GENERATION AND EVALUATION OF NEW PRODUCT IDEAS : CURRENT METHODS AND FUTURE PROSPECTS

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December 1984

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ABSTRACT

In this paper, we review methods currently in use to generate and evaluate new product ideas. We discuss a new micro-computer based methodology to support creative sessions. Some examples, drawn from real life situations, are used to illustrate how this new system affects creativity in an organizational setting. Finally, we discuss some limitations of the proposed approach.

1. INTRODUCTION

New products are a substantial source of growth for most firms. But, they are risky. Although failure rates that are reported in the literature vary according to the source considered, people usually agree that they are high.

The recognition of these risks, along with the necessity for a firm, whatever its activities are, to renew its portfolio of products, led to a new emphasis on the development of decision support systems targeted at key decision areas of the innovation process. Such systems are in regular use to pre-test new products, improve their design and positioning, and monitor sales growth during the early stages of their life cycle. They have been successfully implemented in situations involving both new frequently purchased consumer goods (Wind 1982, Urban and Hauser 1980) and new industrial products (Choffray and Lilien 1980, 1984).

Although this recent research effort led to the development of reliable and valid methods of risk reduction, most of the time there remains some "unreducible uncertainty" that firms have to live with. To cope with it, most of them, rely on a continuous flow of new products, ideas, concepts and projects at the various stages of the product development process.

In a recent survey involving more than 1200 medium-sized industrial firms in France, we observed that more than sixty percent of them had no new product ideas inprocess. Seventy three percent of those that had some new product ideas, had less than five. At the same time, for more than sixty percent of these firms, the expected length of a new product's life cycle was less than seven years, an observation not uncommon in high-tech fields (Choffray 1984).

Although we do not have comparable statistics for the United-States, the situation is probably as bad. Typically, most firms consider that new product ideas are like "free-goods" ; "you get them when you need them".

Real life, however, tends to be different. Considering General Foods experience over a ten years period, it took more than six hundred new product ideas to generate 30 commercial successes (Wind 1982). In one industrial firm, it took 40 ideas to get one single product success (Fogg 1976). These numbers are basically in agreement with Booz Allen and Hamilton (1982), which reports a minimum of ten product ideas per commercial success.

Where to get these product ideas remains an unresolved issue for most firms today. And if one considers the literature, we, marketing scientists have not been very creative at ... helping firms be more creative.

In this paper, we first briefly review the current state of practise in the field of new product idea generation and evaluation. Then we present a new micro-computer based methodology - called CREACTIVATOR - to support creative sessions. Some examples drawn from real life situations are used to illustrate how this new system fosters creativity in an organizational setting. Finally, we discuss some limitations to the proposed approach.

2. THE STATE OF PRACTICE

The last fifty years have witnessed a considerable research effort in the field of creativity. The industrialized nations were seriously questioning their technological, scientific and artistic leadership. This led to the current trend of psychological research in the field of creativity.

Since Galton's (1869) first attempt at an empirical study of human creative abilities, research has addressed problems such as the intellectual traits, personal drives, and psychological characteristics of talented individuals (Vernon, 1978). It has also tackled problems associated with the measurement of creativity (Guilford, 1950). More recently, researchers became interested in the simulation on computers of the typical features of creative thinking (Feigenbaum and Feldman, 1963).

Most of the work done in this area remains controversial and indecisive. A good deal of the confusion stems from loose usage of terms such as creative, talented, imaginative, etc. It also comes from the fact that creative thought is very likely to lead to a large variety of new answers, that is, to be divergent.

It is difficult to define creativity, though many have tried. To psychologists, creative thinking is one of many kinds of thinking which range from dreaming to logical reasoning. They emphasize the unusual combinations of ideas, and the fact that such associations have social value, that is make an impact on other people's way of thinking and behaving.

In this paper, given our specific objective to help business firms in the management of their creative process, we adopt a more restrictive conception of creativity. We define a new product idea as being :

- an association of pre-existing products or concepts,
- in response to an actual or latent need of the market,
- likely to lead to the development of a new product or service,
- which is potentially viable from an economic standpoint over the planning horizon of the firm.

The last two conditions underscore our feeling that the generation of new product ideas must really be part of an innovation strategy based on growth, return on investment and risk reduction objectives (Choffray and Dorey 1983).

How do companies go about generating innovative ideas ? In practise, there are numerous approaches, ranging from unstructured methods such as focused group interviews and brainstorming, to very structured methods such as product deficiency analysis and the systematic study of patents. Readers interested in a comprehensive overview of these methods should refer to Wind (1982) and Choffray and Dorey (1983). In this paper, we will limit ourselves to three methods that are commonly used in practise.

