

Evaluating Probabilities of Technical And Commercial Success And Using Them In Screening New Product Ideas

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Abstract

The screening of new product ideas is perhaps the most critical activity in innovation process and development of new products, the process is associated with uncertainty and complexity.

Probabilities of technical & commercial success which represents uncertainty associated with R & D projects are used in evaluating project index models and some expected benefit/cost ratios. These probabilities were usually subjective expectations of R & D teams. This paper based on a hypothesis that the success of new products in the market is due to the acceptable values of probabilities of technical & commercial success in screening stage.

The purpose of this paper is concerned with introducing a modified method for evaluating probabilities of technical & commercial success of new product ideas, using average weighted scoring method instead of inaccurate subjective expectations, after developing a set of suitable criteria for evaluation of each probability as an effort for getting unique estimations of probabilities of success, then using them in screening of new product ideas, and also can be used in project index models and other expected benefit/cost ratios. The utility of the approach in screening of new product ideas in an industrial organization was illustrated in a hypothetical example.

Key words: Technical success, commercial success, project values, suitability score, compatibility score.

تقييم احتماليات النجاح الفني والتجاري واستخدامهما في تصفية أفكار المنتجات الجديدة

الخلاصة

تعتبر عملية تصفية افكار المنتجات الجديدة من النشاطات الحرجة في عملية التجديد وتطوير المنتجات الجديدة، وتقترب بالكثير من عدم التأكد والتعقيد. استخدمت احتماليات النجاح الفني والتجاري والتي تمثل عدم التأكد المقترن مع مشاريع البحث والتطوير لتقييم نماذج مؤشر المشروع وبعض نسب المنفعة / الكلفة المتوقعة. هذه الاحتماليات عادة هي توقعات شخصية لفريق البحث والتطوير. يستند هذا البحث على فرضية إن نجاح المنتجات الجديدة في السوق يعزى الى القيم المقبولة لاحتماليات النجاح الفني والتجاري في مرحلة التصفية. والهدف من هذا البحث يتعلق بتقديم طريقة مطورة لتقييم احتماليات النجاح الفني والتجاري لأفكار المنتجات الجديدة باستخدام معدل الدرجات الموزون بدلا من التقديرات الشخصية غير الدقيقة، بعد وضع مجموعة من المعايير المناسبة لتقييم كل احتمالية في محاولة للحصول على تقديرات موحدة

لقيم احتماليات النجاح، ومن ثم استخدام هذه الإحتماليات في عملية تصفية أفكار المنتجات الجديدة . وكذلك يمكن استخدامهما في نماذج مؤشر المشروع ونماذج نسب المنفعة/ الكلفة المتوقعة. تم توضيح استخدام طريقة تصفية أفكار المنتجات الجديدة في منشأة صناعية في مثال افتراضي.

Introduction

ments to be successful from a business. In the last several years, Innovation has moved to the top of the world wide business agenda, as shorter product lifecycle, an increasingly competitive services environment, the rapid pace of advances in technology, the continuing stress on profit growth, have been become global trends [1,2,3].

These trends put pressure on companies to be more innovative and to do it quickly [2].

However, for these develops standpoint, the companies must be able to effectively define the market needs of the future, to project advances in technology, and to be alert to competitor capabilities and intentions. Moreover, they must be able to combine all these factors into an effective new product development strategy [1].

The end result is that the ability of an organization to survive has begun to be defined by its capacity to innovate and develop new products in terms of newness to the world and newness to the company [2, 4].

The innovative process may be divided into three areas:

- The fuzzy front end (FFE).
- The new product development (NPD) process. and
- Commercialization [5].

The first part (FFE) is generally regarded as one of the greatest

opportunities for improvement of the overall innovative process, which mainly involves the generation of new product ideas that have not been committed or approved by the management of the firm, and the front end terminates when the firm commits significant human resources to development of the product [4].

Many companies have dramatically improved cycle time and efficiency by implementing a formal Stage-Gate, which is a multi-step approach of logical thought and decision making for use by managers in conceptualizing and developing new processes and products [4, 6].

