An Introduction to Marketing Early-Stage Technologies

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ABSTRACT

This chapter describes marketing concepts and how to use them to create marketing plans for newly developed technologies in the health and agricultural sectors. The traditional marketing model invokes the "four Ps" of marketing: product, price, place, and promotion. This chapter, however, concentrates on the "five Ws" of marketing, which are more relevant to early-stage technologies: who? what? where? when? and why? The author then discusses the concept of the unique selling proposition (USP) and, finally, considers the marketing of technology transfer activities, or internal marketing.

1. INTRODUCTION

Because marketing is usually taught only in formal business programs, it is often not understood by scientists, technologists, and engineers. This lack of understanding can impede the transfer of technology from the laboratory to the commercial sphere.

Common misconceptions about marketing include that it is:

- only relevant to for-profit companies
- just a fancy name for advertising
- making buyers buy things they do not need
- just about one's skill in selling something to others

Let us begin with the first misconception: Marketing is only relevant to for-profit companies. Of course, a for-profit company will not be successful unless it sells products; this means that the company must understand its markets. However, the same is true for a not-for-profit or a government agency: neither can be successful without understanding the markets for its technologies. The reason for this is that the need of these types of persons to have users who will be interested in the technologies. If there are no users, the technology will not be adopted.

Next, marketing early-stage technologies has little to do with advertising. While understanding how markets become aware of technology is important (a key concern of advertisers), this is only one of many pieces of information required to understand how a market will respond to a specific early-stage technology. Advertising is only one small part of an overall marketing strategy for any product; advertising promotes awareness of a product inside potential markets. However, in the case of early-stage technologies, other aspects of marketing are more important: after all, if someone does not know where their potential markets are, advertising will likely be ill-conceived or prepared. Marketing includes identifying markets as well as the features of the technology that will be of interest to those markets.

Third, marketing is frequently characterized as a type of behavior-modification technique that alters buyers' intentions and makes them buy

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products they do not need based on deceptive advertising. It is true that if a product is advertised as having features or benefits it does not have, buyers will be dissatisfied. Children discover this common sense, for example, when a doll they have seen advertised on television proves not to be able to dance!

Finally, although "selling skills"—such as "cold-calling" a prospect, introducing a potential investor/licensee to the idea of an early-stage technology, and conducting a licensing negotiation—are certainly important, such skills are only one aspect of marketing.

Put simply, marketing is:

Understanding the buyer's needs and how to satisfy those needs.

Accomplishing these simple objectives, however, often requires a complex strategy.

2. "PUSH" AND "PULL"

A frequent criticism of technology transfer is that people are too concerned with "pushing" technologies into the market rather than allowing buyers' needs to "pull" those technologies in naturally. But the real problem is that, very often, buyers don't even know what their needs are!

For example, consider the Internet. Although today, most people who use it would say they can't live without it (or they *need* it), 20 years ago, the idea that all computers might be connected by some overarching network was the stuff of science fiction. However, few science-fiction writers envisioned that such a "web" might allow us to place orders for goods and services or to receive communication and information. However, once Internet technology was pushed on to consumers, a market was created. Consumer demand has pulled more and more technologies into the market ever since. The original Internet technology was created despite any study of consumers' need for it; The success of the Internet technology was not anticipated until the early-1990s other than by a few visionaries. Rather, consumers adopted it when they discovered that it satisfied their needs.

3. TECHNOLOGY TRANSFER AND EARLY-STAGE TECHNOLOGY

In this chapter, it will be important to understand two key concepts: *technology transfer* and *early-stage technology*.

Technology transfer refers broadly to any means of moving a scientific idea from a laboratory to practical use application in a production environment. Technology transfer can be formal and well-regulated: for example, assigning intellectual property ownership for a new technology, licensing the technology, and starting up a new company based on the new technology.

Some technology transfer is informal and less regulated. For example, many of the technologies that contributed to the personal computer revolution (such as the laser printer, Ethernet, WYSIWYG, and the mouse) were developed at Xerox's Palo Alto Research Center in the 1970s. Xerox did not capitalize on these technologies by actually bringing any of them to the market as products, and they were eventually transferred to other companies when the employees who had originally worked on those projects left Xerox.