2.1. Common methods of idea generation in group sessions.

- *Brainstorming* is one of the methods most often used by firms to get new product ideas. It is to a large extent similar to focused group interviews, except that it involves a smaller number of participants. A brainstorming session is based on the premise

that the larger the number of ideas generated, the more "productive" the session is. Hence a very permissive atmosphere is needed to encourage creative thinking and any kind of evaluation or judgment is suspended (Osborn 1953).

Contagion of enthusiasm and the development of a competitive environment are two key components of a brainstorming session. To be most productive, special care must be given to the selection of the participants to prevent unwanted self-restriction in the generation of innovative ideas. In addition, the presence of a moderator is often desirable to force people to go beyond top-of-mind responses.

- *The synectics approach* (Prince 1970) is a somewhat more formal way to organize creative sessions. It involves a complex process based on two psychological mechanisms aimed at making the "familiar look strange" and the "strange look familiar".

  The key to this approach is the use of metaphors in the new product idea generation process. Four operational mechanisms are used, including : direct analogy, personal analogy, symbolic analogy and fantasy analogy. Participants are "de-conditioned" through these processes and hence, are more likely to generate truly innovative ideas.

- *Morphological analysis* (Zwicky 1962) is a very structured approach of innovative product ideas generation. It attempts to identify all possible combinations of the key parameters that define the problem at hand. A thorough analysis of the feasibility of all alternatives leads to the selection of the best.

This method rests on an explicit formulation of the creative problem and the identification of all key parameters. It leads to the development of a matrix which lists all possible new combinations of the problem's attributes along with a subjective estimate of the likelihood that such developments are feasible. This estimate is inversely proportional to the number of parameters that distinguish a new product idea from the current state of the art (Allen 1970).

These three methods attempt to create, within an organization, an environment favourable to the development of each participant's creative potential. They usually stress the importance of the following :

. *Motivation* : the fact that an individual needs to be creative to achieve his own goals is essential to him generating new ideas.

. *Diversity of information sources* : creativity often means "divergence". The mere fact that an individual uses many different sources of information is a good indicator of the flexibility of his frames of reference and of his creative potential.

. *Association* : most new product ideas are the result of a slow, maturing process during which many ideas are processed, compared and combined.

. *Retention, accumulation* : if not "written-down", an idea is easily lost. To be creative one has to make sure that one's innovative ideas are safely kept. At the individual level, memory often plays that role.

Each of the three methods, however, falls short on some of these criteria. For instance, the diversity of the information sources that are gathered in a creative group is left to the person, often the moderator, in charge of the session. In addition, these methods are weak in terms of the possibilities that they offer to a company to build on its own, past creative experience. Finally, the organization of such group sessions is not only time consuming, it requires a considerable level of expertise as well as a serious training in the specific approach used.

These are some of the reasons why so many firms rely on several approaches, often used in parallel. This allows them to build "redundancy" in the new product idea generation process, working in different divisions of the firm or at different levels in the same division. Most important, it helps them "close the creative loop" that builds a system in which new product ideas are *continuously* generated, carefully stored, and systematically evaluated.

2.2. Common methods of product idea evaluation

Whatever the approach used to generate new product ideas, quantity often supersedes quality. If they do not want to be overwhelmed by the flow of their own creativity, firms have to continuously filter their product ideas. Methods, used at this level have to satisfy two conflicting objectives :

. provide a fast and reliable evaluation of the degree with which

an idea meets the firm's development constraints and available resources and,

. foster creativity - that is, the method should not filter out highly creative ideas whose risks are substantial, but whose economic rewards in case of success might be considerable.

Most firms use rather simple methods of idea evaluation, often tailored to their own needs. For instance, many use "selection grids" which comprise a set of criteria such as level of financing needed, compatibility with current production process and/or distribution system, etc. Each product idea is assessed against each criterion on a five or seven point scale, representing the degree with which the underlying criterion is satisfied. Individual scores are then aggregated to provide a single measure of the "potential" of each idea.

Models used usually vary from one company to another. The most common approach uses a *compensatory model* that leads to an index obtained by averaging, or computing the weighted average, of the individual scores of each idea.

Other firms rely on the use of a *conjunctive model* that identifies those ideas that satisfy the minimum, and/or maximum requirements that are set "a priori" on each criteria. Others, still use a *lexicographic approach*, based on an ordering of the criteria as well as an ordering of the ideas along each of them, taken in decreasing order of importance, until all ideas have been ordered.

By far the most common method is the compensatory one. It is also in many respects the weakest as it might lead to the selection of ideas that present serious weaknesses on some of the criteria. As depicted in **Exhibit 1**, the use of these three methods may lead to substantial differences in terms of the ideas which an finally retained for further development.