Another approach called (PACE) used also for managing projects in the (NPD) portion of the innovation process [7]. Attention is increasingly being focused on the front end activities that precede this formal and structured process in order to increase the value, amount and success probability of high – profit concepts entering product development and commercialization [5].

The research area in (FFE) is the idea screening and selection process. The idea selection criteria, which information concerning market, technical, production, and business feasibility, are used to screen out less potential ideas for (NPD).

The screening technique illuminates the collective role of competencies (e.g. Market, technology), return and

anticipated / unanticipated risks in the selection of the new product ideas [4].

The screening of new product ideas is perhaps the most critical activity in innovation process. Yet such screening is often not adequately performed. Limited by both nature and the timing of (NPD), and associated with uncertainty and complexity [3]. The gap between predicted results and actual results has been a frequent problem when new product idea evaluations have been performed. But because it is difficult to reliably predict each factor that impacts new product evaluation results into future, it results unavoidably include uncertain factors, so that the problem of uncertainty is not adequately assessed [8].

The uncertainty source classified into two main types:

- Technological uncertainty, and
- Commercial (market) uncertainty.

The technological uncertainty refers to whether new technology can work and complementary technology could be ready in time, and what technology standards will be set up. The commercial (market) uncertainty involves whether there are enough potential buyers, or future market demand will be changed in the future. These uncertain factors will influence potential revenue streams of R & D projects indirectly or directly [9].

1- Research contribution

The basic contribution of this paper is to provide the innovation process with a modified method of distinguishing and screening new product ideas, based on a hypothesis that the successful new products must

have acceptable values of probabilities of technical & commercial success for new product ideas, which can be evaluated in early stages of innovation process. The methodology will be explained later. And also to provide numerical values of these probabilities which are used in some models as follows:

- a. For determining Expected Commercial Value (*ECV*) of new product projects [10].

$$ECV = [(PV \times P_c - C) \times P_t - D] \dots (1)$$

Where:

ECV : Expected Commercial Value of the project.

P_t , *P_c* : Probability of technical & commercial success , respectively.

D : Development costs remaining in the project.

C : commercialization costs.

PV : Present Value of project's future earnings (discounted to today).

- b. Another formula for determining Probable Project Value per project year (*PPV*) [4].

$$PPV = (P_t \times P_c \times Profit \times CL) \div L \dots \dots \dots (2)$$

Where:

CL : expected commercial life time in years.

L : the average time it takes in years to conduct a project.

- c. Index models or project numbers considers the chance or probability of new product idea success and it has been built into several return on investment models, for example; the

American ALCOLAC corporation model [11].

The research plan is to take the probabilities of technical & commercial success together, "which reflects the effectiveness and competencies of the firm" in screening new product ideas as key indicators of new product introduction.

The weighted scoring method was used to evaluate and quantify new product idea success criteria. Individual evaluation criteria were scored and weighted to determine an overall idea success score, thus the procedure needs to set criteria for the evaluations.

The decision of accepting, rejecting or further evaluations is excerpted from basic dimensions of DEMON (DEcision Mapping via Optimum go-No Networks) new product evaluation techniques [11, 17].

The procedure will reduce the risks and uncertainties associated with new products and force the firms to pay too much attention for selecting of potentially successful new product ideas, and chose the most suitable one for further development.

The apparent simplicity and ease of use of probabilities in screening stage will give them a quality of seductive appeal, and this method is essential for ensuring the quality of new product ideas assembled into the final portfolio. Consequently with the judgment of R&D managers, this method will ensure that the different people assessing the same new product ideas will take approximately the similar decision and reduce the risk of narrowly based judgment.

2- Methodology

The point of departure for evaluating the probabilities of success is developing a set of criteria which represents the abilities of the company to success. These criteria can be divided into two main criteria; the first class of criteria or elements related to technical success, and the second class is for commercial success. These criteria must be applicable to most companies and to the typical activities in most industrial R&D sections.

A (4) steps approach was used to develop this method as follows:

Step 1: a list of potential criteria for judging the suitability of new product idea was compiled. These criteria were divided into two classes, the first represents the probability of technical success criteria, and the second represents the probability of commercial success criteria, table (1).

