

# R&D Marketing Integration in New Product Development: The Case of the Telecommunications Industry in Malaysia (Preliminary Findings)

JAMIL BOJEI  
*Universiti Putra Malaysia  
Selangor, Malaysia*

## ABSTRACT

*Developing new products in a complex environment, such as in the telecommunications industry, involves significant integrated effort—particularly between that of R&D and Marketing. The failure to integrate R&D and Marketing in new product development can result in over-designed, over-priced, and either obsolete or radically-advanced products with little customer value. This paper attempts to offer insights into R&D and Marketing integration in the telecommunications industry in Malaysia. In general, only a few telecommunication companies have achieved effective R&D-Marketing integration which is significant in certain areas requiring the integration.*

**Key words:** R&D, marketing, integrated effort, R&D-Marketing integration, new product development, telecommunications industry.

## INTRODUCTION

With the accelerating rate of technological advancements, the state of technology and market conditions are continuously changing and competitive pressure to keep abreast is high. R&D not only needs to shine in its technical expertise, it also needs to excel in translating market needs into viable products and gearing to anticipate needs. In addition, in technology-based industries, technological complexity, highly specialised groups within the organizations, shorter life cycles, and the need for rapid product development in the product development process make lateral and teamwork within and between organizations more important.

## WHY INTEGRATE R&D AND MARKETING

Successful technology-based companies know from experience that invention in the laboratory is important but is certainly no guarantee of success in the marketplace. Importantly, according to Dover (1985:33):

The most successful innovators are those companies that thoroughly integrate their functional efforts. This is particularly true in highly advanced technology firms for the R&D and marketing interface. Further, marketing must play a key role at each stage of the product development process, as active in strategic market planning prior to new product conception as it is in tactical market plan operation following product introduction.

Moreover, most technology-based companies often have research and development capabilities superior to those of competitors, yet achieve only mediocre commercial success or fail completely. In addition, R&D or marketing prowess singularly or even coexisting in the same organization will not necessarily translate into financial success (Shanklin and Ryans, 1987).

In fact numerous studies indicate that in order to succeed in new product development, the firm needs to link R&D with Marketing (Sounder, et al., 1977, 1980, 1981, 1989; Gupta, et al., 1985, 1986, 1987;

Bonnet, 1986; Ruekert and Walker, 1987; Wilson and Ghingold, 1987; Brockhoff and Chakrabarti, 1988; Saghafi, et al., 1990; Gupta and Wilemon, 1991).

Sounder et al. (1977) identified the features of various states of R&D/Marketing relationships and their impact on the project outcome. In their other study (1981), they found that most projects with a harmonious R&D/Marketing relationship succeeded, whilst those with severe R&D/Marketing disharmony failed. The harmonious state is characterised as either having equal partner roles or dominant roles for R&D and Marketing, whereas the disharmonious state is characterised by such factors as: (1) lack of interaction; (2) lack of communication; (3) inability to appreciate differences in values priorities; and (4) distrust.

Saghafi et al. (1990) researched the roles of R&D and top management in achieving a harmonious and productive interface in the telecommunication industry and found that the relationship between R&D and marketing, as perceived by the respondents, had improved. However, senior management were rated low in their attempts to improve and manage the interface effectively. And lack of effective communication and involvement were found to be the most important barriers to effective integration.

Gupta et al. (1985, 1986, 1987, 1991), based on their series of studies on R&D and marketing integration among technology-based companies identified barriers to integration and examined factors that influence the degree of the integration required, such as differences in perception between R&D and Marketing on several new product development (NPD) issues, specific areas requiring integration, and major differences in the organizational practices of high- and low-integration companies. In those studies, lack of communication, lack of senior management support, spatial separation, exercise of reward systems that discourage co-operation, and lack of credibility were identified as contributing factors to poor relationship between R&D and Marketing.

However, the interactions between marketing and development personnel were found to vary across business units pursuing different strategies, e.g., prospector, defender, analyser, and reactor. For example, conflict between R&D and Marketing is greatest under a prospector business unit strategy (Ruekert and Walker, 1987).

