

**THE METHODOLOGICAL REVIEW OF THE STUDIES INVESTIGATING
THE SUCCESS AND FAILURE FACTORS IN NEW PRODUCT
DEVELOPMENT**

M. Halâk KÖKSAL (*)

ABSTRACT

New Product development is a critical activity for companies in order to prosper and survive in today's turbulent business environment. It is estimated that over almost thirty-five per cent of new products fail across a variety of different industrial sectors although they make significant contributions to the sales and profits of companies.

Much has been written on the factors which can distinguish between successful and failure products. However, the methodologies in this area of research are almost as numerous as the articles which have been written. This article reviews the studies on new product success and failure factors from the methodological perspective.

1. INTRODUCTION

It is widely believed that companies must develop and introduce new products on an on-going basis in order to grow or at least survive. It is clear that new products contribute to increases in the sales and profits of companies. According to the Conference Board Report (Hopkins, 1980), 15 per cent of current company sales are based on major new products developed during the last five years. Mahajan and Wind (1992) disclose that the average percentage of total company sales attributable to new products developed within the last three years is 25 per cent. Recently, Page (1993) explained that 32 per cent of company sales come from new products introduced during the previous five years in 1990 and the respondents expect that 38 per cent will come from new products introduced during the 1990-1995 period. Unfortunately, however, developing new products is a risky process, including different problems, pitfalls and failures. The failure rate in the new product development process is quite high and the Booz, Allen and Hamilton Study (1982) reports that it is between 30 per cent and 40 per cent.

With recognition of the importance of new product development during the past thirty-five years a considerable amount of studies have been carried out to identify the factors influencing new product success and failure. Studies in this field are of a multidisciplinary nature and are thus to be found in several disciplines including marketing, organisational behaviour, engineering management, and operations management. The results of the studies underline almost identical factors since, in spite of important variations existing, the

(*) Yrd. Doç. Dr. D.E.Ü. İ.İ.B.F.İşletme Bölümü

subsequent studies have been influenced by the previous ones. Moreover, some studies have been systematically replicated to check the effects of particular factors in different circumstances. For example, The Canadian Study by Cooper was applied in the Dutch (Bronnenberg and van Engelen, 1988) and the Peoples Republic of China environments (Song and Parry, 1994) and Project SAPPHO was replicated in the Hungarian (Szakasits, 1974) and Israeli electronics industries (Teubal et. al, 1976).

There are mainly two groups of studies in the literature which investigate the determinants of new product outcomes. The first group are generalistic in nature; they investigate and measure a different set of variables with respect to their impact on new product projects and programmes. The second group is called specialist studies and concentrate their investigations on one particular area of new product development, such as inter-functional integration in new product development projects (Parry and Song, 1992; Moenaert et. al, 1994) and co-operation among the companies in the development of new products (Litter, et.al.,1995; Bonaccorsi and Lipparini; 1994). In this article, the generalistic studies are broadly reviewed in terms of the methodologies they employed and their results are discussed.

2. PERFORMANCE TYPE INVESTIGATED

Some of the studies investigating the factors influencing new product outcomes focused on either success or failure factors. Collecting information on successful new products is generally easier than failures due to these projects being terminated in the companies prior to commercialisation, and the imputation of managers from the failure, leading to incomplete information on the projects. However, it is arguable that success factors could be the factors which led the new product projects and programmes to failure at the same time or vice versa. Therefore, this represents potential bias. Together with Project SAPPHO, studies attempted to compare successful new products with unsuccessful ones of the same type in order to identify the differences between success and failure.

3. THE LEVEL OF ANALYSIS

The studies into the success and failure factors in new product development have focused their investigations on either the overall performance of the company which is called "programme level analysis", or the performance of a specific new product project which is referred to as "project level analysis".

As in the Johne and Snelson argument (1988) for programme level analysis, it is easier to find at least one successful new product, but it is much more difficult for companies to sustain this performance over a period of time. Therefore, it is a better assessment to measure the performance of the company's

overall product development activities over a period of time so that one-off successes and failures are absorbed and a better appreciation of a company's overall ability to develop new products is gained. Maidigue and Zirger (1985) argue this issue from the learning process perspective which is gained from unsuccessful products over time. In fact, a new product, initially considered as a failure, can contribute to the company by allowing them to learn from their mistakes and incorporate what they have learned in the following successful new products. However, programme level analysis is difficult to carry out since it requires data over a period of time and over a number of projects which may be incomplete due to take-overs or mergers, and survey respondents may be unable to remember the events of up to three or five years ago, or be unable to report accurately.

