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https://doi.org/10.15017/3000368

出版情報：経済論究. 121, pp.99-112, 2005-03-31. 九州大学大学院経済学会
バージョン：
権利関係：

# Four Key Barriers to Innovation Management

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## Abstract

Four primary barriers to Innovation Management (IM) inhibit organizations from creating optimized procedures for the IM process itself, and from achieving optimal results for new projects and activities that IM procedures create. The IM barriers are: (1) mixing project and proposal management, (2) insufficient IM specialization, (3) feasibility evaluation process uncertainty, and (3) insufficient IM efficiency. This paper presents an integrated sequence of management solutions to overcome all four barriers, and in so doing, defines a broadly applicable framework for continuous improvement of IM performance.

## Introduction

The desire to create a successful Innovation Management (IM) process is as common as the realization that new business proposal uncertainty and resource limitations present significant barriers to attaining this goal (Scott, 2001). Uncertainty limits the ability of decision makers to make justified new investment decisions (Galbraith, 1973), while resource limitations restrict the scope and scale of uncertainty-reducing activities (Cooper, 2001). The generally recognized need for innovation productivity safely assumes continuously improving IM is a broadly desired goal of nearly all organizations, regardless of scale, scope, or industrial focus (Drucker, 1985).

Creation of great ideas that easily overcome practical management issues such as initial recognition, evaluation resource limitations, and investment decision uncertainty are rare (Bordley, 1988) to the extent that creation of incrementally improving IM procedures, and not idea creation itself, has become a primary focus of attempts to improve innovation performance. The lack of a comprehensive and easy-to-use IM solution resulting from the application of strategic (Crawford, 1980), financial (Boer, 2002), knowledge (Parikh, 2001), and project management (Smith, Merrit, 2001) methodologies further highlights the need for a clearly defined, universally applicable, and practical method to improve innovation performance (Chesbrough, 2003).

This paper introduces four key barriers to IM productivity and develops a structurally coherent and cumulatively valid framework to sequentially resolve all four issues. The order of consider-

ation of IM issues is important because any practical IM solution must first address the fundamental IM issues of management resource shortages and new proposal uncertainty management before proposing a detailed IM procedural solution. This is because the largest IM issue is not the lack of sophisticated theory to address IM complexity, but the more practical issue of helping organizations to stop ignoring IM entirely.

## 1. Mixing of Project and Proposal Management

Consider how organizations manage the uncertainty of new project proposals and strategically important projects. Typically, teams of the well-qualified people methodically manage the uncertainty of strategically important projects and new project proposals with the full awareness and financial support of senior management (Eisenhardt, 1999). In contrast, perceptibly uncertain new proposals or strategically unimportant projects receive minimal attention (Tritle et al, 200) unless sponsored by someone with the authority to influence investment decisions (Thomas, 1993).

The concept of prioritizing strategic project management while ignoring or downgrading the treatment of unimportant projects and uncertain proposals appears to be a reasonable strategy for resource allocation. The problem is that prioritization frequently means entirely ignoring uncertain proposals as a valuable source of innovative ideas. In this way, the seemingly logical activity of investing in certain project management before uncertain proposals creates a management environment that perpetually under-invests in innovative potential (Christensen, 1997).

The prioritization of IM activities in an unaccountable environment is problematic due to organizational behavior issues such as office politics (Carbral-Cardoso, 1996) or bargaining (Galbraith, 1973). The need to make project investment decisions based upon incomplete, non-strategic, or biased perceptions of proposal value is the result of IM resource limitations. An effective IM process helps organizations strategically manage all new proposal creation activities as a single financially justified project (Khurana, Rosenthal, 1998) that is immune to undesired organizational influences.

Strategic investment is an effective management tool because it helps managers separate the uncertainty of specific functional considerations and pure financial analysis from an overall justification for project investment (Roussel et al, 1991). The holistic nature of strategic thinking provides the clarity of purpose and investment justification that many early-stage or uncertain project proposals require to reach their full potential. IM is a tool that managers use to help process proposals and projects that exhibit any significant difference between strategic and financial investment justification.