Technology transfer is also generally used to refer to the process used to ensure that research findings are translated into actual use. Rather than relying on inventors to determine the practical uses of their inventions and put the appropriate structures in place to bring that use to market, an intermediate person or department (referred to as the *technology transfer office* [TTO]) takes responsibility for that work.

Early-stage technology refers to a scientific, technical, or engineering finding that is not embodied in an existing product and that does not obviously lend itself to a commercial enterprise.

Early-stage technology, for example, led to the creation of the Roundup Ready® line of genetically modified seeds sold by Monsanto. A gene that makes a plant tolerant to glyphosate had been discovered. In itself, the finding had little practical value. However, the already existing herbicide Roundup® was based on glyphosate, and researchers discovered that plants containing the new gene could be safely used with the herbicide. The herbicide kills weeds, but does not harm the Roundup Ready® crops.

Careful marketing work (usually done by the TTO) can help an organization turn an early-stage finding into a commercial product. The TTO accomplishes this by determining possible uses for the finding, identifying potential users, recognizing the features of the end product that will attract users, and then getting the resulting product to those users.

Utility is what a product allows the customer to do. Using a bicycle, for example, allows someone to get from point A to point B faster than on foot. *Marginal utility* is what a particular product does better than any other. A bicycle may have limited marginal utility since it may not be the *only* way that someone can travel a short distance, and it may not be the *best* way, either. A bicycle with square wheels, designed to roll over a roadbed comprised of inverted catenary structures (also known as a "washboard" surface)[1] would likely have a limited marginal utility for almost everyone. Such a bicycle would only appeal to people who not only want or need a bicycle but who also live near a lot of roads with surfaces that follow a very specific, very unusual structure. However, for a few people, a square-wheeled bicycle would have a very high marginal utility, since no other vehicle could travel over such roads.

Let us consider an example of an early-stage technology. A new membrane designed for the separation of proteins has a utility that is similar to many existing technologies such as filter paper or gel electrophoresis. However, if our new membrane has the additional benefit of being able to separate proteins based on their ionic charge, then the marginal utility becomes the ability to separate proteins on this basis. Those users who are interested in this feature (which is likely to be a large number) will be interested in the new product's marginal utility over the general utility of all types of filtering and separation methods.

4. THE "FIVE WS" OF MARKETING, PLUS ONE "H"

4.1 *The who of marketing*

When marketing a product, it's first important to know who will be buying it: What if we were dealing with a new drug that has been identified for hypertension (high blood pressure)? Who is the "buyer" of this drug?

We might begin by assuming that the buyer is the patient because he or she actually pays the pharmacist for the drug. Upon further reflection, however, we realize that it is the prescribing physician who makes the decision about which drug to prescribe. In fact, the patient has little input into that decision; so, in effect, the buyer may be the prescribing physician. Then again, in many jurisdictions, larger organizations—HMOs (health management organizations) or governments—decide for which drugs, and under what conditions, patients will be reimbursed. Thus, the buyer of our new drug may not be the same from jurisdiction to jurisdiction.

Now, let us turn to a different sort of product, an early-stage technology. A researcher has identified a specific genotype that makes pigs much more susceptible to porcine stress syndrome (PSS). Pigs that have PSS are significantly smaller than those without it (do not have the genotype). Farmers who raise the pigs (producers) sell the pigs to slaughterhouses, which in turn sell the carcasses to processors. Processors will pay less money to the slaughterhouses for PSS carcasses, and the slaughterhouses, in turn, pay less to the producers.

Who is likely to buy PSS-identification technology: the producers, the processors, or the slaughterhouses? Most likely, the producers: by using the technology, they can cull PSS-positive swine from their stock and save themselves the cost of raising inferior animals. In turn, the producers can sell to the slaughterhouses with the promise that their herds are PSS free.