Aside from the "undeterminacy" of the method that should be used at this level, common approaches of product idea evaluation fall short on some important matters. First, they are "heavy" to use. Typically, they do not provide any simple scheme to interactively evaluate and/or review the evaluation of past product ideas. Second, they do not address group issues nor do they include uncertainty in the evaluation process. Finally, they do not consider the complementarity which exists between the three models discussed above. For instance a compensatory or lexicographic evaluation is perfectly justifiable, but after a first selection of acceptable ideas has been made with a conjunctive model.

3. NEW PRODUCT IDEAS FROM MICRO-COMPUTER ASSISTED CREATIVE SESSIONS

Recently, a new micro-computer software was developed (Choffray 1984). It provides a dynamic environment to monitor group creative sessions as well as to evaluate interactively new product ideas.

This system is part of a new approach to help firms manage their creative process. It is aimed at producing a set of conditions which foster creativity in groups. It is based on the principle of multiple creative sessions

Evaluation criteria	Individual Scores of Ideas (1 = mediocre) (3 = average) (5 = excellent)				
	Idea 1	Idea 2	Idea 3	Idea 4	Idea 5
C1: Short-run market potential	4	3	4	1	4
C2: Long-run market potential	1	2	4	5	4
C3: Compatibility with current production process	3	4	2	3	1
C4: Likely return on investment	2	4	5	3	1

Relative importance of criteria	Compensatory evaluation				
C1 = 0,40 C2 = 0,10 C3 = 0,30 C4 = 0,20	Idea 1	Idea 2	Idea 3	Idea 4	Idea 5
	3,0	3,4	3,6	2,4	3,1

Minimum requirements (thresholds)	Conjonctive evaluation				
C1 = 3 C2 = 2 C3 = 3 C4 = 2	Idea 1	Idea 2	Idea 3	Idea 4	Idea 5
	unacceptable (C2)	acceptable	unacceptable (C3)	unacceptable (C1)	unacceptable (C4)

Ordering of criterion	Lexicographic evaluation				
C1 = 1 C2 = 4 C3 = 2 C4 = 3	Idea 1	Idea 2	Idea 3	Idea 4	Idea 5
	1	4	3	5	2

Exhibit 1 : Comparison of three common methods of product idea evaluation ... which lead to different evaluation-choice.

which cross-fertilize each other via the computer.

The competitive nature of the creative environment provided by this new system, the possibilities it offers in terms of conditioning and cross-fertilization, as well as the interactive evaluation procedure it provides, may help firms better use their own creative resources.

Generally speaking, this new approach provides an environment to :

- generate new product ideas,
- manage, update, improve portfolios of ideas and concepts,
- evaluate systematically available ideas.

Each of these three goals corresponds to a specific module of the system (see **Exhibit 2**)

3.1. Creation module : generation of innovative ideas

In order to use this module most efficiently, the firm is assumed to have already defined the general nature of the creative problem it is faced with. Methods such as those discussed earlier may be used here, particularly matrix methods, such as morphological analysis, which allow specification of the boundaries of the creative domain. Analytical hierarchy methods (Wind and Saaty (1980), Choffray and Wagner (1983)) may also be used to subjectively set development priorities.

From a practical standpoint the generation of innovative ideas is made by n groups of people, competing with each other. Each group consists of 4 to 5 persons, chosen along much the same criteria as in a standard

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                    CREACTIVATOR

        CREATIVITY MANAGEMENT SYSTEM

MAIN MENU

        <1> "CREATION" MODULE

        <2> "EDITION" MODULE

        <3> "EVALUATION" MODULE

        <4> TERMINATE SESSION

YOUR CHOICE: 1

CORRECT <Y,N>? Y

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Exhibit 2 : The System's Main Menu

brainstorming session. Each group is given the same creative assignment during a briefing that follows the preliminary analysis. At the end of a session, each group is informed about its productivity. The measure used is a function of the number of ideas generated, but also of the intensity of the conditioning that was needed. It provides an objective criterion to attribute a reward to the most productive group.

The creation module comprises two distinct phases :

. *Phase 1 : Divergence*

During the first session of idea generation, which takes about fourty minutes, participants in each of the competing groups generate ideas that are keyed-in the computer via a pseudo word-processor. A member of the group may be given that responsibility. In general, however, it is useful that this person remains independent.

This is the step where the first feature of this new approach appears. While ideas are being introduced into the computer, it reacts and feeds back to the creative group product ideas which are drawn randomly from a bank of *creative seeds* (see **Exhibit 3**).

Both the frequency of the conditioning process as well as the specific bank from which creative seeds are drawn, may be changed at any time by the moderator. This allows him to closely follow the progression observed within each creative group and speed-up idea generation when needed. At any time, participants can also ask for an idea by keying-in "$ID".