The top management of most organizations is typically aware of the investment rational for

strategic projects (Adler, 1992). There is little that an IM process can offer to help organizations improve the management of high profile and strategically certain projects because such projects are already the focus of significant management attention and resources. The pursuit of financial investment justification for highly visible, strategic projects is typically the responsibility of well-qualified and supported cross-functional teams (Christensen, 1997).

In contrast to highly visible, strategically certain projects, senior management focus on strategically uncertain proposals is a counter-intuitive concept (Daellenbach et al, 1999). Few senior managers possess the time, desire, or financial justification to manage investment in uncertain proposal investigation to the same degree of detail as highly visible strategic projects. The resulting exclusive focus on financially and strategically certain projects at the expense of uncertain proposals investigation creates a resource-limited and innovation-unfriendly management environment (Gold, 1988).

An IM process must therefore overcome any structural bias against innovation created in the name of strategic and financial prioritization. One IM methodology capable of achieving this goal is creation of a dedicated team to manage the uncertainty of new proposal investigation and project creation (Drucker, 1985). Such an IM team would justify its existence from the financial value of strategic projects it helps to identify and create. A key IM objective is therefore the creation of an environment where the collective value of new idea investigation receives resources on par with other projects of similar strategic and financial value.

An IM team requires senior management guidance to clarify the desirability of uncertain proposals from a well-informed strategic perspective (Levitt, 1963). Senior management support also encourages evaluation process accountability and consistency (Samuel, 2001). Additionally, an IM team requires the services of subject-area-experts to help determine the desirability of new ideas from multiple evaluation perspectives (Linstone, 1999). Lastly, an IM team must have a minimum level of project management resources to organize, document, and potentially commercialize under-utilized innovative potential.

An IM team clarifies overall IM responsibilities by eliminating the need for an organization's employees to non-optimally allocate their time between strategically or financially certain projects and uncertain proposals. Accordingly, a dedicated IM team is the recommended solution to the first barrier to IM, which is the loss of innovative focus due to inequitable resource competition between certain projects and uncertain proposals. The IM team resolves this issue by providing all new proposals with sufficient evaluation to assure the processing of as many potentially valuable ideas as possible.

## 2. Insufficient IM Specialization

The theoretical benefits of strategically managing uncertain proposals with a dedicated IM team can quickly become a resource bottleneck when qualified managers have insufficient time to participate in the decision processes that create strategic investment priorities. Investment patterns for New Product Development (NPD) imply that senior management cannot spend more than a few percent of their time conducting IM activities (Cooper, 2001). This significant resource limitation directly conflicts with the well-established IM need for strategic guidance from senior management.

The simplest solution to the senior management resource problem is to delegate the responsibility for IM to subordinates. This requires careful consideration of the qualifications of subordinates and understanding of other potential issues that delegation may create (Galbraith, 1973). The use of cross-functional teams of subject area experts is a popular suggestion in the literature (Cooper, 2001), although the resource requirements of cross-functional teams can exceed those of skilled senior managers. The call for cross-functional teams to address IM problems does not address fundamental resource limitation issues because both senior management and cross -functional teams are valuable and scarce resources. It is natural that the allocation of such valuable human resources will naturally gravitate towards strategically certain project management instead of uncertain proposal investigation.

An effective solution to the senior management resource problem must support continued separation of uncertain project and proposal management, as well as provide real efficiency advantages compared to senior management or cross-functional team methodologies. One classical design strategy is the use of sub-task specialization and a hierarchical organizational structure to achieve effectiveness and increased efficiency. Hierarchical structures are not optimal for uncertain project management due to inflexibility (Adler et al, 1992). However, the separation of IM project and proposal management enables the application of a hierarchical structure to the organizationally less complicated task of proposal management.

