The Idea Itself and the Circumstances of Its Emergence as Predictors of New Product Success

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In view of the distressingly low rate of success in new product introduction, it is important to identify predictive guidelines early in the new product development process so that better choices can be made and unnecessary costs avoided. In this paper, we propose a framework for early analysis based on the success potential embodied in the product-idea itself and the circumstances of its emergence. Based on two studies reporting actual introductions, we identified several determinants (such as how the ideas originated, their specific configurations, and the level of technology required for their implementation) that significantly distinguish successful from unsuccessful new products in the marketplace. We suggest that these factors, together with already known factors of success/failure, may aid in the estimation of the potential of a concept early in its development.
(*New Products; Success; Failure Creativity; Templates*)

Introduction

New product introduction is a major activity of firms. However, most of the 25,000 products introduced each year in the United States fail (McMath and Forbes 1998, Bobrow and Shafer 1987). Because the greatest monetary loss for failed products occurs at the market introduction stage (Robertson 1971), it is critical to gauge reception before introduction and to continue to promote products that have a high potential for success. Indeed, in view of the fact that expenditures for developing a new product increase as the process advances toward the launch, it is clearly critical for firms to screen out concepts and ideas that are likely to be failures as early in the process as possible (Dolan 1993).

Previous research on new product performance has shown that a wide variety of factors influence the outcome of new product development activities (cf. Montoya-Weiss and Calantone 1994, Freeman 1982, Virany et al. 1992, Cooper and Kleinschmidt 1987, Lilien and Yoon 1989). These determinants usually involve some combination of strategy, development process, organizational, environmental, and market factors.

Research in this area exists in several disciplines, including marketing, organizational behavior, engineering, and operations management (Montoya-Weiss and Calantone 1994, Freeman 1982, Von Hippel 1988, Barnett and Clark 1996, Tushman and O'Reilly 1996). Much of this research focuses on dyadic comparisons between project successes and failures in an effort to discover principal discriminating factors and to provide strategies to enhance success and avoid failure. According to Griffin and Page (1993), at least 61 research studies resulting in 77 articles were published on the subject prior to 1993.

Cooper (1979a, b) postulated that the success of new product ventures is determined by environmen-

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tal factors related to the setting in which a new product is developed, and controllable factors related to the characteristics of new product activities employed by firms. Since that time, a considerable body of research has been reported. A major comparative study was termed Project Sappho (Freeman 1982, Rothewell 1985) and examined successes and failures in the area of industrial innovation. In its final form, the project included a total of 43 pairs of success/failure cases and, by a "pair comparison" technique, factors that discriminated success from failure were identified. Dominant factors were (1) understanding of user needs, (2) attention to marketing, (3) efficient development work, (4) use of outside advice and technology, and (5) seniority of innovators is their organization.

More recently, Montoya-Weiss and Calantone (1994) introduced a taxonomy identifying a logical grouping of the reported measures into those appropriate at *the firm or project level*. In their meta-analysis, they reduced the determinants of product success to 18 factors (product advantage, marketing synergy, technological synergy, etc.). This taxonomy, and variations on it, are widely used in success-failure research (Cooper 1979a, b, Griffin 1997, Mishra et al. 1996, Yoon and Lilien 1985, etc.). Focusing on the factors that influence profitability, Ulrich and Eppinger (1995) present five dimensions: product quality, product cost, development time, development cost, and development capability. Importantly, actual success of a given product is clearly conditional on the market inclination to adopt it. Market rejection transforms a successful design into a product failure. However, even with all the research that has been conducted in this area, it is still difficult for a firm to determine whether, in fact, a new product will be successful (Griffin and Page 1996).

Furthermore, careful review of the literature reveals that little attention has been paid to the contribution to success/failure of the *idea itself* and the unique product configuration implied by the idea. In research to date, the impact of the idea itself has been implicitly included in more complex determinants related to the R&D *process* rather than investigated directly (Freeman 1982, Barnett and Clark 1996). For example, Holak and Lehmann (1990) use Rogers' (1995) typology (relative advantage, compatibility, complexity, communicability, and divisibility) to predict product success.

In the present paper, we examine a more extensive classification of the determinants of product success/failure by including contribution of the *idea itself*, and the *circumstances of its emergence*, as predictive of actual market results. More specifically, determinants of success and failure used to predict market success are classified into three fundamental groups: (1) *early determinants* consisting of idea-based information—the idea itself and the circumstances of its emergence; (2) *project-level determinants* based on examining the compatibility of the project and the firm (including the execution process); and (3) *market determinants* consisting of market-based knowledge (requiring market research and tests). The third group is assumed to provide the most accurate forecast because it relies on relevant information about consumer preferences and needs. The determinants of the second group allow for evaluation of the project based on internal observation of the firm's characteristics, which is less costly than engaging in market research. The determinants of the first group allow for evaluation of the product idea at the earliest stage of all—the stage of conception. In this paper we assess the power of the first group of determinants to predict product success. If successful in demonstrating the predictive power of the idea itself, the results can be used either to channel the ideation process into those types of ideas that have a higher probability of success ("self-screening" ideation) or as an early screen for the likelihood of success.

We begin by proposing a set of early determinants. This set includes identified regularities in the emergence of successful products—termed *templates* (Goldenberg et al. 1999a), as well as other measures of the circumstances prevailing at the time of ideation. We then review project-level determinants discussed in the recent literature on product success and failure. The predictive power of the early determinants is subsequently examined in two studies. Finally, we present and test a model that unifies the early determinants and the project-level determinants.

