Title: A Critical Review of " Factors for Success in R&D Projects and New Product Innovation: A Contextual Framework" -2

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Abstract: A paper titled "Factors for Success in R&D Projects and New Product Innovation: A Contextual Framework" is critically reviewed in this individual report

A Critical Review of " Make-or-Buy Decisions in R&D: Small Technology-Based Firms in the United States and Japan"

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INDIVIDUAL RESEARCH PAPER

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1.EXECUTIVE SUMMARY

This reseach paper examines the factors which affect make-or-buy decisions in R&D. Author uses data from small technology based firms in the United States and Japan, and he compares the following alternatives:

1. External-Technology Acquisition (BUY)
2. In-house Technology (MAKE)

Data was obtained from questionnaire and 4 different hypothesis were constructed from literature seach and discussions. Different analysis were made for possibble situations and the boundries were drown for the reseach. Analysis suggest the dominance of "Buy" strategy in case of needed technology is less related to a firm's core technology and the number of rivals expected to develop a similar product is greater. The data seem to moderately support some of hypotheses and at the end of the reseach, the supported and unsupported hypotheses appear to imply two qualitatively different perspectives in external technology acquisition: 1) to shorten development time and thereby reap short-term profits and 2) to maximize long-term profits over the life of the innovation.

2. CONCEPTS

In today's environment where technology is rapidly changing, R&D activities are risky by nature since a very small percent of R&D projects are successfully completed.(8) For this reason, it's very important to make the right decision at the beginning. Make -or-buy decisions, the conditions and the key factors which affect these decisions and reseach-evaluation methods of these factors are the main points of the article. What should we do in order to introduce new products into the maket without delay? Main points which are given given as supportive ideas for suggesting strategy-external technology acquisition- are:

1) Colloborative R&D project can reduce each partner's manpower and equipment cost by sharing
2) It can lessen investment risk by combining external technology and internal development
3) It requires lower level of managerial committments and persistent efforts
4) They are sometimes regarded by insightful managers as mortgaging the future for short-term returns.
5) It can reduce development cost and shorten development periods.(17)

In the research, analytical framework was developed by using these propositions and then the variables which affect R&D make-or-buy decisions were identified:

1) The variables which influence expected revenue (Ri): Degree of Competition
Degree of Protection
Expected Technology Life

2) The variables which affect expected total cost (Ci): Technology Relatedness

3) Control variables (intervening variables): History
R&D Capability
Managerial Capability

After identifiying these variables, the author reached the following hypothesis:

Hypothesis 1: The greater number of rivals expected to develop a similar product, the greater likelihood of external technology acquisition.
Hypothesis 2: The less legally and physically protected the needed technology is expected to be, the greater the likelihood of external technology acquisition.
Hypothesis 3: The shorter the expected life of technolog, the greater the likelihood of external technology acquisition.
Hypothesis 4: The less related the needed technology is expected to be, the greater the likelihood that the technology will be acquired externally.

3. METHODOLOGY USED IN THE STUDY

There are 4 major sections of the paper:

1) Contrasting external technology acquisition with in-house R&D by reviewing the relevant literature.
2) Constructing 4 hypotheses by identfying the key factors which affect make-or-buy decisions in R&D settings.
3) Testing these hypotheses by using U.S. and Japanese datas.
4) Concluding with discussions and observations on further research.

As we mentioned earlier, responses from questionnaires provided data from small technology based firms in the United States and Japan. Reseach focused on product development projects in small high-tech firms in the two countries, disregarding those in large firms, because, in large firms regulatory issues and organizational slack often act upon R&D decision making in ways which obscure its performance. Two cases- one successful and one unsuccessful product development project- were collected from each firm (at least one case included external technology acquisition.) Each president completed an interview and a questionnaire. The distinction between successful and unsuccessful cases was based on the respondents' subjective judgments on whether the sales of products satisfied their expectations or not.

Measurement Methods:
(How did the questionnaire items measure the variables?)