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CREACTIVATOR

LET ME GIVE YOU A GOOD IDEA...!

Nail-clipper for five fingers at a
time.

<RTN> TO CONTINUE

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Exhibit 3 : Generation of a Product Idea by the Computer

In reality, these "creative seeds" or "stretching ideas" are the result of prior creative work. Today several such bank have been developed by us to meet the specific needs of different industrial sectors. They are the result of an international effort aimed at scanning the technological environment as well as market trends for the activities under study. Paris-based consulting firm Novaction Co and I.D.S.I. are currently developing banks of creative seeds covering consumer goods and industrial sectors respectively. They include ideas such as "Inflatable concrete", Felt-pens diagnosing spelling mistakes", "Nutritious gas", etc...

The length of this first phase is usually between 30 and 45 minutes, depending on the complexity of the creative problem at hand. The productivity index takes into account the number of ideas generated, the number of seeds provided automatically by the computer as a result of the chosen conditioning scheme, and the number of creative seeds requested by the participants. The latter affects the productivity index negatively as shown in **Exhibit 4.**

The general objective of this first phase is to "warm-up" participants and to broaden their domain of reflection to include innovative ideas coming from other problem-solution sets. Maximum divergence is the target and the bank of creative seeds as well as the frequency of the conditioning process are the tools at hand to achieve it.