Step 2: scoring method was designed based on suitability of new product idea with each criterion, and the importance weight of the criterion.

The suitability of new product idea with each criterion can be scored (1-5) from worst to best [13]. At its best this method would appear to satisfy all of the company aims.

In practice, however participants rarely agree because they for scoring process. These descriptions may differ from have very different views about scoring. To minimize the differences, a description of suitability of new product idea grading for each

criterion can be provided to aid the participants company to another.

These criteria were not all of equal importance, therefore relative importance weights must be developed for each criterion, for example: a questionnaire based on paired- comparison techniques, can be used for assigning a numerical relative importance weights to each class criterion [14]. The total weight of each class is therefore an indicator for its relative importance.

The compatibility score for each criterion, which is the degree of fit of the new product idea with any criterion, is determined by multiplying the suitability value by the corresponding weight as shown below[14 ,15]:

$$\bar{S}_{ij} = \sum_{n=1}^N S_{ij}(n) / N \quad \dots (3)$$

$$C_{ij} = \bar{S}_{ij} \times W_j \quad \dots (4)$$

$$C_{t_i} = \sum_{j=1}^l C_{ij} \quad \text{for all } i\text{'s of technical success criteria.} \quad (5)$$

$$C_{c_i} = \sum_{j=1}^k C_{ij} \quad \text{for all } i\text{'s of commercial success criteria} \dots \dots \dots (6)$$

$$C_{t_i}^{max} = \sum_{j=1}^l W_j \times S_{ij}^{max} \quad \text{for all } i\text{'s of technical success criteria} \dots \dots \dots (7)$$

$$C_{c_i}^{max} = \sum_{j=1}^k W_j \times S_{ij}^{max} \quad \text{for all } i\text{'s of commercial success criteria} \dots \dots (8)$$

Where:

i : assigned to new product idea.

j : assigned to both technical & commercial success criteria.

\bar{S}_{ij} : average of suitability score assigned to the idea (i) with criterion(j).

$S_{ij}(n)$: suitability score assigned by participant (n) to the idea (i) with criterion(j).

N : number of evaluating participants.

C_{ij} : compatibility score for idea (i) with criterion (j).

W_j : relative importance weight assigned to the criterion (j).

C_{t_i} : total compatibility score for idea (i) of technical success criteria.

C_{c_i} : total compatibility score for idea (i) of commercial success criteria.

l ,k : number of criteria of technical & commercial success respectively.

$C_{t_i}^{max}, C_{c_i}^{max}$: maximum total compatibility score for idea (i) can be obtained from technical & commercial success criteria respectively.

S_{ij}^{max} : the maximum suitability score can be assigned to the idea (i) with criterion (j).

Note : calculating \bar{S}_{ij} can be ignored and substituted by calculating the average of Pt_i & Pc_i values evaluated by (N) participants as shown in the next step.

Step 3 : probabilities of technical success (Pt_i) and commercial success (Pc_i) for each idea (i) can be obtained as shown below:

$$Pt_{i(n)} = Ct_i / Ct_i^{max} \text{ for all } (i's) \text{ assigned by participant } (n) \dots\dots(9)$$

$$Pc_{i(n)} = Cc_i / Cc_i^{max} \text{ for all } (i's) \text{ assigned by participant } (n) \dots\dots(10)$$

$$Pt_i = \sum_{n=1}^N \frac{Pt_{i(n)}}{N} \dots\dots (11)$$

$$Pc_i = \sum_{n=1}^N \frac{Pc_{i(n)}}{N} \dots\dots (12)$$

Step 4 : The index or the probability of success can take values between (0 and 1). The recommendations can be done by using the following cutoff values for probabilities of success; it depends mainly on the experiences of R & D teams; for example:

I. Accept the idea or Go if :

$$Pt_i \geq 0.80$$

$$Pc_i \geq 0.80$$

II. Reject the idea or No Go if :

$$Pt_i < 0.70 \text{ or } Pc_i < 0.75$$

Reevaluate or Hold the idea if:

$$0.80 > Pt_i \geq 0.70$$

$$0.80 > Pc_i \geq 0.75$$

Excel – based application can be used to execute the task.