Early Determinants

Templates of Product Change. Considerable research in marketing suggests that the evolution of new products and services is driven by marketing forces. Market-driven ideas are often inferred from market needs, and many of the best product ideas emerge from the responses of customers asked to report problems with current products. This suggests that market-based information should be considered early in the stage of new product ideation (Griffin and Hauser 1993).

In a recent paper, Goldenberg et al. (1999a) question whether new products should evolve solely on the basis of knowledge derived from market-based information, or whether there is an intrinsic *product-based* scheme underlying the evolution of successful products. They identify five major *templates of change* defining regularities that can be inferred from product-based trends. Their main thesis is that certain regularities are identifiable, objectively verifiable, and generally observable, and that these templates can facilitate productive and focused ideation.

To illustrate how one of the dominant templates, termed *attribute dependency*, can be inferred, consider the emergence of the nondripping candle, which addresses the need to preserve a clean surface underneath it. The structure of the candle consists of dual-layer wax, with the external layer having a high melting point and the internal layer a low melting point. This results in the formation of a basin around the base of the flame, preventing the melted wax from dripping. The schematic structure of the new candle can be described in terms of a new dependency between two previously independent variables (melting point and candle radius). The creation of a dependency between two previously unrelated attributes is a recurring pattern in new products.

By analyzing chronological development of several product categories, Goldenberg et al. (1999a) identified five basic templates in the evolution of products: (1) Attribute Dependency (AD), (2) Component Control (CC), (3) Replacement (Rep), (4) Displacement (Dis), and (5) Division (Div). Examples of the templates in the context of computer-mouse products, along with brief descriptions, are presented in Appendix A. Examination of successful new products showed that almost 70% of them matched at least one of these five templates. Further, individuals trained in the use of templates generated superior new product ideas: Judges blind to the existence of templates evaluated template-based ideas higher in their value to the firm than ideas generated by nontrained individuals or individuals who used other methods (random stimulation, morphological analysis, etc.).

In the present study, the five templates are classified into two groups: (1) the attribute dependency template (AD), which consists of variable manipulations, and (2) four component templates (CC, Rep, Dis, and Div) that manipulate the components. Because template-matched ideas were evaluated as more effective than ideas that are not affiliated with templates (Goldenberg et al. 1999a), we expect ideas that can be ascribed to templates to be more successful.

Source of Idea. Although the importance of protocols is noted in Montoya-Weiss and Calantone (1994), so far the marketing literature has paid little attention to the way in which an idea is generated as a possible predictor of its success. The literature on ideation and creativity points out, however, that the quality of ideas changes when alternative cognitive processes (and circumstances) are involved. According to Finke et al. (1992, 1995), ideas are composed of functions (e.g., consumer needs) and their relation to forms (e.g., solutions). They identified three types of cognitive searches for ideas that may be relevant to new product ideation: (1) identifying or defining a function and then performing an exploratory search for a suitable form, (2) identifying a form followed by an exploratory search for a meaningful related function, and (3) creating the generalization of a predefined, restricted function-form relation. When none of these exist, the efficiency of the process and the quality of the ideas are reduced dramatically.

Adopting these findings to the new product ideation context leads to a three-part classification of source variables: (1) *need spotting*—when need identification precedes product (form) development; (2) *solution spotting*—when a form is identified and the inventor searches for a suitable need (use), or both the need and a solution are identified concurrently (usually as an improvisation), and (3) *mental invention*—when according to the inventor's report

the idea is based on a decision to innovate and on internal cognitive process rather than on external market stimulus. Note here that the decision to innovate ignores the recommended "market attention" approach (Freeman, 1982). To these three classes of source variables (identified via self-reports from the individuals involved in the development process), we add two variables related to marketing, namely, (4) *market research for new products* (Crawford 1977)—when a need is identified by marketing analysis and a suitable product is then developed, and (5) *following a trend* (McMath and Forbes 1998)—when a product is developed to follow a market trend in a different class of products.

For example, the first bandage was designed by a husband in response to the need to stop his wife's bleeding (need spotting). In contrast, Vaseline was invented after a chemistry student identified and admired a unique feature in a certain oil residual, and then searched for a suitable benefit (solution spotting). The decision to introduce a solid shampoo was reported as an idea that was suddenly born in the mind of a marketer, with no market attention, and, as such, it can be classified as a mental invention. Pepsi Clear is an example of following a trend because the "clear" trend existed before Pepsi adopted it, and there was no relevance to any fundamental features of Pepsi.

Consistent with Finke et al. (1992, 1995), it is posited that the effectiveness of an idea increases when limits are set on the scope of explored possibilities. In this case, spotting a need or a solution provides cues for an idea before its actual conception. This is consistent with findings showing that limited search within a confined set of possibilities has a positive effect on the quality of ideas (Perkins 1981, Weisberg 1992, and Finke et al. 1995).

The proposition that solution- and need-spotting circumstances lead to superior ideas is supported by a series of studies conducted by Von Hippel (see Von Hippel 1988, 1989; Urban and Von Hippel 1988) on "lead users". In his work, lead users were found to possess unique information about future needs. By creating solutions to their own problems, they were frequently able to predict new and successful products, and often consumers' improvisations provided the basis for formalization of new products. By understanding their needs and problem solutions, lead users provide useful data in a multistage process. According to our notion of idea protocols, need spotting and solution spotting offer signals for successful ideation. Further, empirical tests have validated the proposition contained in the model and elaborated by Finke et al. (1992), termed "Geneplore," which suggests that ideas based on solution spotting are superior to those based on need spotting.