The studies investigating success and failure factors in new product development at the programme level focus on either the overall performance of the company (Peters and Waterman, 1982) or on the company's performance in their product development activities (Johne and Snelson, 1990; Edgett et. al. 1992). However, the studies which focus on overall company performance examined the characteristics of companies who were successful in overall competitive performance terms although they generally pointed to innovation as the key competitive activity. The other studies discussed the factors distinguishing successful new products from unsuccessful ones at the programme level.

The other issue which needs to be discussed in the studies concentrating on the programme level is to decide on making an assessment of the ability of the overall business to innovate or of the ability of strategic business units (S.B.U.) to innovate, in other words to decide on collecting data at the corporate level or within strategic business units. John and Snelson (1990) in their research made it clear that they focused on the business units which compete for business in specified product markets and which submit their own separate plans, budgets and reports to the corporate centre in order to avoid generalised statements being made about practices in large companies. These business units are often remarkably different, reflecting in a large measure their operating circumstances.

The studies investigating success and failure factors at the project level assessed the outcome of one particular new product development. The companies are likely to have detailed financial data regarding particular projects such as return on investment (R.O.I.), profitability level, market share and so on. Therefore, first they should be better able to make an assessment of the performance of the projects. Second, the individuals within the company are more likely to be able to remember specific projects. Finally, it is more likely easier to identify knowledgeable individuals within the company. However, it is difficult to draw any conclusion about the factors which are not directly related to the outcome of one specific project such as strategy, management, organisational

structure and style since these types of studies focus on one particular project. The effects of such factors take some time to become apparent. Moreover, the factors such as the phases of a project process, project management and project structure may affect the outcome of a particular project

4. SAMPLE SIZE EMPLOYED

The sample size employed in the studies investigating the performance of new product development makes the subject more complicated and difficult to reach appropriate conclusions. The studies in the literature tend to use different sample size. However, a careful analysis shows that the studies employed a large or small sample size, depending on the industry(s) and/or region(s) in which the investigation was carried out.

Generally, the studies before the seventies included small sample sizes. Project SAPPHO Phase I investigated 58 projects (Achilladelis et. al, 1971) and Phase II of the same study employed 86 projects (Rothwell et. al, 1974); Sauder and Chakrabarti, (1978) studied 49 successful and 68 failure projects from 18 companies. Utterback (1976) covered 66 successful and 51 failure projects from 166 companies. Rubenstein et. al. (1976) studied 103 projects from six companies.

At the end of the seventies, the studies became more empirical and used more quantitative methods with larger samples. The Canadian study by Cooper included 102 successes and 93 failures from 103 companies (Cooper, 1979a, 1979b, 1980) and Kim in the longitudinal study in South Korea (1986) used 156 success and 123 failure projects from 81 companies. The Stanford Innovation Project employed a total of 325 new product projects (Maidique and Zirger, 1984). However, among the recent studies it is possible to find some working with small samples. For example, Clark and Fujimoto (1991) gathered data from 29 projects in 20 automobile companies.

5. GEOGRAPHIC REGIONS and INDUSTRIES STUDIED

It appears from the review of the studies on new product success and failure factors that some studies collected the data on various industries and/or regions, but some studies only on a single industry and/or region. For example, Song and Parry (1994) included new products from the aerospace, chemicals, consumer electronics and machinery industries in the Peoples Republic of China. Utterback investigated the new product outcomes in the computer, consumer electronics, textiles, automobile and chemical industries in Germany, the UK, France, Japan and the Netherlands (Utterback, 1976). Link (1987) chose his sample from a wide range of industries, including minerals, oils, gas, chemicals and plastics, food components and equipment, engineering, and transportation equipment. On the other hand, Yap and Souder (1994) studied the factors influencing new product

success and failure in small entrepreneurial high-technology electronics companies located in a particular region (Huntsville-Alabama) in the United States. Karakaya and Kobu (1994) surveyed the companies in the medical instrument technology industry and the food processing industry in the United States in order to draw conclusions on the new product failure factors in high-technology and non-high-technology companies.

