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The business of healthcare innovation in the Wharton School curriculum

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Innovation and the value chain in healthcare

For the past several decades, all first-year MBA students at the Wharton School who major in healthcare management take a required course during their first semester. The course, Healthcare Management 841, analyzes the entire value chain in healthcare (see Figure 1.1). A value chain is defined here as the string of firms and industries (sellers) whose outputs serve as the inputs of others downstream (buyers). Thus, in a traditional production model, a value chain links together raw material suppliers, manufacturers, distributors, and end customers.

The structure of the value chain in healthcare is more complex: there are three key sets of actors and two sets of intermediaries between them. The three key sets of actors are the individuals and institutions that purchase healthcare, provide healthcare services, and produce healthcare products (*purchasers*, *providers*, and *producers*). Two sets of intermediaries separate these key actors: those firms who finance healthcare (offer insurance to the purchasers and handle reimbursement to the providers) and those who bulk buy and distribute products (from the producers to the providers).

The logic of this chain is a bit more interesting. All of the money that gets pumped into the healthcare system starts on the far left side of Figure 1.1 and

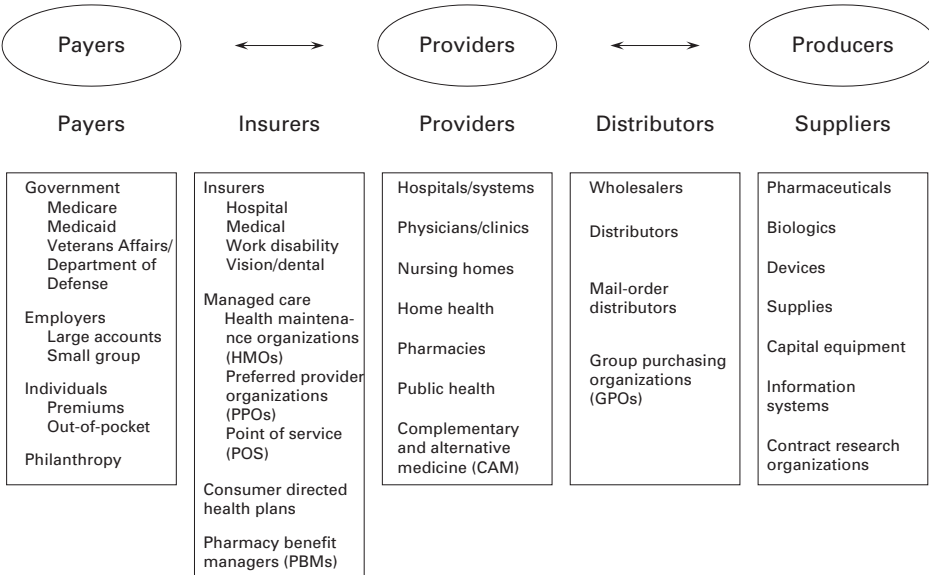


Figure 1.1 The US healthcare value chain

flows to all of the boxes to the right. Conversely, much of the innovation in healthcare starts on the far right side and flows to the adjacent boxes on the left. The two flows collide in the middle, in the provider side of the industry, that is, doctors and hospitals who then have to determine how much of the innovation from the right side they can afford to utilize in patient treatment given the limited supply of funds received from the left side. This is the point at which much of the spending on healthcare and the consumption of healthcare products takes place.

In a prior book, the Wharton faculty examined the flow of money, products, and information between producers, providers, and their intermediaries (wholesalers, distributors, group purchasing organizations).¹ This book examines the producers of the innovative products in the healthcare industry – the major sectors of innovation within the manufacturing side of the industry – on a global basis. These include:

- the pharmaceutical sector;
- the biotechnology sector;
- the genomics and proteomics sector;
- the medical device sector;
- the information technology sector.

The book aims to educate the reader about the structure of each of these industry sectors, the competitive dynamics among firms in these sectors, and

the push for technological innovation that distinguishes them from other sectors of healthcare. The book also highlights the growing convergence among these sectors, as innovations in one sector are utilized by another, and the forces converging to alter the demands on and needs of providers (customers) downstream. Chapters contained in this volume are written by faculty, executives, and analysts from these sectors who have taught in the Wharton School as part of Healthcare Management 841.

The technological imperative in healthcare

The five industry sectors listed above are responsible for supplying a majority of the innovative products that are utilized by physicians and hospitals and which are increasingly demanded by consumers. This supply and demand logic has exerted both positive and negative effects.

