promising, especially after more and more industry standards like web services have been introduced to the world.

#### 4.3. Knowledge Acquisition and Dissemination

Knowledge preservation is not the only way to develop business models. Book publishers also design business models to help readers acquire or disseminate the knowledge embodied in their books. They organize readers’ clubs, hold forums, seminars, or workshops, and sometimes provide supplementary tools, such as video tapes or multimedia CDs, to help readers acquire or disseminate knowledge. These side businesses can be lucrative, sometimes even replace book publishing to become the core business. Software firms can certainly do the same, but they can do even more, because knowledge is embodied differently in software than in books.

Knowledge embodied in books is to be preserved and later disseminated as books are distributed, but the use of knowledge does not take place right upon reading. Basically, readers have to study the contents and comprehend what the authors intend to express, then they can apply the knowledge. Application of knowledge depends heavily on the readers’ learning and absorptive capabilities.

On the contrary, knowledge embodied in software can directly be utilized. Software developers combine their knowledge in programming and in other professional fields, such as accounting, and subsequently embody the knowledge in the software they develop. Software is capable of undertaking a series of actions with just a few clicks. Once the software is up and running, users can easily command it to perform specific tasks or processes (presumably the software is user-friendly enough), such as checking for viruses or balancing the account. Knowledge embodied in software is thus utilized immediately. In this sense, software is like machine tools or drugs, which apply embodied knowledge to carry out certain functions or solve particular problems. Software, to some degree, accomplishes what a book can never achieve: software saves users’ efforts on acquiring and disseminating the knowledge before applying it.

Hence, it is the software developers’ responsibility to acquire and disseminate knowledge for their users. They ought to acquire important knowledge before developing the program, put it in the software to disseminate knowledge for users. They also need to build a mechanism in the software, if possible, to facilitate dissemination of knowledge in the future. Thus more value will be created for end users, and software firms will be able to sustain a long lasting relationship with their users.

A good example can be found in the information security industry. Today, most antivirus software developers build in mechanisms to constantly update the virus signature file, a collection of viruses’ “fingerprints”, in their software. They disseminate their knowledge of new viruses to create value for users, and charge users for signature file updates to appropriate value. Note that the knowledge updating mechanism calls for flexibilities, because users’ needs in knowledge may vary over time.

#### 4.4. Knowledge Application

To push it one step further, software firms may scrutinize the nature of knowledge their users want to apply, and provide services to apply the knowledge for users directly. For example, users of accounting software actually intend to apply the knowledge embodied in the software to generate financial statements. Why not just produce financial statements they need and deliver to them, leaving out the hassles of software installation, operation, and maintenance? The same rationale is also valid for other knowledge domains. The rising business model of “software-as-a-service (SaaS)” and “cloud computing” shows some progress of development in this area.

Of course, application of knowledge for users may not always be able to render via software, because technologies have their limitations. Sometimes human involvement is necessary. As the development of AI and related technologies gets mature, the need of human involvement will be lower. Even if human involvement is still inevitable, software firms can choose to provide professional services delivered by manpower and, if applicable, transform the firm to be service-oriented. In fact, quite a few software firms have been going in that direction with successful outcomes. Examples include IBM, SAP, and Oracle, whose service revenues have already surpassed product licensing revenue for years. Nonetheless, this kind of services will demand distinctively different capabilities from what traditional software firms have, and require deliberate cultivation over time. Also, in different stages of their organizational lifecycle or during different time periods, firms need to determine proper weight on either side of products or services.

Our analysis above based on three different aspects of knowledge—knowledge preservation, knowledge acquisition and dissemination, and knowledge application—to illustrate how to satisfy users’ needs by means of developing knowledge-based business models. For a quick review, a summary of practices, examples, and remarks is provided below in Table 1.

Table 1. Practices, examples, and remarks of business model developments in the three aspects.