Unlike the case of solution spotting and need spotting, we expect trend following to have a negative effect on market performance. Altering a product according to existing market information (i.e., identifying the trend) seems to have a positive effect on the quality of an idea. However, the relevance of a trend to a product is low in many cases (e.g., a clear Pepsi), partly because the idea generation process consists of an attempt to mimic other ideas rather than to generate novelty.

Project-Level Determinants of New Product Success

As already mentioned, previous research has provided determinants that examine the match of a new concept with the firm's resources. These determinants are postulated to play an important role in transformation of an idea into a product. As stated, the aim of this paper is to evaluate the contribution of early determinants to product success and to develop a unified model that incorporates both the early and the project-level determinants.

In view of the importance of an early estimation of the market response to a product, concept tests have become a widely used tool for "go-no-go" decisions. However, these tests have some limitations such as inflated or deflated purchase intention ratings, short time span allocated to consumer reaction, etc. (cf. Juso 1975). Another shortcoming of concept testing is that it focuses on needs and purchase intention, ignoring other factors that become evident only when the product is presented in its final configuration and design (Dolan 1993). Extensive research has been conducted to improve the predictability of success versus failure, and to evaluate success probability earlier. The findings generally indicate that factors related to R&D

improve market performance, and that the characteristics of new product development activities can be controlled by firms. Below we elaborate the main project-level determinants that have been found to affect the market performance of new products.

Newness to the Market. The introduction of products that are "new to the market" can potentially lead to market share gains (Urban et al. 1986). Although products may be rejected because of their newness or premature introduction, innovative products form a significant component of a company's offerings. Booz, Allen, and Hamilton (1982) classified 700 product introductions according to "newness to the market" and "newness to the firm." Of these, 17% were classified as having high market newness, 10% as having a high company newness, and 7%, low company newness. Wind and Mahajan (1997) noted the disproportionate effort currently devoted to "me-too" products (e.g., line extensions, improvement of current products, and cost reduction). New "me-too" products are more than twice as prevalent as "really new products" (Booz, Allen, and Hamilton 1982). To illustrate how newness to the market was classified in the present study, consider the introduction of the first shampoo. The fact that people were already using soap bars to wash their hair (prior to the introduction of shampoo) led shampoo to be classified as a new, but not radically (i.e., moderately) new, product.

Newness to the Firm. Tushman and O'Reilly (1996) review the interplay between revolutionary and incremental innovation and argue that, to survive, it is crucial for firms to implement both. However, in the context of a specific product, newness to the firm may lead to failure. Griffin (1997) argued that firms are reluctant to adopt inventions that are not consistent with their current activities. This is in line with Cooper's (1985) finding that newness to the firm[1] is correlated with failure rather than success. For example, the fact that the first shampoo was introduced by a soap manufacturer suggests that it was not very new to the firm.

[1] Newness to the firm is often defined in terms of newness of the R&D and newness of the market

Changes in Technology. Typically, addressing more needs and improving system performance entails changes in the system (Pye 1978). The market does not generally respond enthusiastically to large-scale changes. In this paper, changes in technology are measured in relation to existing technologies in the field, and to the changes required in the firm's technology to manufacture the product. Mishra et al. (1996) found that newness of the production process is correlated with product failures. In addition, managers often find it difficult to adjust to new technologies successfully (Foster 1986, Anderson and Tushman 1991). We classify level of required technology change into three groups: minor, moderate, and major. Based on this classification, the first amphibious car required a major technology change, and the first shampoo (which was in fact a liquid soap) required a minor technology change.

In general, newness to the market is expected to have a positive impact on product success, whereas newness to the firm and technological change are expected to have a negative effect. In other words, the market favors innovative products that do not require major adjustments to produce them. This market preference can be termed "secure progress"—by rejecting highly complex products, the market exerts pressure on companies to produce new products based on existing resources and technology. The plausibility of this hypothesis is supported by previous findings suggesting that innovation adoption usually occurs more readily in the case of products that appear less complex to the consumer (Ostlund 1974, Labay and Kinnear, 1981).

Product Offering (The Primary Advantage of the Product). The importance of the product offering is discussed extensively in the marketing literature. Based on a review of the literature (e.g., Freeman 1982, Montoya-Weiss and Calantone 1994) and examination of product introductions, we classify products according to their principal offering into the following six groups: (1) technology-stretching products (superior technology introduced into an existing product), (2) need-addressing products (a new and important need satisfied by the new product), (3) economical products (the purchaser saves money or

other resources due to lower price or more economical usage), (4) trend-gimmick products (the product offers a gimmick without any other benefit or mimics a nonrelevant trend in a remote product), (5) segment-focused products (a product adapted to better fit a market segment), and (6) formalization products (a product that incorporates existing improvisations or consumers' habits) (see Von Hippel 1988, 1989).

A product may fall into one or, albeit rarely, more than one, category in this classification. For example, in this study an amphibious car was classified as a technology-stretching product, whereas shampoo was classified as both a need-addressing product and a formalization product (because people used tiny bars of soap and powders to wash their hair before shampoo was introduced). A solid shampoo was classified as a trend-gimmick product, because of its relatively unimportant declared benefits. The new generation of concentrated washing powders was classified as an economical product and a shampoo for treated hair as a segment-focused product.

