

Marketing Technologically Advanced Products

Horst O. Bender

Professor of Business Marketing
University of Twente, Enschede, The Netherlands

This paper calls for a merger of technology and marketing under a customer value perspective; for an enhancement of the traditional technological innovation orientation of the technology-based firm with a market thrust. It establishes technology-based products as product-service offerings that are derived from technological innovation. The aim in marketing technology-based products is an improved understanding of how an organization can combine a technology orientation with a customer value thrust that is common to the firm. In combining this technology and market orientation, the technology-based firm must strive to create and recreate differential customer value through product, process, service, and organizational innovation.

The market for technologically advanced products has become global in the past decade. Technology-based firms – which not too long ago used to launch their new products first in the home market, then their hemisphere of origin, and only ultimately the rest of the world – now strive for world leadership positions through world-wide product introductions. Examples of such global strategies can be found in the computer hardware and software, consumer electronics, semiconductor, machine tool, telecommunications, chemical and pharmaceutical industries. Information technology alters the ways in which marketing is being executed – both within the firm and at the supplier/company/customer/competitor level. Firms of all sizes need to cope with increased competition.

The global competition in the industrial, consumer durable and high technology sectors rests largely in technological innovation. The technological boundary – what is technologically feasible – has advanced dramatically in many sectors of the economy. This has translated into more rapid rates of product and process innovation and has led to a shortening of product and process life cycles. All over the world, previously static industrial and consumer markets have become dynamically competitive. The rules of competition in the national product-marketplaces have changed accordingly.

Confronted with rapid change – in procurement, research, development, engineering, manufacturing,

marketing, distribution and logistics – the technology-based firm more than ever needs to strive for synergy at the technology/marketing interface. It needs to encourage entrepreneurship in new product development, and to gain greater inter-departmental integration. Above all, it must implant more of a marketing orientation in each and every business function. Non-linear solutions are called for in response to these taxing problems.

Technology/Marketing Myopia

While the social sciences – economics, psychology, and, to a lesser degree, sociology – were formative in shaping the marketing discipline, the field has been much less inclined to resort to the natural sciences and engineering for conceptual development. This is a most unfortunate situation, for it is the inventions and their application in industry – technological innovation – that form the lifeblood of business and society.

That technological innovation is a major agent of growth and change has long been recognized. However, only first-order derivatives of the technological innovation literature have found their way into marketing via the new product development discipline (which is preoccupied with incremental product innovation) and the learning curve “effect” (the “cause” of which is incremental process innovation).