It may be mainly due to the difficulties in collecting enough and appropriate data on the subject in order to reach valid conclusions (as John and Snelson (1990), and Clark and Fujimoto (1991) pointed out), although sample size greatly depends on the aim of the researchers. Researchers may overcome this difficulty by employing larger samples from various geographic regions and industries. However, with the samples from different geographic regions and industries it is difficult to generalise conclusions for any industry and region and to make comparisons between the conclusions of the studies.

6. SOURCES OF DATA

Another important issue differentiating the studies from each other in this review is the source of data collected. The sources of data relating to corporate performance are classified into objective, self-assessment, expert-assessment, and peer-assessment sources (Saunders et. al., 1991). These sources, however, can be used by the studies investigating the performance of new product development.

Objective sources are those which are published materials, such as company financial information and market research reports. Financial information sometimes does not reveal sufficient or appropriate data due to accounting practices and generally includes information relating to the highest level of corporate performance. Published market research reports on particular projects and programmes of new product development are often difficult to find and seldom freely available. Therefore, the studies employing published sources are forced to concentrate on corporate level performance, especially where financial data is required. Measures taken at the corporate level, however, reflect the inaccurate performance of new product development because of intervening variables. On the other hand, using objective sources can minimise the effect of respondent error on the assessment.

Self assessment is the second source from which performance data is collected. Self assessment data is gathered by asking those within the company, generally at the managerial level, to make their own assessment of the new product development performance. Self assessment sources are those who are closely involved in new product development activities and therefore, they are best qualified to report on and make assessments on the new product projects and programmes by comparing them with company objectives, despite the chance of

bias. It can be seen from the review of studies that most of the studies collected data from self-assessment sources (Cooper, 1975; Souder and Chakrabarti 1979; Cooper and Kleinschmidt, 1993; Yap and Souder 1994).

Experts are another source from which assessment of new product development performance can be obtained. Experts have a general knowledge of the industry from which they can evaluate the performance of new product development activities. Expert-assessment sources are used in the studies undertaking analysis at the programme level measuring the company's overall innovative ability (Peters and Waterman, 1982).

Peers are people from a competitive company, who have a knowledge of the industry within which the company to be assessed operates. They can make the assessment of the company's new products and its new product development activities. Unfortunately, none of the studies has benefited from peer-assessment sources.

It appears from the review of the studies that combining more than one source of data in the studies may verify the measures obtained and give a cross-checking opportunity on the data. Obviously, some combinations require additional time and money resources. However, the self-assessments and the expert-assessments could be used together in the same study since they need very little additional resources.

7. DATA COLLECTION METHOD

The choice of the data collection method is closely related to the selection of sources from which data will be collected. In the case of an objective source, data is gathered from relevant published material. The choice of a self-assessment source requires the application of primary research methods, including questionnaires being administered by mail, and personal or in-depth interviews (Cooper and Kleinschmidt, 1987a, 1987b, Johne and Snelson, 1990, Edgett et. al, 1992). The expert-assessment source also employs main research methods (Peters and Waterman, 1982). As for peer-assessment sources, it may be expected that they ask competitors for their judgements as part of the main survey.

The selection of the data collection method is also affected by the type of measures which are going to be applied. It may be inappropriate to apply direct financial measures of new product performance in the mail questionnaires. Since companies are not inclined to disclose their financial information, they tend not to respond to survey, resulting in a low response rate. Even if they respond to the survey, there may be a high non-response to these questions. The financial assessments from indirect measures, such as "product's sales and profits impact on the company" (Cooper and Kleinschmidt, 1993) and meeting profit objectives

(Cooper and Kleinschmidt, 1987a) can be applied, to a great extent, in order to overcome low response rate or non-response items in the mail questionnaires.

8. FINANCIAL and NON-FINANCIAL PERFORMANCE MEASURES

The studies investigating the performance of new product development make use of some type of financial measure, either its own, or combined with non-financial measures. Both financial and non-financial measures can be applied directly and indirectly. Direct measures include absolute figures, percentages or ratios. Indirect measures require less exact information than direct measures. The respondent usually indicates an opinion of performance on some dimension, either on an opinion scale, or by answering an "either, or" type question.