Others like Michaels (1982), for instance, says similar advanced technology companies continuously cite marketing capabilities and R&D strength when describing their company's future. This is because, if appropriately utilised, these two areas can effectively anticipate, analyze and exploit market opportunities.

More importantly, by integrating R&D and Marketing, possible market opportunities can guide R&D's efforts (Foster, 1980). This means that the R&D people focus their effort in inventing and developing a product or process for which those in the marketing side will attempt to seek a profitable strategic market application. To make such linkages workable, Foster classified them into categories based on the degree of technical/market fit, namely: (1) heavy emphasis—deserving full support, including basic R&D, (2) selective opportunistic emphasis—requiring a careful approach and top management attention, and (3) limited defensive support—which merits only minimum support.

### **CONCEPTUALISING R&D AND MARKETING INTEGRATION**

A good example of the conceptualisation of integrating marketing and R&D is the illustration by Shanklin and Ryans (1984; 1987) (see Figure 1). They conclude that marketing is the main direction for R&D in market-driven technology (assigning R&D the task of producing innovations that meet specific market objectives). Here, R&D reaction (dotted arrow) on what is technically feasible comes in the form of guidance and ideas from scientific circles.

On one hand, the formal marketing research, which is typical of consumer and industrial markets, helps technology managers

FIGURE 1. Conceptualising Marketing-R&amp;D Interface in a Technology-Based Company



Adapted from Shanklin and Ryans (1984;1987)

guide R&D. On the other hand, in innovation-driven technology, R&D provides the stimulus, and marketing officials must find applications or simply sell the product. Generally, these efforts may help create markets by applying laboratory breakthroughs to largely unperceived buyer needs.

To achieve such integration, Bonnet's (1986) study provided the means for an efficient product design procedure between R&D and Marketing. The link should profit both the engineering design of the product and its future marketability. He also outlined the advantages and the problems inherent in the study, and proposed a framework for implementation. The question is, what marketing with what R&D?

#### LINKING R&D AND MARKETING

As indicated above, linking R&D and market needs is crucial. The techniques focus not only on R&D attributes, but also on the total attribute package which focuses on the relative contribution of all attributes of the buying tendency (Wilson and Ghingold, 1987). They advocated that the R&D product development efforts be driven by the marketplace.

To establish the linkage between market-driven and innovation-driven technology, technology marketers need to know the type of R&D that is being developed today and possibly in the future, so that they can realistically analyze and understand their planning constraints (Shanklin and Ryans, 1987; Wilson and Ghingold, 1987). Shanklin and Ryans (1987: 130-131) state that:

The linkage in the market-driven high technology comes primarily through R&D's active participation in the market planning process, especially in the objective-setting stage. In market planning, R&D can guarantee that marketing does not lose sight of R&D's vision for the product. The corollary is that marketers can offer parameters for the researchers' effort. Through the give-and-take of setting objectives, R&D and marketing can agree on the target market, priorities, expectations, and timing.

The linkage in market-driven situations needs to be formal and carefully designed .... Face-to-face, in person interaction and an agenda for meetings are most productive. Marketing and R&D people should talk almost daily during the initial market planning effort for a new product or application and regularly thereafter for updating and revision. To avoid later misunderstandings, both R&D and marketing should agree on and write the goals and objectives for the marketing plan.

Linking R&D to the marketplace can help focus R&D efforts on high-return projects (Gupta et al., 1987) and a company that cannot achieve a satisfactory degree of integration cannot remain a viable competitor for long (Gupta et al., 1985). The key issue for the management would be directing R&D toward efforts that yield optimum results, given the firm's objectives, strategy, and marketing environment. Therefore, an understanding of market needs and its challenges are called for in marketing's role in product development.