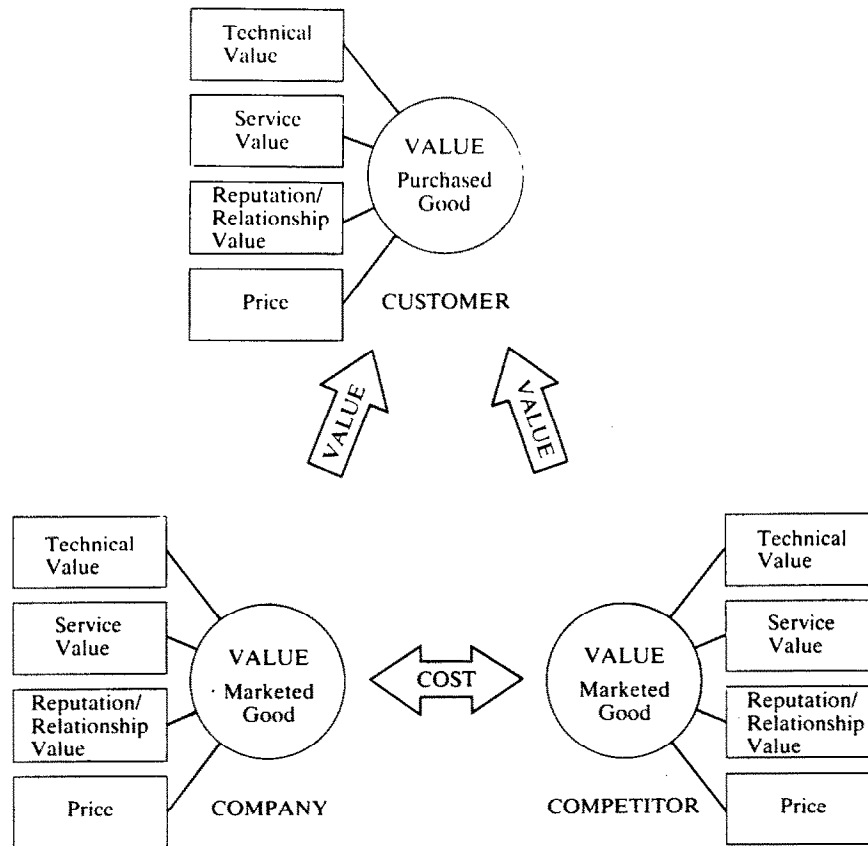


Figure 1 The Value-Triangle (adapted from Ohmae, 1983)

The marketing literature thus addresses (1) incremental innovation only indirectly and (2) radical innovation not at all. This is a major shortcoming, since technological innovation – product and/or process innovation – is instrumental in bringing about state-of-the-art consumer, industrial and high technology goods. In fact, leading firms not just in the high technology, but also the consumer and industrial sectors of the economy see themselves in the business of managing technological – product and process – innovation.

Utterback’s excellent definition of technological innovation as “a new combination of a user need and a technological means to meet that need” makes clear that technological innovation is as much a marketing as a technological phenomenon: it is the result of a matching process linking technology to market. It follows that considerations related to marketing and the generation of customer value should be an integral part of the innovation process. This requirement is commonplace in the innovation and marketing literature. However, a field that integrates technology and marketing and accounts for the instrumental role of technology and technological innovation in generating customer value thus far has been lacking. This paper aims to overcome

this interdisciplinary myopia through merging technology and marketing under a customer value perspective.

Customer Value

The essence of marketing has been stated by Levitt in simple terms as follows:

1. Marketing is concerned with generating and keeping customers.
2. Customers are generated and kept through offerings that provide superior customer value.
3. Superior profit performance will result from the provision of customer value.

Marketers assume that consumer and industrial customers will buy the product that offers the highest value. The mission of the firm then is to generate differential customer value and to exercise control over costs.

In the “value triangle” (Figure 1), differential customer value is provided through the offering that provides an increment in technical cost, service or relationship value relative to the competition. This

puts the buyer or buying unit into a position where, through the purchase of the offering, he can enhance his attainment value.

The Product as a Value Array

The product offering is portrayed in Figure 1 in terms of its technical, service and relationship value and the selling price.

- "Technical value" denotes the core benefit or function, such as technical quality, performance, reliability, conformance, durability, etc.
- "Service value" describes the contribution to overall value from sales and product support activities, such as on-time delivery, product warranty, engineering support, etc.
- "Reputation/relationship value" refers to factors such as supplier image, research and development capability, goodwill resulting from past social exchanges, interpersonal relationships, etc.
- The "price" dimension captures the buyer's total purchase costs in terms of price, payment terms, training, startup, operating, maintenance costs, etc.

The seller can manage the provision of value through enhancing the technical, service, or relationship value of the offering or through lowering the price. In fact, each member of the marketing channel can be construed to opt for the highest value offering.

Perceived Value. Inherent in the portrayal of the product as a value array is a multi-attribute model of perceived value. *Perceived value is the value a buyer attributes to an offering.* It exists in the buyer's head.

Perceived Value =
 (+) technical value
 (+) service value
 (+) relationship value
 (-) price

Value-in-Use is the contribution to efficiency or effectiveness (in purchasing, manufacturing, marketing, R&D etc.) that is derived from the use of a product or service. In essence, it is an engineering calculation applicable to business marketing and organizational buying situations.