4.2 *The what of marketing*

What do buyers want? In order to understand the market, TTO professionals must understand:

- how buyers will use the product
- what factors buyers will consider when making decisions to buy
- what product characteristics buyers find attractive

It is dangerous not to understand exactly what buyers want and what they are willing to pay

for what they want. For example, the Concorde airplane was able to cut the usual trans-Atlantic flight time (approximately seven hours) by a little more than half. However, in order for the company to turn any profit at all, a Concorde flight cost more than three times the price of the average nonsupersonic flight. As you probably already know, the Concorde went out of business.

What went wrong with the Concorde's marketing concept? In all likelihood, the marketers overestimated the amount that buyers of long-distance travel were willing to pay for reduced flight times. In the 1950s, buyers of long-distance travel had certainly been willing to pay more for faster travel: they opted to pay substantially higher prices in order to travel by air rather than rail or ship. Because buyers were happy to make the trade-off, the size of the air-travel market expanded rapidly, which allowed airlines to reduce costs, leading to further market expansions (a so-called virtuous circle). Ultimately, this led to the almost complete replacement of rail and sea travel by air travel. But while travelers in the 1950s were happy to pay for improved travel technology that saved them days worth of travel, Concorde customers did not feel that the prices they were being charged were worth a mere four-hour time savings (a three-hour flight rather than a seven-hour one).

Consider another example. A new set of obstetrical forceps[2] has been devised made from a molded plastic rather than the existing standard of metal. The plastic allows a limited amount of play at the fulcrum point of the forceps. This play ensures that no more than a set amount of force will be put on the head of the baby being delivered. The new technology meets with a great deal of resistance in the marketplace. Why?

In part the answer comes from misunderstanding the *what* of marketing. Buyers (which include obstetricians) obviously consider many factors in purchasing such a device. The use of plastic rather than steel was likely perceived as a deficiency due to the perception that somehow that material is less sterile than metal, which is well known in delivery rooms. In addition, the change in material results in a significant change of weight and the perception that the plastic device is less robust than its metal counterpart. If these perceptions of buyers had been considered, alterations to the product may have resulted in an easier adoption of the technology.

4.3 *The why of marketing*

Once we have established *who* will buy our product and *what* they want to buy, we need to ask *why* someone should buy our product as opposed to someone else's. In order to answer this question, we must ask a broader one: why does a company (after all, most early-stage technologies are not sold to consumers) buy anything? To put it another way what are the drivers or forces acting on a company?

Michael Porter suggests that there are five such forces:[3]

1. Competition among businesses in the industry
2. The threat of new businesses in the industry
3. The threat of new, competing products
4. The bargaining power a company has with its suppliers
5. The bargaining power a company has with its buyers

By understanding these forces, marketers can determine what is of interest to potential users for any early-stage technology. If the technology can help the user address a company's concerns in any of these forces, it is more likely that the technology will be adopted; if there is no effect in any of these forces, there is little likelihood that the user will be interested.

If we analyze these forces for a user deciding whether or not to adopt a product derived from an early-stage technology, we find that the new product must give the user an advantage in one of the five areas. For example: does the new product:

1. **Lessen the potential competition among those already in the industry.** This could be accomplished by creating a new class of products that competitors will not be able to create for a number of years.
2. **Lessen the threat of new companies coming into an industry.** For example, increasing

the barriers to entry for new companies would make this happen.

3. **Lessen the threat to companies within the industry of new, competing products.** By ensuring that there is good IP protection around the new product, the possibility of new, competitive products is lessened.
4. **Affect reliance on existing suppliers.** By either reducing the amount required from existing suppliers or by bringing new suppliers into the picture, the new product would provide added bargaining power over suppliers.
5. **Affect the relationship between buyers.** A new product can significantly alter the relationship with buyers by, for example, providing buyers with product features that they are not able to obtain from anyone else.

It is important to articulate *which* of these forces a technology will help the business customer address—something we might call the "So what?" test. In order to answer this question, you need to consider what your product offers customers in the way of:

- features (the obvious attributes of your product)
- advantages over other, similar products
- benefits to the user

Remember that it is a f-a-b idea to make sure that your product is competitive!