Hypotheses

The predictive power of the early analysis variables was tested using the two-class templates typology and the five-class "idea–source" typology described above.

Templates.

HYPOTHESIS 1A. *Affiliation to the Attribute Dependency templates has a positive effect on product success.*

HYPOTHESIS 1B. *Affiliation to a Components template has a positive effect on product success.*

Source of the Idea.

HYPOTHESIS 2A. *Focus on external cues through need spotting or solution spotting has a positive effect on the success of a product.*

HYPOTHESIS 2B. *Mental ideation has a negative effect on product success.*

HYPOTHESIS 2C. *Products based on following a trend or gimmicks are less likely to be successful.*

Early Analysis Performances.

HYPOTHESIS 3. *Early analysis determinants (template, source of idea) have the capacity to contribute to the prediction of market success beyond the project level determinants.*

Study 1: Predicting Success of Patented Products

Method

A set of 70 detailed cases of successful and unsuccessful consumer products was collected (41 successes and 29 failures). To avoid fuzziness and inaccuracy in deciding whether a product is or is not a failure (cf. Griffin and Page 1996), we define a failure as (1) a product that was totally rejected by the market and ceased to exist, or (2) a product that failed in market tests, resulting in a decision to abort its introduction. Only products that generated substantial positive financial results were defined as successes. The data was obtained from the Israeli patent office, and the 70 patents were chosen randomly from three different categories: kitchen devices, garden tools, and car devices. The inventors of each patent were contacted and interviewed to define each patent as a success or failure. To ensure that the rejection of a new product was not temporary, patent applications after 1990 were not included.

Each product was classified according to the template determinants detailed earlier. The classification process involved submitting the cases to a group of three judges trained in template identification. The categories used for template classification were "components templates", "attribute dependency template", and "not a template". The source variables are not included in this study because of the potential of biases of the inventors. The judges were considered to be experts in the field of new product development; (all had at least eight years experience, and held senior positions in firms involved in new product introduction and innovation).

Training the judges involved a 30-minute session in which the templates were explained and demonstrated with examples of existing products. The judges were not exposed to the notion of classification

of failure or success. After the training, a short pretest was performed: Each judge was asked to classify five products according to the relevant templates. All the judges correctly classified the five products.

Because of the long list of products (70 items), the judges were allowed a short rest during the judgment task. To control for a possible effect of the sequence of product classifications, each judge received a list with a different (randomized) order. During the classification task, there was no interaction between the judges.

Analysis

Interjudge reliability was tested. To test if the proposed templates are redundant, the correlation between the template variables was examined. A logistic regression equation was performed to predict product success based on the templates.

Results

The average agreement between the judges was high (alpha = 0.89). The correlation between the two template variables was 0.22, and thus, they are not redundant. The distribution of successes and failures, broken down separately for each template, is summarized in Table 1.

The logistic regression analysis indicated that a high proportion (89.5%) of the failures and successes can be predicted by the model (see Table 2). Table 3 presents the coefficients and their significance. In general, they match the individual variable results, with the two template predictors significant at the 0.01 level. Clearly, products that follow the template structure have a greater likelihood of success.

Table 1 Success vs. Failure Determinants in the Data of Study 1

Determinant	Variable	Failure(%)	Success(%)
Template	Attribute*** (18)	11 1	88 9
	Component*** (24)	4 2	95 8
	Not a Template*** (31)	83 9	16 1

Note. The numbers in the brackets indicate the sample size. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. For parameters that are not denoted by *, $p > 0.1$.

Table 2 Logistic Regression Prediction Results for Study 1

	Predicted Failure	Predicted Success	% Correct
Observed failure	26	3	89 66
Observed success	5	36	87 80
			Overall–88 57

Study 2: The Unified Model

The aim of Study 1 was to assess the predictive power of template variables. The relatively small size of the sample and the inability to control for bias attributable to inventors' self-reports in Study 1 made it difficult to consider other variables. The purpose of Study 2 is to allow us create a unified model of idea evaluation, using template determinants (Hypothesis 1A, Hypothesis 1B), and source idea-determinants (Hypothesis 2A–Hypothesis 2C), and to compare their predictive power to that of the project-level determinants described in the existing literature (Hypothesis 3).

Method

A set of 127 detailed cases of successful and unsuccessful consumer products was collected (70 successes and 57 failures). The data came from 3 different books (McMath and Forbes 1998, Freeman and Golden 1997, Adler and Houghton 1997) each containing data on successes and failures of new products. We avoided fuzziness and inaccuracy of deciding whether a product is or is not a failure (cf. Griffin and Page 1996) by using the same criteria as in Study 1, which is in line with the books' own criteria; only products that generated substantial positive financial results were included in the books as successes. Only 4 product cases were excluded because of classification ambiguity.

Measures. In view of the fact that the authors of the books were blind to the purpose of this study,

Table 3 Coefficients of the Logistic Regression for Study 1

Variable	B	t	Sig
Constant	1 64	15 27	0 001
Attribute template	3 52	7 54	0 001
Component templates	4 65	16 82	0 001

and the absence of any interaction with them, it was assumed that this sample was free of any bias related to the determinants. To assess the reliability of the reported cases, the details were contrasted with a different source, the *Encyclopedia of Consumer Brands* (Jorgensen 1994). A sample of 30 cases was examined; no discrepancies were found between the data sources.