CREACTIVATOR

SUMMARY OF THE CREATIVE SESSION

CHOFFRAY'S IDEA FILE

NUMBER OF IDEAS GENERATED...: 77

NUMBER OF "CREATIVE SEEDS"
- COMPUTER GENERATED.....: 13
- AT PARTICIPANTS REQUEST.: 7

DENSITY OF IDEA GENERATION..: 5.38

<RNT> TO CONTINUE

Exhibit 4 : Summary of a Creative Session

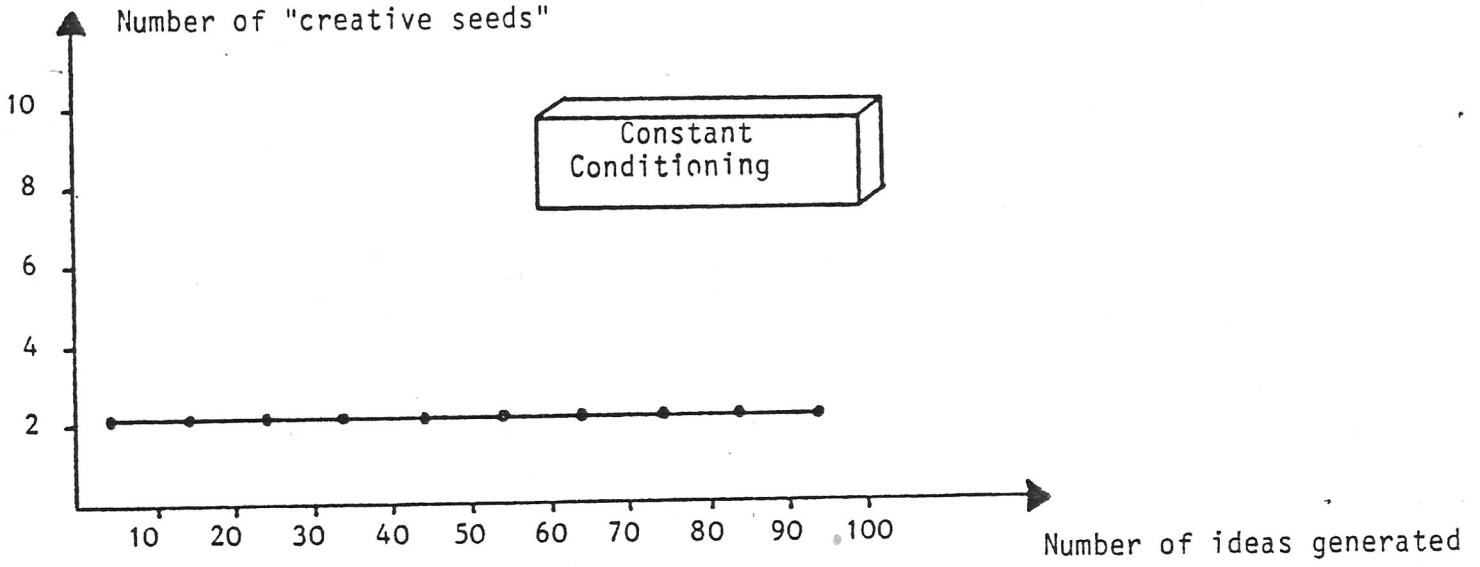
. *Phase 2 : Convergence*

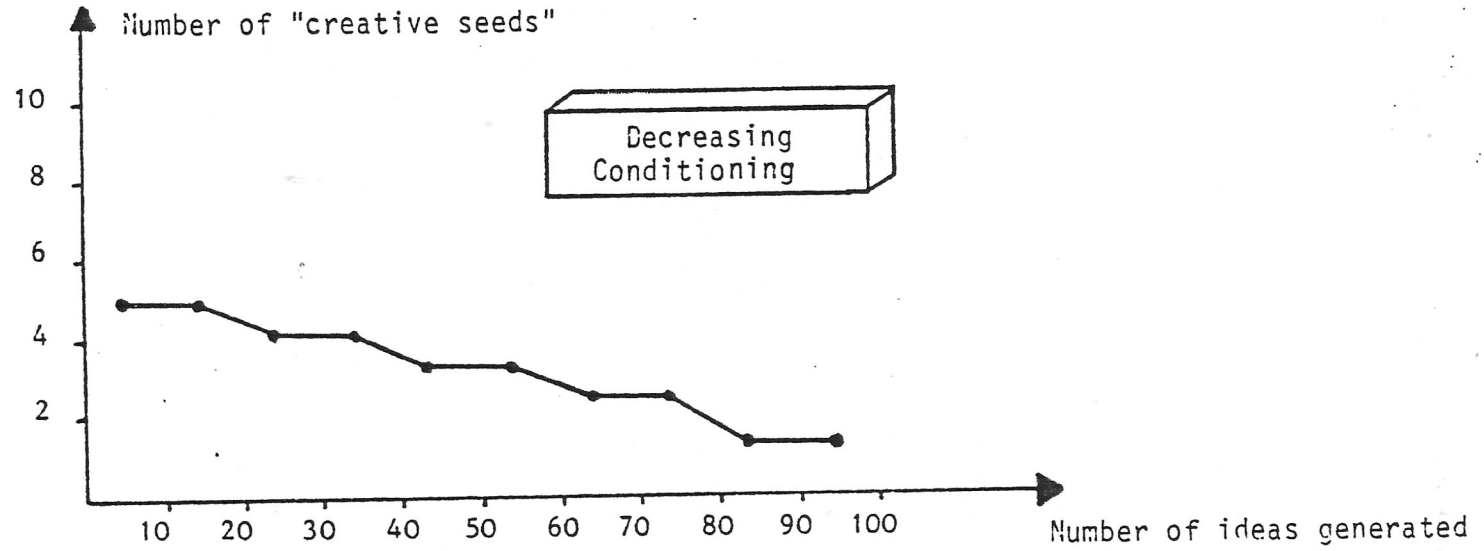
During the second phase, diskettes are inter-changed. Automatically the system re-initializes and cross-fertilize groups by sending creative ideas to each of them, drawn randomly from the idea file created in phase 1 by a competing group.

Once again, the selection of the conditioning file, as well as the frequency of the conditioning process is left open to the moderator. In practice, it is function of the ease with which each group progresses towards its goals. **Exhibit 5** depicts some possible conditioning strategies.

Hence, after having favored divergent creative thinking in Phase 1, our approach aims at homogenizing the creative domain by forcing "common ideas" into competing groups. This second phase is often longer (around an hour for one hundred ideas) as this time, productivity is not negatively affected by the request for ideas from the participants. An index of productivity is also provided by the system to facilitate the evaluation of each group's work.

Both during Phase 1 and 2, the system automatically saves the ideas on diskettes. This allows firms to keep a magnetic "trace" of the work done during the creative sessions. It is also the first step towards the development of a dynamic product idea generation environment as discussed earlier.