Financial measures of performance, used by the studies in this review, can be classified into a number of groups which refer to the base of measure. Profit based measures are commonly used by the studies, presumably because profitability indicates the result of any commercial activity. Direct measures reflecting profitability are "average return on sales" (Peters and Waterman, 1982), "net direct monetary gain" (Rothwell et. al, 1974), and "time to break-even" (Cooper and Kleinschmidt 1987a, 1987b). Indirect measures include "importance of programme in generating profits for the company" (Cooper 1985) and whether or not break-even was achieved" (Maidique and Zirger 1984). If a profit based measure is to be used, the project level is perhaps the more appropriate analysis since where the company's profitability is assessed, there may be many other factors related to this result, together with the company's innovative ability. Peters and Waterman (1982) used a direct measure of asset growth in their studies. Asset based measures, however, may reflect such activities as mergers and acquisitions rather than new product development activities in the company. The sales based measures are almost as commonly used measures as the profit based measures. Cooper and Kleinschmidt (1987a, 1987b) employed "domestic market share" and "foreign market share" as direct measures. Rothwell et. al (1974) assessed the "market share in terms of the number of units sold" and "the average sales price per unit". The study carried out by Peters and Waterman (1982) applied a direct, capital based measure by measuring the "return on capital" and equity based measure by assessing "compound equity growth", the "average return on equity" and the average "market to book".

Financial measures are criticised from two points. First, employing a uni-dimensional financial measure may mislead the researcher since while the product is assessed as a failure in financial terms, it may be successful in technological as well as organisational terms. The notion of different types of success is closely related to the strategy and objectives which the company determines. Therefore, the nature of the strategy and objectives should identify the way in which performance of the project or programme is measured. For example, if the

objective is to produce high quality products, it would be inappropriate to assess performance of the new product development in profit terms since the objective is to increase market share rather than maximise profits. The second criticism is that financial measures reflect short-term viability and growth of companies. They deal with the present performance of the company rather than the future.

The non-financial measures which allow the researchers to assess different types of success in new product development have been developed against the criticism of financial measures. Cooper, (1985) employed "successfulness of programme relative to competitors" and "success failure and kill" rates (per cent) of products developed in the last five years". Cooper and Kleinschmidt (1987a, 1987b) introduced the measure of the "opportunity window on new categories and new markets". Peters and Waterman (1982) asked the "company's 20 year record for innovation. Rothwell et. al. (1974) used the measure of the "alignment with company strategy" and took everything that could be related to company strategy into account. Yap and Souder (1994) developed the measure of the "extent to which the product met the user's need".

9. DISCUSSION and CONCLUSION

Investigating the factors influencing new product performance is not an easy task. Defining and measuring "success" is a very complex issue reflected by the studies on the performance of new product development. Exploring new product performance requires taking some critical methodological issues into account. They differentiate the empirical studies on new product development performance in the related literature. A summary of these issues is explained below as a practical guide to future researchers.

a. Studying on only either success or failure factors could result in potential bias since the factors which explain only one type of performance may be the factors leading the new product projects and programmes to the other end at the same time.

b. Studies focus on their investigations at either programme or project level analysis. Programme level analysis explores the overall new product performance of the company, while project level analysis concentrates on particular new product projects. Although the programme level analysis reflects a long-term perspective, which covers various new product projects and explains the company's overall innovative ability, it may involve problems and data availability. The project level analysis overcomes the problems of data availability. However, the selection of level of analysis depends on the aim of the investigation. For example, when factors reflecting the company's overall approach to new product development, such as strategic management, structure, style and culture, are being investigated, focusing on the programme level may be

more appropriate. When factors which relate to specific new product projects, such as the allocation of resources in the process of development or project management are being investigated, the project level may be more appropriate.

c. Although employing large samples from various geographic regions and industries could overcome the problem of drawing valid conclusions, it may result in the difficulty of generalising them for any industry or region, or to compare the conclusions of the studies.

d. Data from which a measure of success can be gathered from different sources; combining more than one source can validate the data collected.