	<b>Knowledge Preservation</b>	<b>Knowledge Acquisition and Dissemination</b>	<b>Knowledge Application</b>
Practice	<ul style="list-style-type: none"> <li>• Adopt new forms or media to preserve knowledge.</li> <li>• Embed software into hardware to make them inseparable.</li> <li>• Produce software in different forms unique for specific users.</li> </ul>	<ul style="list-style-type: none"> <li>• Provide supplementary tools to help users acquire knowledge.</li> <li>• Build in mechanisms in the software for future knowledge dissemination.</li> </ul>	<ul style="list-style-type: none"> <li>• Enhance the software to apply knowledge for users directly.</li> <li>• Provide professional services delivered by manpower to fulfill users’ underserved needs of knowledge.</li> </ul>
Examples	<ul style="list-style-type: none"> <li>• Embedded software.</li> <li>• Component-based software development</li> <li>• Software component licensing.</li> </ul>	<ul style="list-style-type: none"> <li>• Users groups, forums, seminars, workshops, trainings.</li> <li>• Virus signature file updates in antivirus software.</li> </ul>	<ul style="list-style-type: none"> <li>• Software-as-a-service (SaaS) business model adopted by Salesforce.com.</li> <li>• Professional services provided by Oracle and SAP.</li> </ul>

Remarks	<ul style="list-style-type: none"> <li>• Need to watch over legal arrangements and technical integrations between components.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge updating mechanisms have to be flexible to accommodate future changes of needs in knowledge.</li> </ul>	<ul style="list-style-type: none"> <li>• Distinctive capabilities and organization designs are required and need to be cultivated over time.</li> </ul>
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#### 4.5. Implications for other industries

As the world economy is moving rapidly toward knowledge-based, industries other than software have also encountered tremendous challenges (Cricelli & Grimaldi, 2010). Unlike software firms, which suffer from the free-rider issues, companies in the manufacturing industry often experience a totally different problem of “knowledge saturation” in tangible products. Existing knowledge has largely been embodied in physicality of the products already, leading to the “commoditization” of the products—it is extremely difficult to differentiate products with those offered by others. Simply purchasing equipment, building the factory, and producing products as everybody does can no longer create enough value for end users. Even worse is that, as the world becoming flatter, cheaper labors can always be found somewhere else in the world, at other manufacturers’ disposal. Competition is now keener than ever, while cutting cost cannot increase competitiveness any more.

Under this circumstance, manufacturers attempting to differentiate from their competitors at the product level have usually struggled. A clichéd example—power drill producers attempting to differentiate by adding more features in their products often find their endeavors in vain. After all, product differentiation without creating sufficient value for users can never help a firm stay competitive. Manufacturers should delve into the knowledge essence of their products.

Since knowledge embodied in tangible products has appeared to be saturated, it is hard to preserve more knowledge in the physical products. Trying to find new approaches to disseminate necessary knowledge to users or to facilitate users to acquire related knowledge will be better alternatives. To do so, power drill producers first need to understand why their users buy the drill. Then they can provide user’s guide, online interactive instructions, or something else, to disseminate necessary knowledge to their users, helping them acquire knowledge to make the hole they need.

Power drill producers can go further to apply knowledge for their users—they make the hole for users. In this sense, all manufacturers can also be service providers, and the distinction between manufacturing and services industries blurs. Convergence across the two industries, some named the phenomenon “servitization” (Vandermerwe & Rada, 1988; Neely, 2008), is actually happening, with major manufacturers around the world relying more and more on services than on products to generate revenue.

In response to such a trend, manufacturers start to make their efforts to develop their business models from a knowledge based perspective. Rolls Royce in aero engine manufacture is a good example. The company no longer sells aero engines now. Instead, it offers the capabilities of the engines, via a service package featuring “power by the hour”, where customers buy the hours of flying capability rather than an aircraft engine alone. Rolls-Royce bears the responsibility for maintenance for their clients, and the accompanying risks and failure as well. The ability to do this requires the underlying technical knowledge on products, and relevant knowledge in the development of the operations processes. Rolls-Royce, based on their knowledge on aero engines accumulated over years, creates the new service business model to disseminate and apply knowledge for their clients.



The trend of servitization has been prevailing, as many observed (Neely, 2008), and will not likely turn around. For the majority of manufacturers, to develop new business models based on knowledge is crucial for their current competitiveness, or even their survival in the long run.

## 5. Conclusion

Using software and books to illustrate the essence of knowledge, we have developed an overview of business model development from the aspects of knowledge preservation, knowledge acquisition and dissemination, and knowledge application. Embodiment of knowledge is the nature of software, and that is what a user appreciates the most. Today in the knowledge-based economy, the same logic also applies to other industries. Firms have to prepare themselves for new business models, based on the knowledge perspective, to secure their long-term competitiveness.

Our analyses have provided a distinctive viewpoint to look at business models, and hopefully will also facilitate businesses to develop their new business models. Obviously, this article's intention to intrigue trades off its comprehensiveness, but we hope limitations of this article will invoke more future research.

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