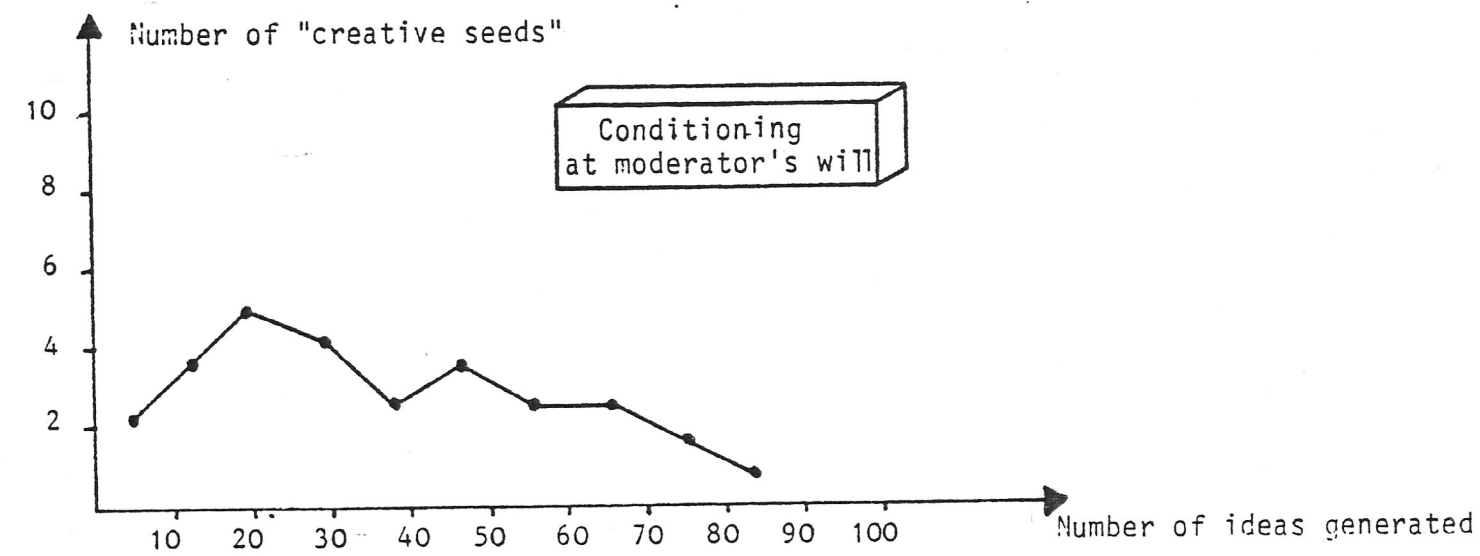


Exhibit 5 : Some possible conditioning schemes

These files will be used mainly for three different purposes ; conditioning of future creative sessions within the same firm, up-dating and editing of the firm's portfolio of new product ideas, and, finally, evaluation. **Exhibit 6** summarizes the general structure of the idea generation module in both phases.

3.2. Editing Module : Updating a bank of innovative ideas

The adoption by a firm of a truly innovative strategy implies the existence of a continuous flow of new product ideas. Therefore, it is essential to be able to update, adapt and modify the ideas that are currently in the portfolio, a task handled by the second module of system.

At this level, the software provides a complete range of editing capabilities, available through a pseudo word-processor, allowing the user to further specify the product ideas that were stored previously or during another creative session. Ideas can be added or deleted at will. Files may be combined and listed either on the screen or on the printer.

The mere existence of these files provides an additional incentive for the firm to be creative and innovative. The feeling of guilt that arise from the lack of use of this strategic reserve of new product ideas is in itself a key result of this new approach. Decision-makers, faced with their responsibilities, have to constantly ask themselves :