On the one hand, technology is commonly cited as being the major driver of rising healthcare expenditures worldwide. Scholars have characterized this driver as the “technological imperative” – that is, innovative treatments and equipment are demanded by patients and their (physician) agents on the grounds of quality, and are reimbursed by payers and their fiscal intermediaries.² Indeed, empirical evidence from the US documents that the cost of new technology, and the intensity with which it is used, consistently accounts for anywhere from 20 percent to 40 percent of the rise in health expenditures over the past forty years (see Figure 1.2).³

Particularly disturbing to many, given this level of spending, is evidence that high levels of spending on technology, particularly in the US, do not always translate into added “value” (outcomes divided by costs).⁴ The problem here is manifold: the utilization of technology without weighing the commensurate benefits, the overutilization of technology in the US (which increases spending without added benefit), and market-based competition among provider organizations to have the latest equipment (which increases the diffusion and utilization of expensive technology at the expense of older, less-expensive alternatives).⁵

Governmental efforts in the US to contain spending on medical technology (e.g., Certificate of Need (CON) laws enacted in the 1970s, the Prospective Payment System enacted in 1983, the threat of presidential-led health reforms in 1978/79 and 1993/94) exerted only short-term effects, followed by a resumption in spending. Governmental restrictions on access to this technology, on the prices charged for the technology made available, and on the wages

Relative contribution to healthcare inflation: academic studies covering periods 1960–2007 and 1940–1990

	1960–2007	1940–1990		
	Smith, Newhouse, and Freeland	Smith, Heffler, and Freeland	Cutler	Newhouse
Aging of population	7	2	2	2
Changes in third-party payment	11	10	13	10
Personal income growth	28–43	11–18	5	<23
Prices in the healthcare sector	5–19	11–22	19	N/A
Administrative costs	N/A	3–10	13	N/A
Defensive medicine and supplier-induced demand	N/A	0	N/A	0
Technology-related changes in medical practice	27–48	38–62	49	>65

Sources: Sheila Smith, Joseph Newhouse, and Mark Freeland, “Income, Insurance, and Technology: Why Does Health Spending Outpace Economic Growth?” *Health Affairs*, 28 (2009): 1276–1284; Sheila Smith, Stephen Heffler, and Mark Freeland, “The Next Decade of Health Spending: A New Outlook,” *Health Affairs*, 18 (2009): 86–95; Joseph Newhouse, “Medical Care Costs: How Much Welfare Loss?” *Journal of Economic Perspectives*, 6(3) (1992): 3–21.

Figure 1.2 Technology and intensity of service as drivers of rising healthcare costs in the US

paid to labor who apply this technology, have been favored methods of controlling healthcare costs in other countries.⁶ Other regulatory initiatives underway in the US as part of healthcare reform seek to redesign both provider organization and provider payment incentives in an effort to “bend the trend” of steadily rising costs.⁷

On the other hand, there is growing public recognition, based on recent scholarly evidence, that new technologies contribute to increases in longevity and mobility, reductions in disease and pain, improvements in worker productivity, and improvements in quality of life – especially for patients with particular conditions.⁸ One report argues that increased health spending is “worth it”: over the past twenty years, each additional dollar spent on healthcare services in the US produced health gains valued at \$2.40–\$3.00 (i.e., in terms of increased life expectancy, reduced disability, improved overall health).⁹ Based on this recognition, there continues to be public pressure for more healthcare spending and access to new technology worldwide.

This book does not seek to attack or defend the technological imperative in healthcare. It takes the position that technology does not increase costs by itself, but rather must be viewed as part of the health systems in which they are used. What is critical are the payment structures and incentives established within a given healthcare system that promote or retard the use of

technologies for given patients (and their diffusion to other patients). The book also takes the position that any analysis of increased spending on technology must be combined with an analysis of the benefits achieved by using these technological resources.¹⁰ Finally, the book takes it as a given that technological innovation will continue to drive the dynamics of the healthcare industry into the future, as it did during the past century.¹¹ The book seeks to analyze the push for innovation through the lenses of the companies that produce it.

The innovation challenge

All of the healthcare sectors studied here are considered “high-technology.”¹² Like other high-tech industries, innovation is the key driver of competitive advantage and commercial success. Analysts at the Boston Consulting Group (BCG) report that research and development (R&D) investments can account for up to one-third of a medical technology firm’s stock price, and are correlated with the firm’s gross margins four to five years down the road.¹³ At the same time, innovation is also the continuing challenge facing firms in these sectors. The high price-to-revenue multiples for many of these firms suggest that financial markets expect these firms to grow revenues and sustain gross margins above and beyond other investment sectors, all of which necessitate continued innovation.¹⁴

Successful innovation hinges on many factors, including serendipity of discovery, wise paths taken in the past, wise investment decisions in the present, wise options taken out on the future, and access to new technologies via mergers and acquisitions (M&As) and strategic alliances. These factors manifest themselves in terms of favorable market structures, the possession of key resources and capabilities, and fruitful ties with other organizations upstream and downstream in the value chain. However, successful innovation also rests largely on the process skills or the art of management practiced inside the firm.