In general, both consumer and industrial adoption decisions are based on perceived value. However, value-in-use calculations can be beneficial in establishing and communicating value, that is, in affecting and influencing perceived value.

Strategic Postures. To enhance customer value, the company can opt to increase the technical, service or relationship value of the offering or to lower the price (strategies which Porter describes as product differentiation and cost leadership postures).

- A company pursuing a *product differentiation strategy* strives to enhance product value through enhancing the technical, service or relationship value of the marketed good. Product differentiation can be accomplished through product and/or service innovation.
- A firm following a *cost leadership strategy* aims for the low cost producer position through assuming a process innovation thrust and through passing this cost position on to its customers in the form of a lower price of the marketed good.

The avenues leading to product differentiation and cost leadership are product, process and service innovation, where (1) product innovation affects the technical and/or service value characteristics of the marketed good (Figure 1), (2) process innovation the cost position and the firm's ability to compete on a price basis, (3) service innovation the service value characteristics.

Linking Technology and Marketing under a Customer Value Perspective: Marketing Technology-based Products

Technologically advanced companies are effectively in the business of managing and marketing technological innovation. These companies compete on the basis of technology first and foremost. They use technology as a competitive weapon. Consequently, they are oriented toward their internal core technology: they are rooted in and continue to derive competitive advantage from product and process innovation.

However, a technological innovation capability is only a necessary condition for the firm to succeed. To prosper – and even to survive – the firm must enhance its technology focus with a marketing thrust that concentrates on generating customer value. The key idea is to combine two basic sources of competitive advantage: a technological innovation orientation (with concentrates on technical product characteristics) with a customer value focus (which concentrates on user needs). Figure 2 takes such a dichotomous perspective. It portrays the product and its associated manufacturing and marketing processes into two interrelated spaces: "characteristics space" and "value space", illustrating the previous portrayal of technological innovation as a