The cases were classified according to the determinants detailed earlier (i.e., template affiliation, idea-source, and project-level determinants). The classification process involved submitting the cases to three different groups of three judges, selected for their area of expertise (i.e., technology level was judged by engineers, newness to the market by experienced marketers, template identification by trained judges). The judges were considered experts in their field; all had at least eight years experience and held senior positions in firms involved in new product introduction and innovation. The categories used for product classifications are summarized in Appendix B.

As in Study 1, training each group of judges involved a 30-minute session in which the determinants were explained and demonstrated with examples of existing products. The judges were not exposed to the notion of classification of failure or success. The training quality and judgement requirements were assessed following a similar procedure to that of Study 1.

Analysis

Interjudge reliability was tested. To test the redundancy of the proposed determinants, a factor analysis was performed. A logistic regression equation was then created to predict product success based on the early determinants (template affiliation and idea source), project-level determinants, and a combination of both groups of determinants. To estimate the contribution of the template and idea-source determinants to the prediction of success, a nested model test was performed. Finally, we removed the effect of potential covariates (e.g., durable versus consumable products, industry growth, etc.) by including them in the analysis.

Results

The average interjudge agreement was high in all three groups (average alpha = 0.89, 0.92, 0.89). The correlation matrix revealed that the highest correlation between variables was −0.39 (between newness to the market and trend following). The second highest correlation was only 0.27. Thus, the determinants are not highly correlated. In addition, a factor analysis revealed that there are 11 factors with eigenvalues larger than one, which explain 72.6% of the variance. The eigenvalues decrease without a noticeable elbow, suggesting that no clear groupings exist. Therefore, we use specific determinants rather than factors in subsequent analysis.

The distribution of successes and failures, broken down separately for each determinant variable, is summarized in Table 4. Most of the differences are consistent with the hypotheses—low levels of newness to the market, major technology change, following a trend, and mental invention tend to be associated with failure. By contrast, meeting needs, economical products, segment-focused, formalization products, minor technology change, need and solution spotting, and products that match a template tended to predict success.

To further investigate the role of each of the early determinants (template affiliation and idea source), a logistic regression analysis was performed. The results indicate that most (81.9%) of the failures and successes can be correctly predicted by the template and idea-source variables (see Table 5). Table 6 presents the coefficients and their significance. In general, they match the results obtained for the individual variables, with the five variables significant at the 0.05 level having all been identified as relevant by the previous analysis.

To further evaluate the role of the template affiliation determinant and the idea source in market success estimations, a nested model was tested. First a logistic regression was applied with the project-level variables as predictors. The results indicate that 79.5% of the failures and successes were correctly predicted (see Table 7). This result replicates findings of previous studies in new product successes cited earlier: The same factors were found to govern the success

Table 4 Success vs. Failure Determinants (Study 2)

Early Determinants	Variable	Failure (%)	Success (%)	Project level determinants	Variable	Failure (%)	Success (%)
Templates	Attribute*** (24)	8 3	91 7	Newness to the market	High** (39)	43 7	56 4
	Components*** (31)	12 9	87 1		Moderate** (87)	30 4	69 6
	Not a template*** (76)	67 1	32 9		Low*** (32)	75	25
Source of idea	Need Spotting*** (34)	35 3	64 7	Newness to the firm	New to the firm (87)	47 5	52 5
	Solution spotting*** (17)	11 8	88.2	Product Offering	Need addressing*** (54)	24 1	75 9
	Market research*** (11)	27.3	72 7		Economical (5)	60	40
	Random event** (7)	14 3	85 7		Segment Focused (24)	37 5	62 5
	Mental invention*** (40)	67 5	32 5		Trend, G mmick** (39)	59 0	41 0
	Trend following*** (19)	78 9	21 1		Technological Superiority* (24)	91 0	9 0
					Formalization** (27)	25 9	74 1
				Technology change	Major*** (24)	79 2	20 8
					Moderate (33)	57 6	42 4
					Minor*** (69)	26 1	73 9

Note. The numbers in the brackets indicate the sample size, ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. For parameters that are not denoted by *, $p > 0.1$

and failure, which provides evidence for the external validity of our sample.

We then applied the logistic regression again, including the proposed early determinants to form a unified model. The percentages correctly predicted increased to 92.1% correct predictions (see Table 8), indicating a significant incremental contribution of early determinants in success prediction even in later evaluations, when more project-level information is already available. Table 9 presents coefficients of the significant variables of the unified model. Comparison of the unified model with the early determinants again suggests that the early analysis alone accounts for a substantial amount of the predictive power of the full set of variables.

Table 5 Logistic Regression Prediction Results for the Early Determinants (Study 2)

	Predicted Failure	Predicted Success	% Correct
Observed failure	49	8	85 96
Observed success	15	55	78 57
			Overall–81.89

Effect of Covariates. One possible explanation for the predictive ability of the early analysis determinants is that they reflect the market conditions into which the product is introduced, and that it is these covariates, and not the early or project-level determinants, that govern success or failure. Therefore, we examine some obvious covariates that might explain success. Specifically, four covariates were tested: (1) consumer versus industrial products, (2) durable versus consumable products, (3) growth rate in the industry, and (4) high-tech versus low-tech products. Each of the 197 products (from Study 1 and Study 2) was categorized with respect to these four variables. Initial analysis showed that the proportion of successes vs. failures for each covariate in the sample was not significantly different from 50% (Table 10). When logistic regression was performed using the four covariates as predictors, only 59.4%