This book examines the source of technological innovation in the healthcare industry. Specifically, for the firms in each of the innovative sectors listed above we ask the following set of questions:

- What products do these companies make and what is so innovative about them?
- What are the different business models of innovation pursued by firms in this sector, and how do they finance them?

- What are the strategies pursued by firms in this sector?
- What are the key success factors for innovative firms in this sector?
- How have firms in these sectors, and the sectors themselves, grown over time?
- What impact have these firms had on the organization and delivery of healthcare?
- What are the important competitive and regulatory forces shaping these sectors?
- What trends are taking place among downstream customers that these sectors will increasingly need to acknowledge and deal with?

To answer these questions, the book adopts multiple, related perspectives: industrial organization, the resource-based view of the firm, value chain analysis, and organizational innovation and change.¹⁵ These perspectives help to focus on the many determinants of successful innovation. They are outlined below.

Industrial organization perspective

Industrial organization (IO) is a branch of economics that examines the number of competitors in a market (or industry), the size and distribution of these firms and their respective market shares, the degree of concentration (i.e., how many firms account for the majority of the market share), and the strategies pursued to broaden the horizontal and vertical boundaries of the firm (e.g., horizontal consolidation, vertical integration into input and output markets). In the last two decades, the IO perspective has been popularized in Michael Porter's "five forces" framework, which analyzes five sets of factors that shape an industry's competitiveness and the ability of firms within it to earn above-average profits.¹⁶ These forces include: degree of internal rivalry among incumbent firms; threat of entry by new firms; degree of substitution by new products/technologies; bargaining power of suppliers (input side); and bargaining power of buyers (output side). Viewed in this perspective, a firm's competitive advantage derives from the structure of the industry in which it finds itself, as well as its position: for example, a small number of large-sized firms, the presence of scale economies that serve as an entry barrier, competitive input and output markets, and so on.

The IO perspective is used here to assess the corporate strategies of firms in these sectors. Thus, the chapters discuss the use of mergers and acquisitions to build scale, access new technology and products, and erect barriers to entry; the (sometimes unsuccessful) pursuit of economies of scale and scope to

achieve efficiencies; the degree of vertical integration into upstream and downstream markets; and the pursuit of product and market diversification in order to expand.

Resource-based view

The resource-based view (RBV) of the firm suggests that competitive advantage in an industry lies not only in a firm's position within a favorable industry context (i.e., among the five forces above). Advantage also derives from the distinctive capabilities a firm possesses. Capabilities are based on assets and resources that firms harness and coordinate in productive ways. Capabilities become distinctive, strategic, and valuable when a firm can coordinate these resources to provide superior returns in ways that other firms cannot duplicate.¹⁷ Capabilities become "dynamic capabilities" when firms possess the ability to adapt their production routines to new market needs and opportunities.

The RBV perspective is used here to discuss the distinctive abilities of different life sciences firms to create new products. Thus, Chapters 2 and 4 examine the differential capabilities of large pharmaceutical firms and smaller biotechnology firms in developing small and large molecules, respectively. The perspective is also used here to analyze the strategic alliances that develop among different life sciences firms to broaden their total set of capabilities. Finally, the RBV perspective is utilized to describe the types of integrative processes and learning mechanisms needed to help M&As succeed. A key challenge facing all of the sectors dealt with here is their need to adapt their capabilities to deal with competitive issues not only within their sector but also with major changes occurring among their downstream customers (see Chapter 8).

Value chain perspective

The value chain perspective analyzes the entire sequence from raw materials (input) markets to final customer (output) markets.¹⁸ The sequence is labelled a "value chain" because each link in the chain adds value to its inputs. Each link also seeks to maximize its contribution to the total product's added value, thereby capturing as much profit as it can. This may involve focusing on only those links that add the greatest value (and let other firms focus on links that add less value), or encompassing as many links as possible in order to maximize the total profit captured (and leave as little as possible for other firms to divide up).

The value chain perspective is used here to assess the business models of firms in these sectors. Thus, the chapters discuss the key steps in the value chain in that sector (e.g., research and development, manufacturing, sales and marketing), how much value is generated within each of those steps, trends in the scope of these activities that firms elect to focus on (e.g., broad versus narrow range of steps), and the use of the strategies above to broaden a firm's business model. Thus, for example, a value chain perspective assesses whether large pharmaceutical firms should vertically dis-integrate and outsource core functions to others (e.g., contracted sales, manufacturing, and research organizations), or whether smaller biotechnology firms should vertically integrate to perform most if not all of these functions themselves.