In this stage, the decision makers need to adopt a positive attitude rather than to approach the task as a filtering out of less attractive ideas. Decision

makers need to ask how an idea can help to move forward or how an idea can be modified to make it more attractive, rather than how to determine which idea to kill. Scoring should be done in a way that encourages creativity and should not be so restrictive as to stifle new ideas [5].

The evaluation can be done for some attractive ideas, by improving values or scores of some low scored criteria. The improvement of values sometimes needs enhancement of relevant sections in the organization (i.e. Funding of R & D, availability of resources, or availability of new information, etc.).

Having decided which ideas are worth further attention, the next step is to prioritize the attractive ideas and select the best ones [5, 16].

The hypothetical example in table 2-a&b was constructed to illustrate the utility of the approach in an industrial organization.

The next step is to calculate the average of Pt_i & Pc_i values obtained by participants (step 3). Suppose the values were the same as shown in the (table 2a,b). The managers will select the second idea ($Pt_i = 0.852$, $Pc_i = 0.830$) if the same cutoff values in step(4) were depended. The first idea can be reevaluated to improve Pt value ($Pt_1 = 0.792$). It is obvious that the managers will select to improve the score assigned to the idea (1) with criterion (7) i.e. (S_i, γ) by improving the manufacturing capability of labors and technicians. If (S_i, γ) improved to be equal to (4), the value of Pt_i will be increased to about (0.80) and they can

select the first idea too as a second choice.

3- Discussion & Advantages of method

a- The new product development process is multi-dimensional, requiring different viewpoints and expertise, and is highly risky and uncertain.

This method is an unpretending effort based on integrating all these multiple views in framework.

The framework considers technical analysis which emphasizes manufacturability, and commercial analysis which focuses on marketability, and looks at the current and potential competition. Thus selection decision of new product ideas and ranking them according to probabilities of success will be more accurate.

b- The difference between this method and the simple scoring methods used in screening of ideas is that the criteria classified into two classes and the decision made sequentially in case the idea will pass the technical success criteria and then the idea should pass the commercial success criteria.

c- The advantage of flexibility of this method will make the managers respond to the changes more effectively. However, because of rapid changes in technologies and market environment, in addition, as new information becomes available, the managers need to be prepared to modify their criteria and reevaluate their new product ideas as soon as there is new

information about the following points:

- The list of criteria used to drive each factor score, can be modified to suit each organization.
 - The relative weight of each criterion which can be modified.
 - The cutoff values for probabilities of success which can be specified according to the needs of individual organization.
- d- Another advantage of this method is its ability of focusing the weak points of the organization during evaluation process and makes the managers respond to the incorrect conditions.
- e- Finally, the use of numeric values of probabilities of success obtained from this method in many formulas such as Expected Commercial Value (ECV) and Probable Project Value (PPV), etc. will contribute in making the expectations more accurate.

4- Conclusions

The subjective expectations of probabilities of success of new product ideas cannot be expected to be mathematically exact because they are dependent on dynamically changing situations and industry specifications, thus the purpose of this paper is to offer a modified evaluation method for estimating probabilities of success which reduces the dependence to subjective expectations.

The accuracy of evaluated probabilities depends on the precise inputs fed into the proposed probability evaluating method; it needs qualified and familiarized

research managers, engineers, and market analysts.

The use of probabilities of technical & commercial success in screening stage will reduce the risk & uncertainty associated with new product development process because it highlights on different criteria of new product idea screening issues. The criteria can be modified and the weights & scores can be improved according to dynamically changing of data & experiences of persons.

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Table (1): A list of potential criteria for determining probabilities of success: 5 point scale, strongly disagree (1), strongly agree (5). [5, 6, 10, 18, 19, 20].