Table 6 Coefficients of the Logistic Regression

Variable	B	t	Sig
Constant	−0 18	0 05	0 83
Attribute template	2 94	12 51	0 001
Component templates	2 58	15 72	0 001
Mental invention	−1 50	3 32	0 07
Trend following	−1 81	2.94	0 08
Solution spotting	2 04	4 13	0 04
Need spotting	−0 26	0 10	0 74
Random event	0 05	0.00	0 96
Marketing research	0 04	0.00	0 96

of the successes and failures were correctly predicted, and the coefficients of the covariates were not significant (p values varied from 0.131 to 0.588). When a logistic regression was performed including both the idea variables and the four covariates, the increase in the correct prediction was minimal (1.9%). Further, in this regression none of the covariate coefficients was significant. By contrast, all the coefficients of the variables significant in the unified model remained significant and were similar in magnitude. A log-likelihood test confirmed that the covariates do not add significant predictability to the current regression.

Why Early Determinants Can Predict Success

Given the high failure rate for new products, it may be surprising to learn that certain factors in general and templates in particular provide a strong clue as to the eventual success or failure of a product. This paradox is resolvable by considering the information processing done by potential adopters, both on their own and in response to persuasive communication (e.g., advertising).

Table 7 Logistic Regression Prediction Results for the Project-Level Determinants

	Predicted Failure	Predicted Success	% Correct
Observed failure	45	12	78 95
Observed success	14	56	80 00
			Overall–79 53

Table 8 Logistic Regression Prediction Results for the Unified Model (Study 2)

	Predicted Failure	Predicted Success	% Correct
Observed failure	52	5	91 23
Observed success	5	65	92 86
			Overall–92 13

First, remember that humans in general avoid, rather than seek, radical innovations. Part of this is based on evolution and adaptation, which makes individuals comfortable with both the familiar and the fathomable. In other words, radical changes are likely to be rejected and minor ones ignored. This leads to the notion of the optimal or "just right" level of innovation and explains why modest innovations tend to be more successful than trivial or radical ones. In other words, a successful innovation must at the same time be both new and easy to comprehend.

Goldenberg et al. (1999a, c) argue that the relations between problems and solutions are evolutionary. When a change in the external environment (e.g., market preferences) occurs, products that do not adapt to the new condition cease to exist. Over time, market changes leave traces in product configurations that can be identified as product-based trends. Those trends, crystallized as templates, provide the skeletons from which numerous new successful ideas are spawned.

One reason early determinants such as templates predict success is that they channel information processing into routes that invoke a perception of innovativeness. The fact that certain structures are conceived as superior is consistent with the view of the brain as a self-organizing system where paths of minimum energy serve as attractors for responses or preferences (Kelso 1995). There is mounting evidence that such schemes facilitate consumer receptiveness to new products. Evidence to the existence of such structures was found by Goldenberg et al. (1999d), who identified six groups of templates in the context of advertising, some of which are similar to the replacement and attribute dependency templates described earlier. Ulrich (1988) describes function sharing in the context of mechanical design, whereby an object already

Table 9 **Coefficients of the Logistic Regression for the Unified Model (Only Significant Determinant Included, All Other Determinants Are Not Significant)**

Early determinants	B	t	Sig	Other determinants	B	t	Sig
Attribute template	3 66	7 74	0 005	Low market newness	−1 95	5 02	0 02
Component templates	2.95	10 55	0 001	Meeting needs	1 75	4 39	0 03
Mental invention	−2.27	6 41	0 01	Formalization	3 03	8 53	0 003
Solution spotting	1 83	2 55	0 1	Low technology leap	4 46	16 43	0 000
Trend following	−2 40	3 50	0 06	Constant	−2 87	9 47	0 002

carrying out one function is assigned another. In the context of new product development, function sharing and the replacement template are identical. The templates discovered in the context of new products comply with what Maimon and Horowitz (1999) term a *closed world condition*, which, in the domain of engineering problem solving, was shown to be one of two sufficient conditions needed for ideas to be perceived as inventive. Relatedly, Nam Suh (1990) offers a set of axioms characterizing good design. Designs that fit the axioms involve minimization of the "information content of the design" (the information axiom) or the total number of parts (see also Stoll 1986). The best design according to Nam Suh is "a functionally uncoupled design that has the minimum information content" (p. 48).

The advantage in processing template-based ideas is in the type of knowledge transfer generated when consumers try to identify similarities between a new ideas and previously known ones. Holland et al. (1989) drew a distinction between *surface* similarities (e.g., chemical ingredients) and *structural* similarities between the target (new idea) and the base (existing ones). If the idea is new, comparison based on surface properties may be limited because of the dearth of superficial links between the target and the base. Unlike surface properties, templates are "deep" structures (Hofstadter 1985) that rely on regularities which have been proven successful in other contexts (possibly even by the same consumers). Templates-based ideas are likely to be perceived as new, yet "familiar." The upshot of this is that template-based ideas on the one hand create a sense of new superior products. On the other hand, they minimize risk of rejection associated with their novelty, because they are structurally similar to other successful products.