This perspective is also used to assess the trading relationships between adjacent firms in the value chain of healthcare (e.g., producers who supply drugs and devices to providers, payers who reimburse providers for these supplies). A value chain view suggests that firms can develop strategic advantage as they develop long-term, collaborative alliances with adjacent firms that benefit both sides and address problems of information exchange between trading partners.¹⁹

Organizational innovation perspective

The organizational innovation perspective draws on management theory and research in order to examine some of the key managerial practices and organizational conditions needed to sustain strategic change. The findings from this literature are so diverse as to warrant a separate volume to summarize them.²⁰ Nevertheless, ingredients for successful innovation include:

- the need to balance divergent and convergent thinking;
- the need to balance top-down strategic initiatives with bottom-up experimentation;
- the need to balance a focus on short-term efficiency and shareholder value maximization with long-term exploration;
- the ability to source new ideas from anywhere inside and outside the firm;
- the need for integrative structures to coordinate the contributions of multiple disciplines (silos) within a firm;
- the benefits of organizational slack (e.g., dedicated resources for innovation, latitude for long-term thinking and commitment to projects);
- a focus on the process (and not just the structure) of change;
- the need to conduct integrative programs of change that recognize the importance of articulating changes in one part of the firm with changes in other, related parts of the firm.

Some common themes emerge from this list: balance, sourcing of ideas, integration, latitude and slack, and process.

In partial validation of this list, BCG consultants have identified their own list of “process” skills based on recent field research and have labelled them “high science.” These skills include: R&D governance (e.g., using milestones as learning exercises, analytical tools, and decision-making criteria), the use of measurement systems that balance short-term and long-term perspectives and integrate the efforts of the entire R&D team, and the use of incentives that keep innovators motivated.²¹

The organizational innovation perspective is used here to highlight the different managerial skills required in the development of a start-up firm in the biotechnology sector and in the coordination of the internal and external activities of a large pharmaceutical firm. It is also used to explain why M&A within the pharmaceutical sector often fails to achieve its intended results (see Chapter 3). The perspective is helpful in understanding why new technology often fails to be widely adopted by the intended end user (e.g., the physician) by virtue of neglecting how it disrupts the work routines of professionals.

Why study the producers of healthcare products?

Deemphasized in traditional curriculums of health administration

Historically, the producers of innovative products in the healthcare industry were ignored in most graduate-level courses in health administration taught in schools of business and public health. Into the early 2000s, most popular introductory texts included few, if any, chapters dedicated to the product sectors of the industry. This situation has fortunately begun to change. These texts now include a chapter on “technology” and/or the pharmaceutical industry, as well as a discussion of some of the regulatory bodies governing these sectors (e.g., Food and Drug Administration).²² Few texts, however, discuss industry dynamics or company business models. None takes a global perspective.

Similarly, until recently, few graduate programs in health administration included dedicated courses on these industry sectors. The Wharton School is one of a very small number of business schools that include separate courses on pharmaceuticals, devices, and information technology, as well as dedicated lectures on each of the product sectors in its introductory MBA-level course.

The limited understanding of these sectors can foster a narrow view of the overall industry on the part of academic researchers and executives of health provider organizations. Graduate curriculums of health administration devote considerable attention to the purchaser and provider sectors of the industry, along with the fiscal intermediaries that separate them (see Figure 1.1). This is understandable, given that (a) healthcare policy focuses heavily on governmental regulation and reimbursement of health services, and (b) the bulk of academic research is conducted on these sectors of the healthcare industry. With a handful of exceptions, most researchers have not considered the implications of developments in the “producer” side of the industry for the purchaser and provider sectors. Consequently, the majority of graduates of health administration programs receive little formal training on the healthcare industry sectors that manufacture the products utilized by providers and consumed by patients.

Failure fully to appreciate the technological imperative

Why might this be of concern? As an illustration, one cannot fully understand the technological imperative in the US healthcare system unless one understands the relationship that vendors of new products have with individual physicians.²³ The failure to understand this relationship can undermine efforts by health provider organizations to control their own costs. Executives of provider organizations may not fully appreciate that their physicians often develop closer alliances and attachments to the manufacturing firms than to their own organizations. These attachments have as much to do with the innovative features of the products made as with the intense sales and marketing support that goes with them. Indeed, vendors and physicians have developed a two-way exchange of mutual benefits that executives and purchasers may have trouble modifying. For their part, vendors offer clinicians access to the latest technology, information about the product, assistance and training in its use, involvement in clinical trials, training of the clinician’s residents and nursing team, donations and honorariums, royalties for intellectual property, and opportunities for “naming” rights on new equipment. For their part, clinicians offer to vendors thought leadership, avenues for influencing colleagues to use the product, feedback on the product to assist with next-generation product development, leaders for clinical trials, and access to patients.

This entire set of exchanges – discussed in detail in Chapter 6 – is poorly understood. They are also now under scrutiny by the Federal and State