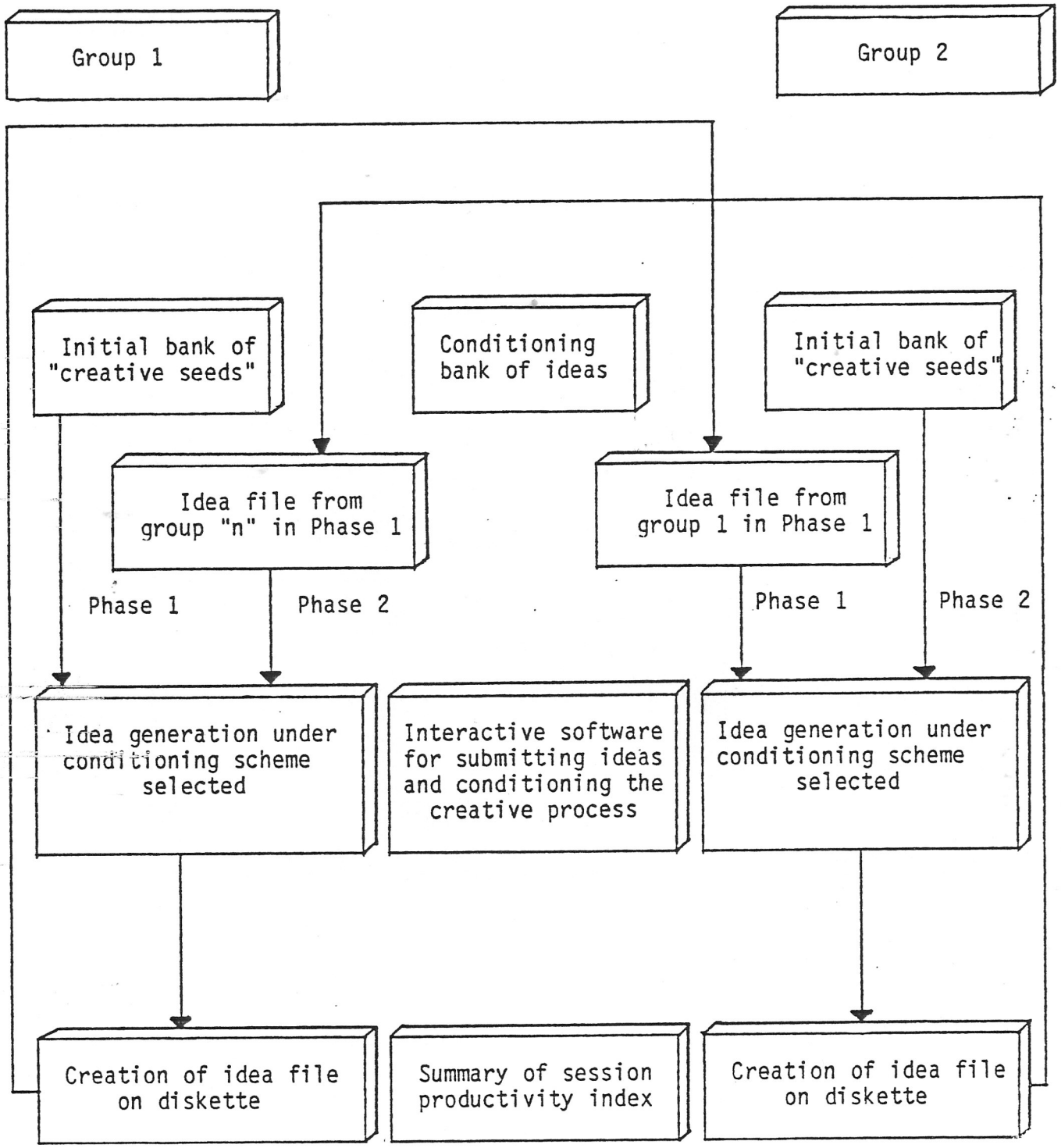


Exhibit 6 : General structure of the idea generation module

. how to improve, in the future, the generation of new product ideas ?
. how to make better use of the firm's past experience in this area ?
. when to rely on external sources of new product ideas ?
. are the firm's growth objectives viable when placed in parallel with its creative track record and potential ?

This recognition of the incidence of these questions on the firm's future is of the highest importance in the definition of its strategy. It's a clear consequence from using a formal approach of management of the creative process, as discussed here.

3.3. Evaluation module : assessing the potentiel of innovative ideas

The third module of the system is concerned with evaluating product ideas, previously stored on a diskette. This module can be invoked at any time, immediatly after a creative session, or later, with past idea files.

Again, the system offers a highly personalized environment. It provides a fast, and reliable way to get new product ideas evaluations. The development of this module was inspired by the two following objectives :

. provide a way to aggregate the individual evaluations of several persons and,
. measure the degree of uncertainty affecting the "potential" of each product idea.

In order to meet these two requirements, the evaluation procedure built into the software comprises two phases.

. *Phase 1 : Conjunctive evaluation*

During Phase 1 of the evaluation process, each person on the "evaluation committee" is invited to indicate whether each idea should be retained for further evaluation or not. This decision is personal and collected independently from the other members of the committee. The set of thresholds, corresponding to the constraints of the company, is common to all and provided beforehand.

This phase is interactive and is usually performed in a very limited amount of time (see **Exhibit 7**). Ideas from the chosen file are interactively selected and evaluated until the final number kept is less than a given maximum. This maximum may vary according to the development objectives and constraints of the firm. In practice we have often used the number twenty.

Once all individual evaluations are collected, they are aggregated. Only those ideas which have been selected at least once as acceptable are kept in a separate file for futher evaluation.

. *Phase 2 : Probabilistic evaluation*

Acceptable ideas can be used as input to a group evaluation aimed at subjectively estimating the three following parameters,

CREACTIVATOR

PERSONAL EVALUATION OF J.M. CHOFFRAY

IDEA NO 27

Movement sensitive pen performing a diagnosis of spelling mistakes.

<X> TO KEEP <X> TO REJECT

Exhibit 7 : Conjunctive Evaluation of Ideas

defined over the planning horizon of the firm :

P : the likelihood that the new idea might lead to a marketable product or service,

M : the size of the potential market in case of commercialization,

C : the total cost of development and commercialization of the product.

The procedure used to subjectively fit a distribution of uncertainty around the expected value of each of these parameters is the method of fractiles. A beta distribution is assumed for P while M and C are assumed to be log-normally distributed. Based on the confidence interval provided the firm, a measure of potential may be obtained for each idea.