No.	Probability of technical success criteria	Probability of commercial success criteria
1	Technical gap.	Distribution channels.
2	Strategic technical fit	Market maturity (growth).
3	Technology readiness	Customer strength.
4	Complexity (program complexity).	Potential market share.
5	Development skills (people + time).	Time to commercial start up.
6	Facilities for R & D.	Existence of commercial applications skills
7	Manufacturing capability (people).	Proprietary position.
8	Manufacturing capability (time).	Competitive intensity
9	Manufacturing capability facilities).	Competitive time advantage
10	Synergy with corporate units.	Durability or sustainability of competitive position
11	Raw material supply.	Contribution to profitability.
12	Effect on firm’s layout.	Cost position.
13	The use of byproduct.	Payback period.
14	The use of excess capacity of machines	Regulatory, social, health, safety, political impact.

Table (2-a): A hypothetical example of the use of an evaluation sheet of probability of technical success.

No (j)	criteria	Weight (W_j)	Suitability score S_{ij}				Compatibility s. $C_{ij}=W_j \cdot S_{ij}$			
			new product idea i				New product idea i			
			1	2	3	4	1	2	3	4
1	Technical gap.	4	5	5	4	2	20	20	16	8
2	Strategic technical fit.	5	4	5	3	1	20	25	15	5
3	Technology readiness	4	3	3	4	1	12	12	16	4
4	Complexity (program complexity)	3	2	4	2	2	6	12	6	6
5	Development skills (people + time)	4	5	4	4	4	20	16	16	16
6	Facilities for R & D.	3	4	5	3	3	12	15	9	9
7	Manufacturing capability (people)	3	3	5	3	2	9	15	9	6
8	Manufacturing capability (time).	3	4	4	5	3	12	12	15	9
9	Manufacturing capability (facilities)	3	5	5	4	4	15	15	12	12
10	Synergy with corporate units.	3	4	5	4	2	12	15	12	6
11	Raw material supply.	4	4	5	4	5	16	20	16	20
12	Effect on firm's layout.	4	3	2	4	4	12	8	16	16
13	The use of byproduct.	3	4	4	3	5	12	12	9	15
14	The use of excess capacity of machines.	4	5	4	3	3	20	16	12	12
$\sum_{j=1}^9 W_j$		50								
$C_{ti} = \sum_{j=1}^9 C_{ij}$							198	213	179	144

$\sum_{j=1}^i W_j \times S_{ij}^{max}$	$C_{t_i}^{max}$	=	250			
$P_{t_i} = C_{t_i} + C_{t_i}^{max}$			0.792	0.852	0.716	0.576

Table (2-b): A hypothetical example of the use of an evaluation sheet of probability of commercial success.

No (j)	criteria	Weight (W_j)	Suitability score S_{ij}				Compatibility score $C_{ij}=W_j \cdot S_{ij}$			
			new product idea i				New product idea i			
			1	2	3	4	1	2	3	4
1	Distribution channels.	5	5	5	5	5	2	2	2	2
2	Market maturity (growth).	4	5	4	4	3	2	1	1	1
3	Customer strength.	5	4	4	4	4	2	2	2	2
4	Potential market share.	4	4	4	3	3	1	1	1	1
5	Time to commercial start up.	4	5	4	5	4	2	1	2	1
6	Existence of commercial applications skills.	4	5	4	4	3	2	1	1	1
7	Proprietary position.	4	4	4	3	2	1	1	1	8
8	Competitive intensity.	5	4	4	3	3	2	2	1	1
9	Competitive time advantage.	5	4	4	3	2	2	2	1	1
10	Durability or sustainability of competitive Position.	4	4	5	4	2	1	2	1	8
11	Contribution to profitability.	4	4	4	3	2	1	1	1	8
12	Cost position.	4	4	4	3	3	1	1	1	1
13	Payback period.	4	5	4	3	3	2	1	1	1
14	Regulatory, social, health, safety,	4	5	4	4	5	2	1	1	2

4	political impact.						0	6	6	0	
$\sum_{j=1}^k W_j$		60									
$Cc_i = \sum_{j=1}^k C_{ij}$							265	249	219	190	
$\sum_{j=1}^k W_j \times S_{ij}^{max}$							$Cc_i^{max} =$		300		
$Pc_i = Cc_i + Cc_i^{max}$							0.883	0.830	0.730	0.633	