Furthermore, any product or early-stage technology needs a unique selling proposition (USP): that is, something that distinguishes your product from any other (discussed in section 5).

4.4 *The where of marketing*

We have figured out *who* will buy our products. Next we must ask: *where* are products or early-stage technologies sold? After all, there is no eBay for technologies yet (although a number of technology exchanges are in the works).

Products typically move through "channels of distribution." Let us take the example of a hypothetical new technology that allows us to amplify DNA. How can we get that technology into use? What channels of distribution would exist? First, there could be use in research laboratories. Laboratory use could be subdivided into academic and for-profit (such as in a pharmaceutical company) research labs. There is also use of the amplification technology with various practical tests for patients: paternity testing and predictive genetic testing, as well as forensic crime-scene testing. Finally, the amplification technology could also be used in certain drug-production processes. Without much work we can see how one relatively simple early-stage technology may have a large number of uses.

These different uses have an intellectual property implication. Although that aspect is beyond the scope of this chapter, it is important to realize that certain types of uses for a technology may be prohibited by IP protection making it important to derive as many different uses as possible: some of these may be hindered from use by IP considerations; others may be free for use.

Consider another example: software that helps hospitals use their imaging equipment. What channels of distribution do marketers need to consider? Depending on the jurisdiction, hospitals may be free-standing private institutions, part of a health-management organization (HMO), or part of a government or quasi-government organization. In addition, a hospital may not be entirely independent: it may be associated with other hospitals or healthcare providers in a buying group.[4] In other words, the person who makes the buying decision (or even lists a software product in a catalog) may be some distance from the users of the software.

Furthermore, should the software company be separate from, or in alliance with, the companies that sell the imaging equipment? This is not a trivial decision, because it is likely to determine who the buyer is. For example, an equipment vendor is more likely to sell directly to medical staff, whereas a software vendor is more likely to sell to the computing and information services department. Not only are there a number of potential buyers within the hospital in at least two different departments, but also the hospitals or departments may buy software through a number of different channels (directly from equipment manufacturers, or through one

or more buying groups). There are at least eight channels[5] of distribution!

4.5 *The when of marketing*

The last question to ask is *when* can you sell something to buyers?

4.5.1 *The long-term when*

Many technologies exist long before people become interested in them as products. For example, after the discovery of the double-helix nature of DNA in the 1950s, it took approximately 40 years (until the 1990s) before actual products depending on DNA were generally available. This long-term aspect becomes important when one considers that the term of patent protection is usually limited to twenty years. In other words, even if the original discovery of the structure of DNA had been patented, any actual revenues resulting from the discovery would only have been seen after the expiry of the relevant patents.

Another technology that took more than a century to be adopted by the public was the fax machine. It was invented in the early 1800s, but it was initially too slow: transmission took six minutes or more per page. Public interest in the fax machine only arose in the late 1980s, when digital compression technology allowed a page of data to be sent in less than one minute.

4.5.2 *The short-term, seasonal, or cyclical* when

Governments and institutions have differing equipment needs, depending on where they are in their annual budget cycles, how old or up-to-date their equipment is, and whether or not regulations have recently changed. For example, the software that allows accountants to create non-tamperable digital images of documents moves off the shelves most slowly in February, March, and April. Why? The answer is simple: at that time of year, accountants are too busy dealing with their clients' taxes to consider purchasing new tools for their own administrative needs.

4.6 *The* how *of marketing*

Thus far, we have considered the five Ws:

- *Who* is going to buy our product
- *What* product features should be emphasized
- *Why* buyers should want to buy the product
- *Where* we should sell the product and *where* along the distribution channel buyers are
- *When* buyers will be most interested in the product

So *how* should marketers use this information?

Usually, the *how* is answered with a *marketing plan*, a written document that answers each of the previous questions in detail. If the product is an early-stage technology, there are probably not going to be any concrete answers. In fact, it may be sufficient to identify *possible* answers and their ramifications. The early marketing plan can also be considered a provisional document that will be regularly revised as research and development continue.