Once performed, this evaluation may be used to list acceptable ideas in decreasing order of expected return or in increasing order of risk. The final decision as to which of these two criteria should be finally used is left to the firm.

4. ORGANIZING MICRO-COMPUTER ASSISTED, CREATIVE SESSIONS

Over the last twelve months this new approach has been implemented a number of times to assist companies in the management of their creative process. It has also been used in several management development programs held at ISSEC* in Paris.

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* ISSEC stands for Institut Supérieur des Sciences Economiques et Commerciales.

By and large, the results observed so far are encouraging, although it is too early to conclude at the existence of a definite increase in productivity and quality of the idea generation. Results as of today, however, indicates that it might well be the case.

We summarize in **Exhibit 8** the results of a test performed with ten creative groups, half of which used the new approach. Participants were selected randomly from the same executive development programs and matched according to age and role-responsabilities in their respective firms. All groups were given the same creative task and had 45 minutes to generate innovative ideas. One person was in charge of writing them down, so that groups were completely "free". Finally, an evaluation was performed by an "independent" committee.

Based on that experiment, use of the system does not appear to significantly affect the total number of ideas generated. Creative conditioning may even slow down the idea generation. The "overall" quality of the creative production, however, seems to be considerably better. More ideas are "acceptable" and their mean score, obtained through a compensatory evaluation scheme, is higher.

These results notwithstanding our experience with micro-computer assisted creative sessions, indicates the existence of some other interesting "side-effects".

> *Emulation* : The use of several creative groups competing with each other, associated with an objective measure of productivity, favors emulation. The reliance on micro-computers to collect, save innovative ideas, and react creatively, is also well accepted and adds to ... the fun !

	Standard Brainstorming	Micro-Computer Assisted Creative Session
Average Number of Ideas Generated	110	97
Average Number of "Acceptable" Ideas	33	48
Mean Score of "Acceptable" Ideas (7 = maximum)	3.7	4.6

Exhibit 8 : Comparison of Standard Brainstorming with Micro-Computer Assisted Creative Sessions

Creative conditionning : the seeding of the creative process with "stretching ideas" in Phase 1 favors divergent thinking. The use of an idea file generated by a competing group in Phase 2 tends to homogenize the creative domain which is covered during a session.

Supervision : the moderator's total freedom in terms of choice of the conditioning file as well as in terms of the frequency of the seeding process, allows a careful management of each group's idea generation.

Editing : the many possibilities offered by the software to edit, adapt and modify ideas at any time, free participants from the guilt of submitting "partial" wording of ideas as they work. The safeguard on diskettes, automatically performed by the system, leads to more concentration of the participants on the creative problem at hand.

Evaluation : the use of a completely interactive evaluation system, leading to the selection of an "acceptable" subset of ideas and to a subjective estimate of their potential along with the "uncertainty" that surrounds it, allows adequate filtering of the creative production. This procedure also favors continuity of the creative effort as well as the constitution of a "solid" portfolio of innovative ideas.

Management of the creative process : typically, firms do not lack ideas, but they do loose them. Use of micro-computers may help avoid this loss in the future. Not only are the ideas safely

stored on diskettes, but the availability of a powerful editor, allows a firm to manage dynamically its portfolio of innovative ideas.

In the case of the three firms where the system was used recently, reactions were quite positive. In less than a day, it helped develop a "strategic reserve" of ideas comprising more than two hundred new product/service concepts.

5. DISCUSSION

The last ten years have seen the development of a number of decision support systems for managing new products at different stages in their development (Lilien and Kotler 1983). These systems have proven to be reliable and valid in areas such as product concept evaluation, test marketing simulation, and product growth monitoring. They all stress the necessity for a firm to adopt a truly innovative strategy, that is, a strategy that rests on a continuous flow of new products at the different stages of the development process.

Adoption of such a strategy, however, requires the existence of a portfolio of innovative ideas. This "strategic reserve" of products and concepts must be managed dynamically over time in an attempt to meet the needs of the firm in terms of future sales growth and return on investment.

This first step of "idea generation and evaluation" seems to have been largely neglected in the marketing literature.

In this paper, we review methods commonly used by firms to generate new product ideas. We discuss a new approach, which makes use of micro-computers to organize the creative process within organizations. The system is based on the principle of multiple parallel creative sessions that are competing with each other. Micro-computers are used to collect ideas, condition the creative process with "creative seeds", cross-fertilize competing groups, create idea files on diskettes, edit and update these files, and finally interactively evaluate available ideas.

Use of the system so far is encouraging, although evidence of its impact on the productivity and quality of idea generation is still limited. More research is clearly needed. Notwithstanding these limitations, this new approach should be seen as a first, but definite step, in the development of computer-assisted environments for creativity enhancement and management.

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