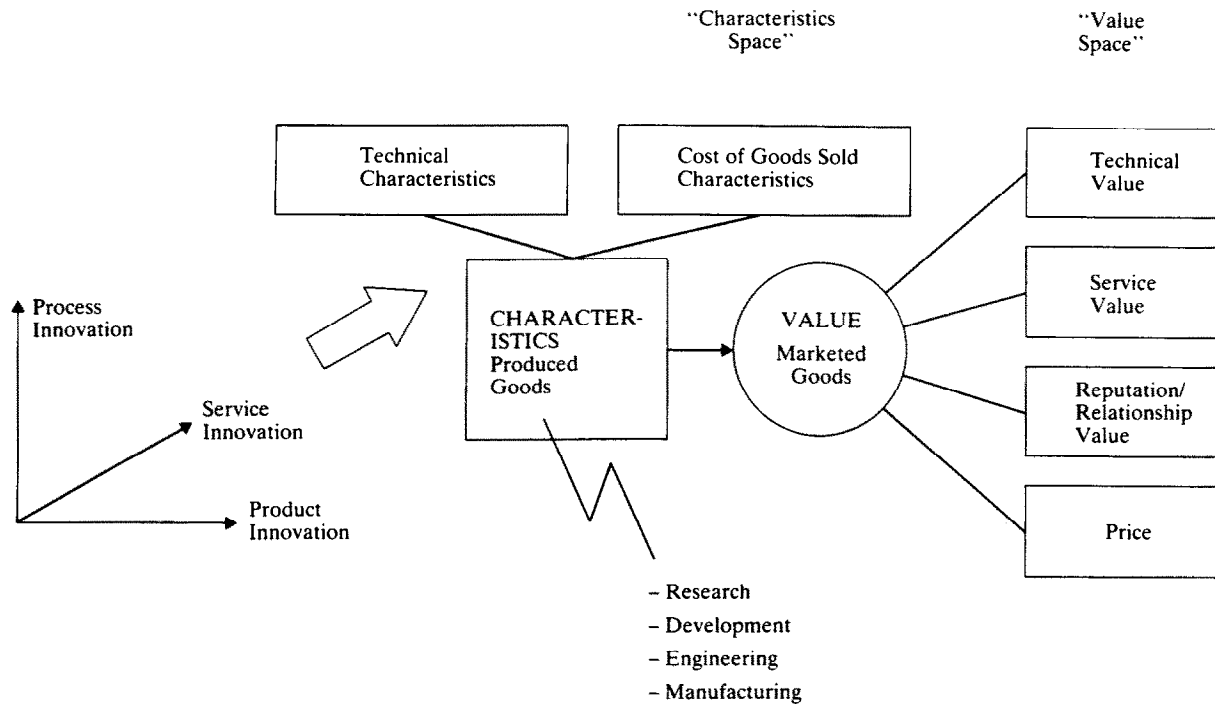


Figure 2 The Dichotomous Perspective of the Technology-Based Product

new combination of a user need and a technological means to fill that need.

- "Characteristics space" captures the product in terms of its technical and cost characteristics, such as physical or chemical properties and cost-of-goods sold;
- "Value space" portrays the product as before in terms of its technical, service and reputation/relationship value and the price.

Clearly, the two spaces are related, since there is a correspondence between the "technical characteristics" in "characteristics space" and "technical value" in "value space". In fact, the "technical characteristics" are latent indicators, or signals, of product worth. Technological innovation can be examined according to this dichotomous product perspective as follows.

1. In a *process innovation situation*, the engineer strives to improve the production technique so as to manufacture the produced good with the "technical characteristics" unaltered, but at a lower "cost of goods sold" (in "characteristics space"). A firm following a cost leadership strategy would then pass these cost-of-goods-sold gains on to its customers in the form of a lower "price" (in "value" space).

2. In a *product innovation situation*, the technologist strives to affect "technical value" of the marketed good (in "value space") through a new or improved production technique. There are two approaches to do so: demand-pull and technology push.

- The *demand-pull product innovation* begins by analyzing consumer demand for certain kinds of "technical value" and "service value" and the degree to which current and potential competitors supply these ("gap analysis"). This approach maps the analysis of "technical value" back into "technical characteristics" and then configures a manufacturing technique to produce "technical characteristics" (in "characteristics space") that corresponds to this mapping.
- In the *technology-push product innovation* situation, a firm starts by producing "technical characteristics" and then proceeds to seek markets in need of these characteristics.

In Figure 2, the technology-based firm is construed to (1) manage product and process innovation to generate customer value, and to (2) enhance the core technology with service innovation to increase the value of the offering and to reduce the adoption risk to the user. The resulting *technology-based products* become *product-service offerings* that are derived from