A second and related reason that certain determinants predict success relates to the literature on product diffusion. Rogers (1995) points out certain factors which enhance or retard adoption (e.g., the complexity of the product, the degree to which it may be tried on a limited basis, etc.). These factors determine the benefits related to using the new product versus the level of risk perceived in use (Dowling 1986). A related factor influencing adop-

Table 10 **Success vs. Failure Covariates**

Covariate		Failure (%)	Success (%)	P value
Product classification	Consumer (186) vs	43 0	57 0	0 33
	Industrial (11)	54 5	45 5	
Product classification.	Consumable (83) vs.	39 5	60 5	0 19
	Durable (114)	49 4	50 6	
Growth rate of the industry	High (43) vs	46 5	53 5	0 73
	Low (154)	42.9	57 1	
Industry classification	High (24) vs	62 5	37 5	0 17
	Low tech (173)	41 0	59.0	

Note The numbers in the brackets indicate the sample size

tion or rejection is the communicability of the innovation: According to Rogers (1995), an important aspect in the diffusion of innovation is that the innovators and potential users differ in expertise. When a change agent is more technically competent than his or her clients, this frequently leads to ineffective communication. As a consequence, the fewer new things to convey, the easier it is to convey them.

Taken together these points suggest that consumers' mental models favor innovations that consist of something new surrounded by familiar product attributes. Because templates involve changing only one or a few attributes or components, they may be more compatible with consumers' mental models (Moreau et al. 1999). Communicability of template-based ideas is enhanced because a high perceived benefit obtained with minimum configuration changes leads to favorable evaluation since it does not undermine one's knowledge structure.

Conclusions

We found that adoption and rejection can be estimated by using early determinants that can be constructed by inspecting the idea itself (template affiliation) and the circumstances of its emergence (protocol). More precisely, successful products tend to (1) fit one of the template groups, and (2) involve a solution to a customer problem. In contrast, products developed in isolation by the inventor, or products that attempt to mimic a popular trend from other products, were generally unsuccessful.

These early determinants allow for the prediction of an idea's market potential in the very first stages of its emergence. It is not argued that market response can be predicted accurately without market research. However, by using the early determinants, ideas can be screened before progressing to the concept level of development and market testing. Further, the incorporation of early determinants into models of new concept valuation (using project-level determinants) is likely to increase their predictive power even if applied later in the process of product development.

These conclusions are subject, of course, to the limitations of the study. A sample consisting of products from different categories, or new products that differ less dramatically in outcome, may lead to weaker or even different results. Further, a host of potential covariates remain to be investigated. We demonstrate that the early determinants dominate such obvious covariates as consumer versus industrial products, durable versus consumable products, growth rate, and low tech versus high tech in predictive power. However, other important covariates may exist (e.g., controllable factors of new product management—Calantone et al. 1996, Freeman 1982). Another effect that should be considered is that the sample in Study 2 does not include products that failed to reach the market. For example, it is plausible to assume that radically new products (to the market, or from the technology change perspective) are associated with failure (as verified in Study 2). Hence, the results of our study have only been demonstrated for those new products that reach the introduction stage. In addition, it is important to note that the expected value of a developed new product is a function of probability of success and revenue. Our model does not consider the "risky but highly rewarded" projects; the determinants discussed are applicable solely to the probability of success.

Overall, this paper draws attention from areas such as speeding product development toward carefully examining the product idea itself and the circumstances of its emergence. As such, it provides a complement to other methods for predicting success. Hopefully, further work in this area will establish both the role of the idea and how to manage it.

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Appendix A A Brief Presentation of the Five Templates

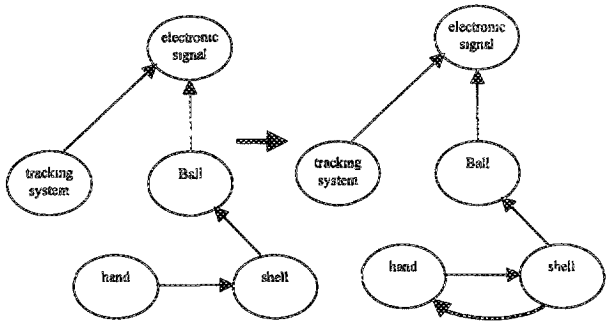
The distribution of templates in a study analyzing soap-related products (Goldenberg et al. 1999a) was as follows: attribute dependency—43%, component control—13%, replacement—15%, displacement—6%, and division—1.5%. Additional mapping studies reported in that study focused on other product classes (hygiene products, bank accounts, and sneakers), following the same procedure as that used in the study of the soap category. These studies produced the same template typology and similar proportions of

template-matched product versions. attribute dependency: 40–68%, component control: 10–30%, replacement. < 1–19%, displacement: 1–3%, and division: 2–4%.

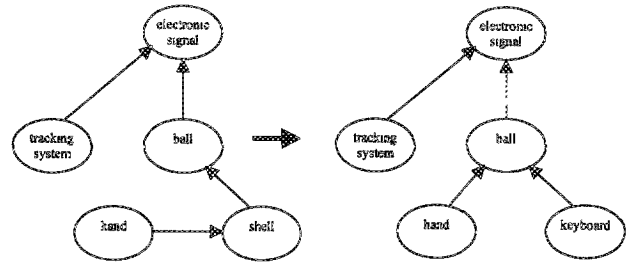
The five templates that are categorized in the present study into Attribute Template (I) and Component Templates (II) are briefly described below, using a computer mouse application

I. The Attribute Dependency Template (AD). This template, described in the body of the text (see the candle example), operates in the product *attributes* space The Attribute Dependency Template involves introducing a new dependency to previously independent variables In the context of computer mouse products, different shapes for right-handed and left-handed users, or acceleration of the cursor as a function of the velocity of the hand that moves the mouse, are attribute dependency-based products.