VARIABLE	QUESTION TYPE
Degree of Competition	# of rivals they expected when they decided to develop the product
Degree of Protection	Effectiveness of their patent protection and other protection methods.
Life of Technology	Life-cycle stage of the core technology.
Technological Relatedness	Management skill, manufacturing capability, marketing capability and financial capability, relevant and realible technological advice
History	Previous frequency with which they had engaged in external technology acquisition since the startups of their companies.
R&D Capability	Very weak.....very strong (5 point, Likert-type question)
Managerial Capacity	Management skill, manufacturing capability, marketing capability and financial capability

The affect of the independent variables and the control variables were examined by using Multiple Regression Analysis. U.S. and Japanese subsamples were used (in order to examine country-specific biases) and succefful and unsuccessful subsamples were utilized (in order to investigate the effectiveness of the hypotheses.) Multiple Regression Analysis is an important and effective method to identify the significant factors. As a second step, correlation matrix was costructed and intercorrelation for the defined variables were shown on table. In order to see whether separate regressions must be estimated or not, F-tests were conducted. The result indicated that cross-country differences in the regression slopes were significant and there were qualitative differences between the two variables. These situations lead the authour to analyze separate regressions for each country and all results were given on table.

4.FINDINGS OF THE STUDY

The following results are obtained from the analysis of the regressions of the defined variables:

* Datas-especially the U.S. datas- seem to moderately support Hypothesis 1
* No support to Hypothesis 2
* No support to Hytpothesis 3
* Especially the Japanese subsample seem to moderately support Hypothesis 4

While two of the four hypothesis were moderately supported. the autor found no support for hypothesis 2 and 3. The reasons of these unsupported hypotheses seem to have the same root. The supported hypotheses also seem to emphasize a short-term aspect of external technology acquisition, because a firm is likely to acquire external technology when it faces competition, and when it expects lower costs in external acquisitions compared with in-house R&D.

5. LITERATURE SEARCH AND COMPARISONS

In order to make comparisions with other reseach publications in the field, the literature seach was made in 3 different topics:

1) Success Criterias for R&D
2) Project Selection and Decision Factors for R&D
3) Differences Between U.S. and Japanese R&D Structures

There have been many attempts over the last 30 years to discover the critical factors that can indicate the success or failure of R&D projects and new products introductions. R. Balachandra undertook an extensive review of the germane literature to find whether a general agreement exists about the factors leading to success or failure in new product and R&D projects.(1) Success in product innovation or in R&D projects is hard to define, for it is a composite of a number measures. There is also a time gap between a product's introduction or the completion of a R&D projects and it's being deemed a success. Cooper and Kleinschmidt (2) identify three factors that are themselves composites-financial performance, opportunity window. and market share. These measures usually available after a considerable interval. A recent study by Griffin et al. (3) illustrates the diverge of views about and the complexity of the definition of success in R&D. Since there is no comman measure of a number of success. and success is a composite of a number of subjective and objective measures, we have used success as defined by the

the large number of factors that determine success using a variant of the method used in marketing strategy studies to structure information-market, technology, environment or organization.(1)

Decisions to initiate, continue and modify R&D projects are that to do the right R&D. Such decisions require careful consideration of the R&D cost and time; the probabilities of technical, implementation and commercial success and the potential value given success. (4) Firms have different capabilities, they often carry out the same activity with different production cost. Economizing firms will take this into account when deciding whether to perform the activity in-house or on a buy basis. As relative capability change, firm boundaries are adjusted accordingly clear criteria, however, have yet to be developed for identfying and characterizing firm capabilities. N. Argyres identified the role of firm capabilities in decision making inR&D. (5) Gerald s. Rosenfelder and Guy H. Gessner focused on the importance of decision makers and in their article, participants identified some critical applications of corporate R&D money. he allocation of new product technology funding is largely by it's fit with the company's strategic focus, one as a percent of overall R&D.(6) Michael M.Menke's Picmet'97 paper proposed a method focusing an organization's internal use of R&D decision-making practices that can be used to diagnose the quality of R&D decision making and to increase the value created by R&D. (7) 100 examples of successful R&D studies were investigated to obtain the relationship between R&D cost and performance in Takura Munezawa's Pcmet'97 paper. Project selection is an important factor which has been extensively studied by many reseachers. (9,10,11,12) Ramsey developed a comprehensive framework for assessing development projects. (13) This work focused more on the selection decisions.

T Daim, S. Lazaris, B. McClement and L. Poh , in their study, identified the cultural differences between U.S. and Japan and the effects of these diferences on the R&D strategies. (14)

6. STRENGTHS & WEAKNESSES OF THE STUDY

Strengths:

*.At the beginning of the paper, external technology acquisitions were contrasted with in-house R&D by reviewing the relevant literature. As a second step, hypothesis were constructed by identifying the key factors which affect make-or-buy decisions. Then, these hypothesis were tested by using U.S. and Japanese datas and, discussions and observations were concluded. In this systematic approach, we can say that, the format of the paper is easily understood, clear and strong.