Here, marketing is basically responsible for constant surveillance of the market and effectively communicating market needs to

R&D and finding commercial application for R&D's product ideas and technologies (Gupta et al., 1985, 1986); R&D, meanwhile, is expected to get involved in marketing by developing products according to market needs. So, integrating R&D and marketing will maintain and open up lines of communication between these areas. A model introduced by Gupta et al. (1985) can be useful if one wants to undertake a study on R&D and marketing integration. Besides indicating that R&D and marketing need to integrate their efforts, this framework helps in identifying specific problem areas. This will help in building the much needed integration between R&D and marketing. Perhaps the best description concerning the interdependence of R&D and marketing is the one that is stated by Butler (1976: 7):

The fact is that our research and development activities are very interdependent. Without a flow of significant innovations coming from the development effort, our marketing team could not be effective. Without an effective marketing team and technological advances into profit-making innovations, our research and development organization could not long pay its bills.

The degree of R&D and marketing integration achieved or required could be measured in terms of the extent of R&D and marketing involvement and information sharing in the various stages of the innovation process. For instance, Elstone et al. (1988) detected differences in dissatisfaction between R&D and Marketing in the first four of the six stages of new product development in the pharmaceutical industry. With Marketing, very few differences were detected between the actual interface and what would be considered desirable. However, R&D seemed to be most dissatisfied in the first stage, but the dissatisfaction decreased as the product approached the launch stage.

#### **ACHIEVING SUCCESSFUL R&D AND MARKETING**

To achieve successful R&D and marketing integration requires management to develop a method for linking R&D expenditure and

marketing variables (Wilson and Ghingold, 1987). These key variables include attributes such as product, features, or benefits. In industrial markets, such as telecommunications, this simply means that a product, besides its physical characteristics, will be portrayed as an array of economic, technical, and personal relationships between buyer and seller. And to ensure continued interaction between R&D and marketing, various organizational arrangements such as a venture team, project task force, or other forms such as vertical or horizontal integration need to be established. Also, there is a need to formalise the relationship so that firms can provide some types of formal structure to ensure that joint, complementary efforts of R&D and marketing are recognised (Shanklin and Ryans, 1987).

In addition, certain factors related to organizational design and management support along with sociocultural differences will affect the level of integration that can be achieved by the organization. A study by Gupta et al. (1985), identified 19 key areas or activities where R&D and marketing are required in the product development process. In some cases, R&D and marketing integration may be required in all the three innovation phases—planning phase, development phase, and post commercialisation phase. They also found that high-integration companies achieve significantly greater integration in all areas requiring R&D and marketing and that firms with successful new product programs achieve significantly greater R&D and marketing integration in each area requiring integration.

The extent of R&D and marketing integration the company will ideally require is influenced by the firm's strategy and its perceived environmental uncertainty, i.e., economic and technical uncertainty (Bonnet, 1986; Gupta et al., 1986). For instance, developing and marketing technologically advanced products involve making a series of decisions under uncertainty (Bonnet, 1986)—economic uncertainty (resulting from incomplete information about the future market outcome of finished products) and technical uncertainty (resulting from the increasing complexity of the market

TABLE 1. Barriers to R&amp;D-Marketing Integration

Element of Barrier		MEAN SCORE	
		R & D	Marketing
1.	Lack of effective communication	2.36	2.10
2.	Lack of involvement/cooperation	2.56	2.20
3.	Poor organizational structure	3.83	2.60
4.	Poor working (environment)	4.03	3.10
5.	Conflict between the two groups	3.30	3.43
6.	Lack of information sharing	2.90	2.76
7.	Lack of trust between the groups	3.27	2.97
8.	Working environment and training background differences among the groups	2.77	3.10
9.	Differences in goals and priorities	2.17	2.33
10.	Lack of respect, trust and commitment	3.17	3.30
11.	Lack of sufficient resources	3.70	2.93

Note : Mean scores based on 5-point scale (1= strongly agree to 5 = strongly disagree)

TABLE 2. Quality of R&amp;D-Marketing Integration

Perception of :	Excellent	Above Average	Average	Below Average	Poor
Marketing	23.3%	10.0%	23.3%	26.7%	16.7%
R&D	13.3%	36.7%	26.7%	20.0%	3.3%