e. The method of data collection is linked to the selection of the source from which data will be gathered. Mail, telephone and interview questionnaires are the most commonly used methods although desk research and depth interview have been used by few studies. Collecting data via questionnaires requires acknowledging the difficulties in getting information on financial data.

f. The performance measures employed in the studies can be grouped into one of two categories, including financial or non-financial measures. Financial performance measures are criticised from two aspects. First, they may be different types of success together with financial success, such as market and technology. Second, financial measures reflect the present situation in the companies. Therefore, financial performance measures are to be combined with non-financial measures to provide a more balanced approach. In addition, indirect and relative measures are more appropriate than direct measures, especially when financial data is collected via mail questionnaires.

ÖZET

Yeni ürün geliştirme, günümüzün hızla değişen iş dünyasında rekabet eden işletmelerin hayatta kalması ve büyümesi için büyük önem taşımaktadır. İşletmelerin satış ve karlarına önemli katkılar yapmalarına rağmen üretilen ürünlerin yüzde 35'inden fazlasının değişik endüstri sektörlerinde başarısızlığa uğradığı hesaplanmaktadır.

Yeni ürünlerin başarılı ve başarısız olmalarına neden olan faktörler konusunda çok sayıda çalışma yapılmıştır. Bununla beraber, bu alandaki çalışmalarda kullanılan araştırma yöntemleri yazılmış olan makaleler kadar fazladır. Böylece, bu çalışma yeni ürün başarı ve başarısızlık faktörleri konusundaki çalışmaları kullanılan araştırma yöntemleri açısından irdelemektedir.

KAYNAKÇA

- ACHILLADELIS, B; JERVIS P. and ROBERTSON A.; *Project SAPPHO* (1971): *A Study of Success and Failure in Industrial Innovation*, Science Policy Research Unit, Sussex.
- BONACCORSI, Andrea and LIPPARRINI, Andrea, (1994) "Strategic Partnerships in New Product Development: an Italian Case Study", *The Journal of Product Innovation Management*, Vol. 11, No. 2, March.
- BOOZ; ALLEN and HAMILTON (1982), Inc., *New Product Management for the 1980's*, New York, NY: Booz, Allen and Hamilton.
- BRONNENBERG, J.J. A.M. and van ENGELEN, M.L., (1988) "A Dutch Test with the NewProd-Model", *R&D Management*, Vol. 18, No.4.
- CLARK, Kim B. and FUJIMOTO, Takahiro (1991), *Product Development Performance: Strategy, Organisation and Management in the World Auto Industry*, Harvard Business School Press, Boston, Massachusetts,.
- COOPER, Robert G., (1975), "Why New Industrial Products Fail", *Industrial Marketing Management*, Vol. 4.
- COOPER; Robert G., (1979a) "The Dimensions of Industrial New Product Success and Failure", *Journal of Marketing*, Vol. 43, Summer.
- COOPER, Robert G., (1979b), "Identifying Industrial New Product Success: Project NewProd", *Industrial Marketing Management*, Vol. 8.
- COOPER, Robert G., (1980), "Project NewProd: Factors in New Product Success", *European Journal of Marketing*, Vol. 14, No. 5/6.
- COOPER, Robert G.,(1985), "Overall Corporate Strategies for New Product Programmes", *Industrial Marketing Management*, Vol.14.
- COOPER, Robert G. and KLEINSCHMIDT, Elko J.,(1987a), "Success Factors in Product Innovation", *Industrial Marketing Management*, Vol. 16.
- COOPER, Robert G. and KLEINSCHMIDT; Elko J., (1987b), "What Makes a New Product a Winner: Success Factors at the Project Level", *R&D Management*, Vol. 17, No. 3, July.
- COOPER, Robert G. and KLEINSCHMIDT, Elko J., (1993), "Major New Products: What Distinguishes the Winners in the Chemical Industry", *Journal of Product Innovation Management*, Vol. 10.
- EDGETT, Scott, SHIPLEY, David and FORBES, Giles, (1992), "Japanese and British Companies Compared: Contributing Factors to Success and