It is essential to point out that this marketing plan is likely an important function of the technology transfer office. The creation of such a plan will be done once the office answered the questions that we have posed in this chapter and add considerable value to the early-stage technology. Value is added by identifying potential markets, products that can be sold into those markets and the features, advantages, and benefits those products will have.

Although there may be no hard answers at this point, market research will never go to waste. It may come in handy when the company considers licensing or spinouts. Also, potential buyers can be contacted early, and their responses can be useful for later market research. Moreover, people who work in early-stage technology are usually happy to cooperate with someone who is researching the market for a new technology.

5. THE UNIQUE SELLING PROPOSITION

The *unique selling proposition* is the advantage or benefit that the product offers to the buyer, *not* a description of the technology that creates that advantage or benefit. To see the difference, consider the following examples.

During the California Gold Rush in the 1870s, miners complained that their pants wore out very quickly. In response, a tailor named Levi Strauss put copper rivets at the corners of the pockets of his denim pants. Miners quickly recognized the superiority of these pants, and to this day the USP of Levi's jeans is their durability. The copper rivets are the source of that durability, but they are not the advertised feature.

USPs are also used in the automobile industry. Volvo represents the ultimate in safety, Ferrari represents the ultimate in speed, Rolls-Royce represents the ultimate in luxury, and Toyota's Prius the most environmentally friendly hybrid car. These companies advertise the concepts of safety, speed, luxury, or environmental friendliness—not the technologies that make their cars safe, fast, luxurious, or environmentally friendly. Brands such as GM and Ford, which no longer have any USP associated with their mark, are doing rather badly compared to those with clearly defined USPs.

Likewise, the computer industry uses USPs. Apple, for example, emphasizes how easy its computers are to use rather than advertising the specific technologies that make its computers user-friendly.

In order to develop an attractive USP for an early-stage technology, marketers must emphasize what buyers need over what the technology can offer. The tendency of many marketers to overemphasize the technology may explain why they are often accused of "pushing" their products into the market rather than letting them be "pulled" in by virtue of consumer demand.

Let us take, for example, a technology that allows certain vaccines to be administered using an aerosol rather than an injection. There is no question that the science may be exciting and of interest to potential users. However, the USP has nothing to do with this exciting science. Rather, the real potential which will increase user demand is to point out that aerosol vaccine delivery will allow significantly easier (and painless) delivery to the end users as well as potentially an easier storage and delivery of the vaccine prior to administration.

Sometimes a USP is bound up with the business model of the company. FedEx guarantees overnight package delivery; Domino's Pizza specializes in extremely rapid, hot, home-delivered pizza. Both of these companies have business models that allow for unusually fast delivery of products or services. With this kind of USP, of course, it is vital that delivery be as timely as promised: even small delays may send customers elsewhere.

6. CONCLUSION

Marketing is the technique of identifying markets. For early-stage technologies, it can be a difficult process given the uncertainty of what uses the technology can be put to. Nonetheless, for some early-stage technologies, the work done in the marketing phase can actually add significant value, since it identifies potential uses and buyers that may not have been considered by the original scientists. ■

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1 Peterson I. 2004. Riding on Square Wheels. *Science News Online*, 165 (14). www.sciencenews.org/articles/20040403/mathtrek.asp.

2 See U.S. Patent No. 5,849,017.

3 Porter ME. 1979. How Competitive Forces Shape Strategy. *Harvard Business Review* 57(2): 137–145. An explanation can also be found at en.wikipedia.org/wiki/Porter_5_forces_analysis.

4 MEDBUY® is an example of a purchasing group. www.medbuy.com.

5 The actual distribution channels for such a product, defined by those who might make the decision to buy this product, include: (1) the radiologists who are ultimately responsible for the equipment; (2) the medical administrators of the hospitals; (3) the information technology department in charge of software at the hospital; (4) the purchasing department in charge of purchasing imaging equipment; (5) a buying group that acts on behalf of an aggregate of hospitals such as an HMO; (6) a paying authority that authorizes any new acquisitions such as a government department or an HMO; (7) the manufacturer of the equipment looking to integrate the software; and (8) individual physicians and departments who find out about the software and are looking to acquire the tool outside of the normal channels.