TABLE 3. Changes in Quality of R&amp;D-Marketing Integration in the Last Five Years

	Improved	No Change	Deteriorated
Marketing	30.0%	63.3%	6.7%
R&D	53.3%	46.7%	0.0%

TABLE 4. Efforts to Improve R&amp;D-Marketing Integration

Efforts	Mean Score	Rank
<b>Marketing Efforts :</b>		
1. Trying to increase teamwork with R&D such as by getting joint committees more involved	1.90	3
2. Improving communication with R&D	1.63	2
3. Implementing the product management system	1.93	4
4. Increasing the understanding of technology	1.03	1
<b>R&amp;D Efforts :</b>		
1. Increasing teamwork and involvement with marketing	1.83	3
2. Improving communication with marketing	1.93	4
3. Forming product-line management interface and joint committees	1.83	3
4. Providing marketing with better product specifications	1.56	1
5. Initiating greater customer contact in product design, planning and developing stages	1.77	2
6. Getting involved with marketing in market research	2.00	5
7. Learning more about marketing	2.50	6

Note : Mean scores based on 5-point scale (1= strongly agree to 5 = strongly disagree)

applications). A close relationship between R&D and the marketing functions in the early stages of product development is the most efficient way to manage these products.

Ideally, the R&D department should provide a satisfactory balance between technical viability and commercial viability of technologically advanced product characteristics that would then be integrated into the product design to maximise its marketability. Bonnet (1985, 1986) suggested how the major components of R&D and marketing design link can be implemented or improved. So, it is important to have a creative, cooperative partnership between R&D and marketing to ensure the success of a firm's product improvement efforts and new product development.

### THE STUDY

Given the scenarios above, this paper attempts to examine the extent of the R&D and

marketing integration in the telecommunications industry in Malaysia, specifically the business units of the firms. This study closely adopts the ideas in the studies reviewed above.

The survey was carried out among the R&D and marketing managers in the telecommunications industry in Kuala Lumpur, Malaysia. Kuala Lumpur was chosen for the study because most of the telecommunications companies are concentrated in the area. The data was collected through personal interviews and structured questionnaires. Sixty sets of usable questionnaires (30 from R&D and 30 from Marketing managers) were obtained from the interviews in the months of January and February 1994.

### THE RESULTS

A 5-point scale (1=strongly agree to 5-strongly disagree) was used to determine the extent

to which each factor affects the integration of R&D and Marketing. Both R&D and marketing viewed lack of effective communication, lack of involvement or cooperation and differences in goals and priorities as important barriers to integration (see mean scores in Table 1). Another factor viewed as important by Marketing is the organizational structure, while R&D viewed differences in the working environment and training background as the barriers to integration.

The respondents were asked to evaluate the current quality of the relationship between the two groups. Thirty marketing and thirty R&D managers responded to this question. From Table 2, the results show that 33.3% of marketing and 50% of R&D respondents ranked the relationship between the two groups as being above average, while 43% of marketing and 23.3% of R&D managers thought that the relationship was below average or worse.

To assess the dynamics in the quality of the relationship over time, the respondents were asked to indicate if they perceived any changes in their partnership over the past five years. Only 6.7% of marketing respondents believed that the relationship had deteriorated over time. In fact, marketing and R&D managers were more optimistic—30% of marketing managers and 53.3% of R&D managers believed that it had improved (see Table 3).

Both groups were asked to indicate the efforts that each group can make to improve the R&D-marketing relationship. The results are shown in Table 4. The mean scores for all of the factors were rated highly from 1.03 to 2.00 (except learning from marketing with 2.50) on a 5-point scale (ranging from 1=strongly agree to 5=strongly disagree).

The respondents were asked to identify the areas that require R&D-Marketing integration. Table 5 shows 19 areas requiring R&D-marketing integration that are ranked in order of their relative importance. The data is then further analyzed to examine whether the companies that achieve high R&D-marketing integration concentrate their efforts only on certain key areas that require integration. The areas that companies

focus on may provide insights for organizations attempting to make improvements by first focusing on these specific areas.