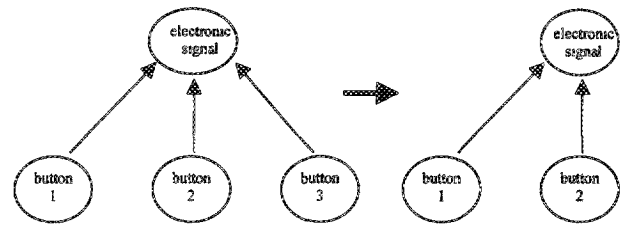
IIa. The Component Control Template. This template involves the creation of a *link* (in the form of control) between one internal component and another internal or external component For example, compare the shapes of computer mouse models designed to reduce hand fatigue to earlier models that were not shaped to accommodate the shape of the hand. A link has been created between the shell and the hand, as illustrated in the figure below



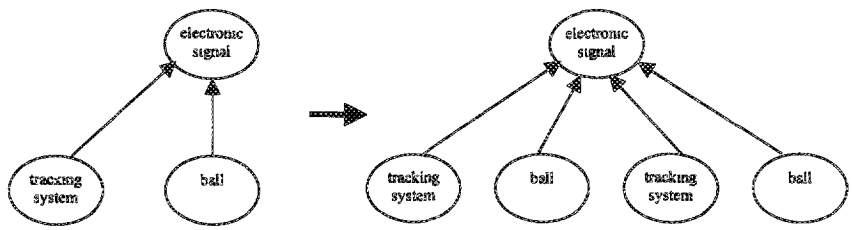
IIb. The Replacement Template. This template involves the removal of an *essential* internal component from the configuration while maintaining its function (the relation between the removed component and the remaining components). This operation creates a temporarily inconsistent abstract structure. Because of the dangling link, the operation is completed only when the missing component is replaced by another *already existing* component: *The replacement has to be an external component that can perform a function similar to that provided by the one removed.* For instance, consider the mouse installed in the keyboard of a portable computer. The shell has been removed and its function is assigned to the keyboard (see the scheme presented in the figure below) This template is described in detail in the context of forecasting technological innovation in Goldenberg et al. (1999b).



IIc. The Displacement Template. This template also operates in the *components* space. Here too, an essential internal component is removed from the configuration However, in contrast to the Replacement Template, its associated function is removed as well. In this case, a new idea for the product has to be based on a new appeal, one that the former product did not provide: For example, the transition from three buttons to two buttons in the case of computer mouse—one button has been removed along with its function (see the scheme in the figure below).



IId. The Division Template. This template involves splitting one component into several components which either contribute individually to the accomplishment of its function, or become responsible for different subfunctions. For example, consider the concept of dividing the ball in the mouse into two—one for determining the course of movement and the other for fine movement of the cursor.



Appendix B

To clarify our classification procedure, we illustrate below examples of cases and their coding. Note that the Source classification is based on the details of the case which are not provided here

Case	Description	Template	Source	Project-level determinant
Amphibious car	A car designed to be used also as a boat	Not a template	Mental Invention	High newness to the market, major technology change, new to the firm, segment focus
Bandage	A husband applied a gauze and adhesive to his wife's injured hands Johnson & Johnson adopted his "lead user" based concept.	Component control	Solution spotting	Moderately new to the market, minor technology change, not new to the firm, need addressing
Coffee drip filter	The inventor spotted when her friend smiled, specks of black coffee grounds on shiny white teeth	Component control	Need spotting	High newness to the market, minor technology change, new to the firm, need addressing
Pepsi Clear	A transparent cola that mimicked the trend of transparent drinks	Not a template	Trend following	Not new to the market, minor technology change, not new to the firm, trend/gimmick offering
Vaseline	A residue from an oil-rig pump (called "rod wax") was reduced to a moist white jelly as part of a laboratory experiment	Displacement	Solution spotting	High newness to the market, minor technology change, new to the firm, need addressing
"Polavision"	Polaroid camera that produced a 2.5 minutes movie	Not a template	Mental invention	High newness to the market, major high technology change, not new to the firm, need addressing
Thermos	A scientist experimenting low temperature liquefaction of gases created a device in which he placed a flask inside another that created a vacuum between them and prevented heat transfer.	Attribute Dependency	Solution spotting	High newness to the market, minor technology change, new to the firm, need addressing
Smokeless cigarettes	Cigarettes that eliminate smoke	Not a template	Need spotting and market research	High newness to the market, major technology change, not new to the firm, need addressing
Conditioner	An idea to divide shampoos into two different product categories by excluding the conditioning ingredients and introducing them as a separate product	Division	Market research	Moderately new to the market, minor technology change, not new to the firm, Segment focus based offering
Ultrasonic device against cats	A device that produces ultrasonic waves to scare cats from sitting on the warm cars.	Not a template	Mental invention	High newness to the market, moderate technology change, new to the firm, need addressing.
Snacking doll	A doll designed with a little motor and a set of gears that powered the doll's jaw (which included teeth) allowing it to chew plastic carrots	Not a template	Mental invention	Moderately new to the market, moderate technology change, not new to the firm, gimmick
Unwaxed candle	A brushed aluminum butane candle was introduced to replace the wax candles.	Not a template	Mental invention	High newness to the market, major technology change, not new to the firm, economical offering.

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