*An analytic framework was developed for R&D decision making process and cost, revenue and timing relationships of product introduction was shown on the graph. This is a visiable, easy and clear way to explain these relationships and identify the decision factors with the reasons.

*While two of the hypothesis were supported, no support could be found for the other 2 hypothesis. But the reasons were explained for these unsupported hypothesis and a relationship was found between them.

*Datas were analyzed for each culture, cross cultural differences identified and seperate regresion analysis were made on ETA and INETA. Different results and different explanations of hypothesis were reached for each coutry.

*Participating firms were selected based-on certain criterias. In order to observe their realistic project performances and to reach real, homogenous and usual datas, the following criterias were considered:

1)They have been in business for more than 7 years.

2) They have the number of employees between 20-200.

3) They belong to the electronics or computer industries.

4) They are not heavily involved in government or defense-releted contracts.

5) They are independent of any business or financial group.

Weaknesses:

The following section explores the weaknesses of this study. Some of them are inevitable due to the nature of the data collection method and methodology used in this study.

* It is hard to eliminate subjectivity and/or biases of ranking individuals. The distinction between successful and unsuccessful cases was based on the respondents' subjective judgements on whether the sales of products satisfied their expectations or not. It is diffucult to compare and evaluate these informations with each others. There were no common. exact criterias or reference points to evaluate success of the company.
* Participating firms had different capabilities and they often carry out the same activity with different costs. The fact that R&D decisions vary from one firm to another might have affected the results of the analysis.
* Neither a buyer nor seller of technology has a clear idea of cost and often the benefits of the technology. Expected values of R&D make-or-buy options should be emphasized. It is diffucult to identify and calculate actual values in R&D and these actual values don't enter into decision making process. Expected values are used and this means. subjectivity.
*Paper disregards some of the noneconomical aspects of external technology acquisition-licensing for avoiding patent in fringements. colloborative R&D projects with government. labs for politacal reasona- These factors can be strongly effective in same cases.

7.CONCLUSIONS AND RECOMMENDATIONS

The supported hypothesis (Hypothesis 1 and 4) seem to emphasize a short term aspect of external technology acquisition, because a firm is likely to acquire external technology when it faces competition and when it expects lower costs in external acquisitions compared with in-house R&D. According to these discussions. the supported and unsupported hypotheses appear to imply two qualitatively different perspectives in external technology acquisitions:

1) to shorten development time and thereby reap short-term profits and
2) to maximize long-term profits over the life of the innovation.

The paper suggests the dominance of the short-term strategy. I agree that the author has valid conclusion. Therefore the paper is well stated. Several recommendations would be applicable to companies that have R&D activities and therefore. face the challenge of R&D make-or-buy decisions:

* Start collecting data on the factors that are identified by this study and thought to be important for this purpose at different phases of this study.
* Formalize the monitoring process for R&D projects. Monitoring process can be done through the use of an expert system. Decision support systems will be very beneficial in both eliminating uncertainities in the R&D environment and providing input for decision makers in such decision process. (20) proposes a framework for monitoring R&D projects and present a sample of difficult questions to be answered during R&D project reviews. In another study by Matheson et al. (21), 45 best decision making practices that for a blueprint for building and monitorinf an effective R&D program are identified.
* The methodology should not necessarily be regression analysis. Analytical Hierarchy Process, descriminent analysis or scoring methods are alternatives for this. As another example, a company can

keep track of the factors that have significantly changed over time and make a decision when the number of such factors reaches a certain number.

8. FUTURE WORK

The opportunity for further research into phenomena of external technology acquisition is great. For example in-depth case studies will clarify further the relationships among the variables defined in this study. Research with respect to different technology , company, size and country will also broaden the understanding of this subject. Without such research, it is uncertain whether these findings are specific to electronics and computer-related small firms in the current study or if they represent firms in general. Decision making process includes communication methods of project status to R&D staff, decision makers involved in this process, psychological and motivational effects of such decisions on the fate of R&D organization and so forth.In general, human resource management of such decisions seem to be fruitful potential area for future work..

A similar study can be conducted by collecting data from large companies and from different countries. Forthermore a potential research area lies in identification of discriminating factors for R&D project in environments in different nations, such as protected economies, less industrialized and a lower technological level even though R&D practices in such environments are as intense and important as those in industrialized, technologically advanced countries with free market economies.

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