Responses from R&D and marketing managers on the extent of the current level of integration achieved by their organizations were categorized as high- or low-integration-achieving companies. A high-integration company is defined as one that has an overall average of below 3 (an approximate midpoint on our 5-point scale) on the 19-item integration scale. The mean score for R&D and marketing responses for high- and low-integration companies are presented in Table 5.

The table clearly indicates that R&D, as well as marketing managers, perceive that high-integration companies achieve a significantly and uniformly high degree of integration in some of the areas requiring integration. It can, therefore, be concluded that high-integration companies concentrate on a few key areas of integration.

Differences between high- and low-integration companies were also investigated. The quality of the relationship existing between the R&D and marketing groups had the greatest impact on the degree of integration achieved by a company. The results shown in Table 6 indicate that in high-integration companies there was a high level of give-and-take between the R&D and marketing groups. More importantly, conscious effort was made to involve both R&D and marketing from the earliest stages of the new product development process, which is one of the key differences between those companies which achieved high integration and those that did not. The result also shows that in high-integration companies, R&D-marketing conflicts were resolved sooner and at lower organizational levels.

The study indicates that the organizational design of high-integration companies differed from the low-integration companies in terms of rules, responsibilities and authorities which are clearly defined. In high-integration companies, the responsibilities of the managers were clearly articulated via policies, new product development procedures and job descriptions.

TABLE 5. Areas of Focus in R&amp;D-Marketing Integration

Areas of Focus	Level of R&D-Marketing Integration Achieved by The Firms			
	Marketing's Perception on Integration		R&D Perception on Integration	
	High	Low	High	Low
<b>Marketing is involved with R&amp;D in :</b>				
1. Setting new product goals and priorities	1.75	3.85a	2.03	3.40
2. R&D's budget proposal	2.94	3.61a	2.78	3.95
3. Establishing product development schedule	3.00	4.62	2.65	3.90
4. Generating new product ideas	2.13	3.23b	2.65	4.23
5. Screening new product ideas	2.31	3.46a	2.35	3.90a
6. Finding commercial application of R&D's new product ideas	2.31	4.30	2.63	3.60
<b>Marketing provides information to R&amp;D on:</b>				
1. Customer requirements of new products	1.93	3.46	2.38	3.85
2. Regulatory and legal restrictions on product performance and design	2.93	3.92a	2.93	4.15
3. Test marketing results	2.25	3.23a	2.35	4.25b
4. Feedback from customer regarding product performance	2.06	3.69a	2.35	3.85
5. Competitor's strategies	2.06	3.77	2.45	4.05a
<b>R&amp;D is involved with Marketing in :</b>				
1. Marketing's budget proposal	3.18	4.00b	3.13	3.85c
2. Screening new product ideas	2.87	3.00a	2.68	4.15
3. Modifying product according to Marketing's recommendation	2.43	3.61c	2.35	3.85
4. Developing new products according to the market needs	2.37	3.46	2.33	3.90
5. Designing communication strategies for the customers of new products	2.81	2.84	2.93	3.10
6. Designing user and service manual	3.18	4.00a	2.90	3.05
7. Training user in new products	2.87	4.23	2.88	3.25
8. Analyzing customer needs	2.81	3.77c	2.65	2.90

Note: a Difference is significant at 0.1 level  
 b Difference is significant at 0.01 level  
 c Difference is significant at 0.05 level

(Based on a 5-point scale from 1=highly involved to 5=not at all involved)



TABLE 6. Differences in Levels of R&D-Marketing Integration  
Among The Various Factors