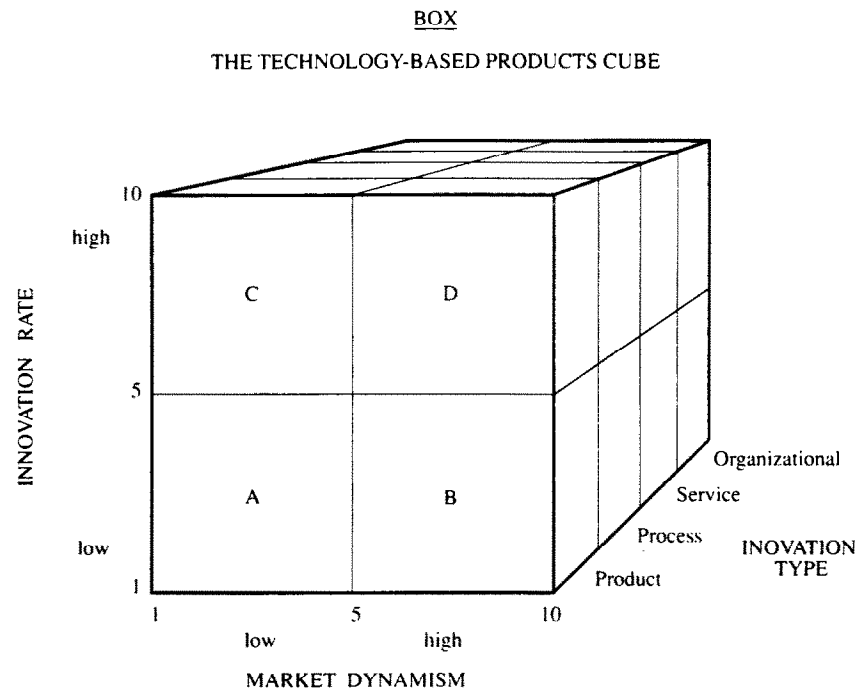


Figure 3

- Cell A: This cell characterizes a static product-market; a market characterized by low rates of innovation and competition.
- Cell B: This resembles a “high engineering” product-market in which an established set of firms competes vigorously on the basis of innovation. The European automotive market in could serve as an example.
- Cell C: These are product-markets characterized by low rates of innovation and high market dynamism. An example are recently deregulated industries, such as the U.S. airline industry.
- Cell D: These product-markets are typical of high-tech industries, such as the market of computer hardware (product innovation), microchips (process innovation), and computer software (service innovation).

RESEARCH ISSUES IN MARKETING TECHNOLOGY-BASED PRODUCTS

The research issues in marketing technology-based products include:

- #1: Procurement Marketing. The strategic importance of purchasing, just-in-time procurement and inventorying, international channels of distribution, procurement decision support systems, global sourcing and seller-buyer relationships are the subjects of this area.
- #2: R&D/Marketing Interface Management (Product Innovation Management). The management of the innovation process – from the idea generation/opportunity recognition to the diffusion/adoption phase – including project management, diffusion/adoption models, engineering myopia, and interfunctional conflict – are the themes of this research area.
- #3: Manufacturing/Marketing Interface Management (Process Innovation Management). This area covers the diffusion and adoption of factory automation technology, including robotics, CAD/CAM, flexible manufacturing, seller/buyer relationships (including user involvement in systems design), and other factors pertaining to the generation of customer value through manufacturing.
- #4: Marketing Implementation. Managing strategic change – the implementation of marketing and an orientation that fosters the generation of customer value in the technology-based firm vis-a-vis engineering cultures and value systems of personnel with science and engineering backgrounds – is the topic of this research area.
- #5: New Information Technology: Understanding their Impact on Marketing and How to Serve New Markets. This area of research is concerned with the assessment of the impact of information technology on marketing. Topics include the new digital telecommunications technology (e.g. ISDN), novel ways of product augmentation, electronically networking with customers, new product development.

technological innovation (product and process innovation). They include those industrial products, consumer durables and nondurables, high technology products, and value-added services which are proximate to the state-of-the-art in terms of function and design and/or in the ways in which they are produced. Technology-based products are then characterized:

1. by the innovation rate in the respective strategic arena (product-market and the corresponding technology),
2. the degree of dynamism in the marketplace, and
3. the innovation type (see Figure 3 in the Box for the resulting technology-based products cube and its interpretation).

This three-dimensional portrayal of technology-based products in terms of innovation type, innovation rate and market dynamism merges technology and marketing. Thus, both "the dichotomous product perspective" (Figure 2) and the "technology-based products cube" (Figure 3) are geared to provide a better understanding of the central issue in the marketing of technology-based products: how (1) a technology focus can be combined with (2) a marketing orientation under a (3) customer value thrust that is (4) common to the firm. (How this cube can be used will be demonstrated in the conclusion section.)

The Role of Organizational Innovation

In examining the role of marketing in the technology-based firm, a distinction needs to be made between marketing as a business function and as a firm's mission.