- Failure in NPD", *The Journal of Product Innovation Management*, Vol. 9.
- HOPKINS, D.S., (1980), *New Product Winners and Losers*, The Conference Board, Report No. 773, New York.
- JOHNE, Axel F. and SNELSON Patricia, (1988), "Marketing's Role in Successful Product Development", *Journal of Marketing Management* Vol. 3.
- JOHNE, Axel F. and SNELSON, Patricia, (1990), *Successful Product Development: Management Practices in American and British Firms*, Basil Blackwell, Inc., Oxford.
- KARAKAYA, Fahri and KOBU, Bülent, (1994), "New Product Development Process: An Investigation of Success and Failure in High Technology and Non-High Technology Firms", *Journal of Business Venturing*, Vol. 9.
- LEE, Jinjoo and KIM, Hong-bumm, (1986), "Determinants of New Product Outcomes in a Developing Country: A Longitudinal Analysis", *International Journal of Research in Marketing*, Vol. 3.
- LINK, Peter L., (1987), "Keys to New Product Success and Failure", *Industrial Marketing Management*, Vol. 16.
- LITTER, Dale, LEVERICK, Fiona and BRUCE, Margaret, (1985), "Factors Affecting the Process of Collaborative Product Development: A Study of UK Manufactures of Information and Communications Technology Products", *The Journal of Product Innovation Management*, Vol. 12.
- MAIDIQUE; Modesto A. and ZIRGER, Billie Jo, (1984), "A Study of Success and Failure in Product Innovation: The Case of the US Electronics Industry", *IEEE Transactions on Engineering Management*, Vol. EM-31 No: 4, November.
- MOENAERT, Rudy K., SOUDER, William E., DEMEYER, Arnold and DESCHOOLMEESTER, Dirk, (1994), "R&D-Marketing Integration Mechanism, Communication Flows and Innovation Success", *The Journal of Product Innovation Management*, Vol. 11, January.
- PAGE, Albert L., (1993), "Assessing New Product Development Practices and Performance: Establishing Crucial Norms", *The Journal of Product Innovation Management*, Vol. 10, No. 4, September.

- PETERS, Thomas J. and WATERMAN, Robert H., (1982), *In Search of Excellence: Lessons from America's Best-Run Companies*, Harper and Row Publishers, London.
- ROTHWELL, R., FEEEMAN, C., HORSLEY, A., JERVIS, V.T.P., ROBERSON, A.B. and TROWSEND, J., (1974), "SAPPHO Updated Project SAPPHO phase II, *Research Policy*, Vol. 3, No. 3.
- SAUNDERS, John, BROWN, Michael and LAVERICK Stuart, (1991), "The Best of British: A Peer Evaluation of Britain's Leading Companies", Marketing Education Group Proceedings of the 1991 Annual Conference.
- SONG, X. Michael and PARRY, Mark E., (1992), "The R&D-Marketing Interface in Japanese High Technology Firms", *The Journal of Product Innovation Management*, Vol. 9, No. 2, June.
- SONG, X. Michael and PARRY, Mark E., (1994), "The Dimensions of Industrial New Product Success and Failure in State Enterprises in the People's Republic of China", *The Journal of Product Innovation Management*, Vol. 11, No. 2, March.
- SOUNDER; William E and CHAKRABARTI, Alok K., (1979), "Industrial Innovations: A Demographical Analysis, *IEEE Transactions on Engineering Management*, Vol. EM-26, No. 4, November.
- SZAKASITS, George D.,(1974), "The Adoption of the SAPPHO Method in the Hungarian Electronics Industry", *Research Policy*, Vol. 3, No. 1.
- TEUBAL, Morris, ARNON, Naftali and TRANCHTENBERG, Manuel (1976), "Performance of Innovation in the Israeli Electronics Industry: a Case of Biomedical Electronics Instrumentations" *Research Policy*, Vol. 15, No.4, October.
- UTTERBACK, James M., ALLEN, Thomas J., HOLLOMAN, J. Herbert and SIRBU, Marvin A., (1976), "The Process of Innovation in Five Industries in Europe and Japan", *IEEE Transactions on Engineering Management*, Vol. EM-23, No. 1, February.
- ZIRGER; Billie Jo and MAIDUQUE, Modesto A., (1980), "A Model of New Product Development: An Empirical Test", *Management Science*, Vol. 36, No.7, July.