Factors	Highly Integrated	Poorly Integrated	Significance Level
<b>R&amp;D-Marketing Relations</b>			
1. Give & take relationship exists between R&D and marketing	1.93	2.45	0.09
2. R&D and marketing are involved early in the new product development process	1.90	2.55	0.1
3. Early resolution of conflicts between R&D and marketing	1.85	2.05	0.1
<b>Organizational Structure</b>			
1. Roles, authorities and responsibilities are clearly documented	1.98	2.45	0.1
2. Very few actions are taken without the approval of a superior	2.45	2.00	NS
3. Even small matters have to be referred to someone higher up for final decision	3.30	3.10	NS
4. Employees are encouraged to participate in the decisions related to:			
- new product development	2.15	2.78	0.044
- product modification	2.10	2.85	0.2
<b>Support From Top Management</b>			
1. Provides incentive to work on new ideas despite uncertainty in their outcome	2.03	2.00	NS
2. Initial failures in new product development don't reflect on individual manager's competency	2.23	2.10	NS
3. R&D and marketing share equally in the rewards from a successfully commercialized new product	2.18	1.80	0.1
4. Credit for success and blame for failure given to the group that deserves it	2.53	3.15	0.027
5. Top management provides opportunities for R&D and marketing to communicate and understand each other	2.10	1.70	0.1

Note: Numbers represent mean score on a 5-point scale (1=strongly agree to 5=strongly disagree) on each factor for each category of firms. Differences in the mean scores were tested for statistical significance by T-test.

Table 7: Impact of R&amp;D-Marketing Integration

Impact	Correlation Value
Market Share	0.3805 *
Market Growth	0.4912 **
Financial Performance	0.4727 **
Interpersonal Relationship	0.4910 **
Staff Motivation and Performance	0.4553 **

\* = 1-tailed significance at 0.01  
 \*\* = 2-tailed significance at 0.001

This study also found that high-integration companies encouraged participation in new product development and modification at all levels within R&D marketing.

Senior managers in high-integration companies could be characterized as interested in promoting the need for R&D-marketing integration and tolerant of failure; they also established joint rewards for R&D and marketing's new product development efforts, and they provided significantly greater opportunities for their R&D and marketing managers to communicate and understand each other's needs.

The study also examined the effect of R&D-marketing integration in general. The results in Table 7 indicate that the quality of R&D-marketing can increase the market share as well as the market growth and financial performance of the firms. This is due to the increase in new products being developed and the decrease in the number of new product failures which resulted from the relationship between the two groups. The other areas of impact include the increase in interpersonal relationships and staff motivation and performance. This resulted from greater or increasing communication between the groups where each group met regularly and discussed problems together in order to solve them. Consequently and most importantly, greater job satisfaction can be achieved.

### CONCLUSION

Successful technology-based companies know from experience that invention in the laboratory (R&D) is important but certainly

no guarantee of effectiveness in the marketplace. In fact, the most successful innovators are those companies that thoroughly integrate their functional efforts, i.e., R&D and marketing. R&D and marketing integration, if properly utilised, can effectively anticipate, analyze and exploit market opportunities. Also, by integrating R&D and marketing, possible market opportunities can guide R&D efforts. Linking R&D to the marketplace can help focus R&D efforts in high return projects. R&D and marketing integration can be measured in terms of the extent of R&D and marketing involvement and information sharing at the various stages of the innovation process.

The study showed that only a few telecommunications companies effectively achieve the R&D and Marketing integration. The trend in recent years, however, seems to be positive, and a substantial number of the respondents agreed that the relationship between the two groups had improved. Lack of communication and involvement, and lack of cooperation as well as differences in goals and priorities were found to be the important barriers to effective integration. Importantly, the companies which were highly integrated achieved significantly greater integration in those areas where integration was crucial. These companies were found to be more productive and harmonious in their R&D-Marketing relationship. Some of the organizational design issues and the role of and participation by the senior management were found to be contributing factors to improving R&D-marketing relationship and integration. R&D and marketing integration was found to have impact on market share,

market growth, financial performance, interpersonal relationships, and staff motivation and performance.