- Marketing as a business function aims at closing the gap between the company and its customers. Marketing on the functional level focuses on the 4 P's and is the responsibility of the marketing department.
- Marketing as a business philosophy focuses on the process of generating customer value, such as through manufacturing, R&D, new product development, engineering, procurement, product augmentation, etc. However, generating customer value is the responsibility of all members of the firm, including procurement, research, development, engineering, marketing, and – above all – senior management.

In short summary, marketing must be managed at two different levels in the technology-based firm: at the marketing function level, closing the gap between the company and its customers; and at the strategic

level throughout the organization. The objective is to "pull together the organization" to generate customer value – a senior management responsibility.

This need to pull the organization together becomes essential in situations characterized by dynamic change (cells B, C and D in Figure 3), since there may be little time for the firm to react. That is, the technological and service innovation thrust that was promulgated earlier is sufficient for survival only under conditions of relative stability (cell A). In order to survive and prosper vis-a-vis dynamic technologies and/or markets, the firm's technological and service innovation capability needs to be enhanced by organizational innovation through the integration of all business functions – such as manufacturing, R&D, new product development, engineering, procurement, and marketing – towards generating customer value. This is a major issue in today's major multidivisional corporation.

Conclusion

Technology-based products have been characterized in this paper to result from a merger of technology and marketing, to have technological innovation – product and/or process innovation – at their inception. The field of marketing of technology-based products strives to gain an improved understanding of how the company can enhance its traditional technology focus with a market thrust that is common to the firm and that aims at generating differential customer value through product, process and service innovation.

From the three-dimensional representation of the technology-based product in terms of innovation rate, market dynamism and innovation type, the following strategic conclusions can be drawn:

From the Perspective of the Firm

1. For a firm to maintain share in a given market, it needs to innovate at industry average (e.g., at point A on the cube).
2. In order to gain share in a given market, the firm's innovation rate needs to be above industry average (e.g., at point C on the cube).
3. In order to maintain share vis-a-vis a competitor increasing the rate of innovation, the company itself must also increase its innovation rate. However, it should respond with a different product/process/service innovation portfolio than the competitor, unless it wants to end up with a "me-too" product.
4. Organizational innovation may be a necessary

first step before a firm can engage in major product, process, and/or service innovation.

From a Macro Perspective

1. Greater market dynamism may induce increased innovation (the intended effect of "Europe 1992").
2. Conversely, an increased innovation rate may lead to greater market dynamism (c.f. in micro-chips).
3. New high-tech product-markets are characterized by a "high/high" position in the innovation rate/market dynamism matrix.
4. The dynamics of product and process life cycles within an existing technology/market S-curve are such that there is constant pressure towards the "low/low" quadrant in the matrix.
5. Technology/market S-curve jumps are characterized by shifts from "low/low" to "high/high" positions, usually in technological substitution situations.
6. Structural shifts in an economy are indicated as follows:
 - Major innovation cycles through a shift in the innovation rate from low to high. Of course, such structural shifts will cause markets to become more dynamic, leading in turn to high innovation rates, etc.
 - The easing of barriers to entry result in a move from low to high market dynamism. Such structural shifts again are likely to lead to higher innovation rates, and these higher innovation rates in turn to greater market dynamism, and so on.

This paper called for the technology-based firm to

augment its traditional technological innovation orientation with a customer value thrust. It approached technology-based products as product-service offerings derived from technological innovation. In implementing marketing and a customer value orientation, the technology-based firm was construed to create and recreate differential customer value through product, process, service, and organizational innovation. The ultimate aim in this portrayal of the technology-based product is an improved understanding of how an organization can combine a technology orientation with a customer value thrust that is common to the firm. To gain it, researchers and practitioners from different backgrounds must join forces in understanding the essence of marketing: *generating customer value through technological, service and organizational innovation*. Theory, research and management practice stand to gain from such an interdisciplinary approach.

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