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#### BIBLIOGRAPHY

- Bonnet, D. C. L. (1986). Nature of the R&D/Marketing Co-operation in the Design of Technologically Advanced New Industrial Products, *R&D Management*, **16 (2)**: 117-126.
- Brockhoff, K. & Chakrabarti, A. K. (1988). R&D/Marketing Linkage and Innovation Strategy: Some West German Experience, *IEEE Transactions on Engineering Management*, **35(3) August**: 167-174.
- Butler, O. B. (1976). What Marketing Expects from R&D, *Research Management*, **19 (1)**: 7-9.
- Dover, P. A. (1985). Practices and Problems in Marketing Technological Innovations, *European Management Journal*, **Vol. 3 (1)**: 33-38.
- Drews, J. (1989). Research in the Pharmaceutical Industry, *European Management Journal*, **7(1) March/Spring**: 23-30.
- Elstone, C. G., Ball, D. F. & Pearson, A. W. (1988). The R&D/Marketing Interface in the Pharmaceutical Industry, *Management Research News*, **11 (4/5)**: 31-34.
- Foster, R. N. (1980). Linkage Comes to United International, *Business Horizons*, **23 (6) Nov-Dec**: 70.
- Gupta, A. K., Raj, S. P. & Wilemon, D. L. (1985). R&D and Marketing Dialogue in High-Tech Firms, *Industrial Marketing Management*, **14**: 289-300.
- (1986). A Model for Studying R&D-Marketing Interface in the Product Innovation Process, *Journal of Marketing*, **50 (2) April**: 7-17.
- (1987). Managing the R&D-Marketing Interface, *Research Management*, **30(2) March-April**: 38-43.
- Gupta, A. K. & Wilemon, D. L. (1991). Improving R&D/Marketing Relations in Technology-Based Companies: Marketing's Perspective, *Journal of Marketing Management*, **7(1) January**: 25-45.
- Jacques, B. H. & Van der Meer (1988). R&D-Based Strategies in the Semiconductor and Drug Industries: Rationale, Organizing and Actions, *Journal of R&D Management*, **18**: 111-121.
- La Zerte, J. D. (1989). Market Pull/Technology Push, *Research Technology Management*, **32(2) March-April**: 25-31.
- Liberatore, M. J. & Titus, G. J. (1983). Synthesizing R&D Planning and Business Strategy: Some Preliminary Findings, *R&D Management*, **13 (4)**: 207-218.
- Michaels, E. G. (1982). Marketing Muscle: Who Needs It? *Business Horizons*, **25 (3) May-June**: 66.
- Nystrom, H. & Edvardsson, B. (1980). Research and Development Strategies for Swedish Companies, in Sahal, D. (ed.), *Farm Machinery Industry: Research Development and Technological Innovation*, Massachusetts, USA: Lexington Books, 39-53.
- Ruekert, R. W. & Walker, Jr. O. C. (1987). Interactions Between Marketing and R&D Departments in Implementing Different Business Strategies, *Strategic Management Journal*, **8**: 233-248.
- Saghafi, M. M., Gupta, A. & Sheth, J. N. (1990). R&D/Marketing Interfaces in the

- Telecommunications Industry, *Industrial Marketing Management*, **19**: 87-94.
- Shanklin, W. L. & Ryans, J. K. (1987). *Essentials of Marketing High-Technology*. Massachusetts, USA: D. C. Heath and Company.
- Sounder, W. E., et al., (1977). *An Exploratory Study of the Coordinating Mechanisms Between R&D and Marketing as an Influence on Innovation Process*, Washington: National Science Foundation, NTIS PB-279-366/AS, August.
- \_\_\_\_\_ (1980). Promoting an Effective R&D/Marketing Interface, *Research Management*, **23(4) July-August**: 10-15.
- \_\_\_\_\_ (1981). Disharmony Between R&D and Marketing, *Industrial Marketing Management*, **10, February**: 67-73.
- \_\_\_\_\_ (1989). Improving Productivity through Technology Push, *Research Technology Management*, **32(2) March-April**: 19-24.
- Wilson, D. T. and Ghingold, M. (1987). Linking R&D to Market Needs, *Industrial Marketing Management*, **16**: 207-214.