Design of a hierarchical structure for uncertain proposal investigation and strategic investment requires identification of the functions that can be delegated by senior management. Fortunately, the processing of uncertain proposals is a relatively simple compared to uncertain project management. This is because uncertain project management, especially in the case of New Product Development (Cooper, 2001), must optimize project team organization and justify increased investment as a project passes through the key milestones between initial concept and final product launch.

The highest level of identifiable functionality for uncertain proposal management involves the tasks of new proposal capture, evaluation, and investment (Abell, 1980). The direct management

of superior idea creation is a desirable but elusive activity (Leonard, Straus, 1977) that appears all but impossible except in an analogical manner (Dahl, Moreau, 2002). For this reason, New Product Development processes focus primarily on the capture of new proposals rather than the cognitive processes of new idea creation (Cooper, 2001).

The function of proposal idea capture is a project management activity that requires experience and the development of tools such as an interactive database. Proposal capture does not require specialized knowledge for feasibility evaluation or strategic investment decisions. For this reason it is possible to group proposal idea capture with the many other project management activities required to process uncertain ideas. *Process Control* is the function that conducts all project management activities for uncertain proposals. The term Process Control avoids confusion with project management of uncertain projects. Process Control increases IM productivity by assuring consistency, accountability, and the maximum possible amount of process automation for proposal-processing activities.

The requirement for proposal evaluation by subject-area-experts originates from the senior manager requirement for knowledge to support informed investment decisions (Linstone, 1999). *Feasibility Evaluation* is the IM function that evaluates uncertain proposals, and *Investment Management* is the function that manages strategic investment decisions. The value added contribution of Feasibility Evaluation comes from the collection and presentation to Investment Management of feasibility knowledge about uncertain proposals. The challenge of Feasibility Evaluation is to comprehensively collect feasibility evaluation knowledge in as efficient a manner as possible.

Process Control is a labor-intensive function that increases in effectiveness proportional to the quality and quantity of labor invested. Feasibility Evaluation and Investment Management are knowledge-intensive functions that increase in effectiveness proportional to the quality of participant knowledge. For example, a Feasibility Evaluation expert may significantly contribute to the effectiveness of an evaluation activity in a matter of seconds while Process Control may require hours to format evaluation data for efficient Investment Management review.

The specialization of proposal processing functions into Process Control, Feasibility Evaluation, and Investment Management requires each function to rely on the effectiveness the other two functions to assure overall IM functionality. If any of the three functions fails to perform its duties the process as a whole will cease to function. Such transparency and mutual dependence forces corrective action in response to non-optimal performance. The resulting correction of problems by the specialists who perform each function is preferable to any function attempting to perform more than one IM activity.

Assuring that no IM participant fulfills the roles of two proposal-processing functions simultaneously is a simple way to enforce specialization of IM functions. Separation of proposal

processing functions also helps achieve optimal overall IM results by assuring that only the best-qualified participants perform each activity and rapid identification of resource limitation problems. Functional separation also eases the task of accountability tracking by assuring that each participant is only responsible for a single aspect of uncertain proposal processing.

Functional IM specialization provides a natural extension to the separation of proposal and project processing activities. Project management is a team activity while proposal processing is a hierarchically structured activity with Process Control and Feasibility Evaluation reporting to Investment Management. The hierarchical structure for proposal processing is optimal because of the differences in objectives and personal resources of potential participants and because of the simplicity of proposal processing compared to uncertain project management.

## 3. Feasibility Evaluation Process Uncertainty

Creating a practical, effective, and efficient methodology for the Feasibility Evaluation function that operates smoothly within the hierarchical structure for proposal processing is another major barrier to IM. The origin of the evaluation problem is the incorrect belief that the uncertainty of new ideas is undesirable. The linguistic linkage between uncertainty and undesirability is unfortunate because in the IM context uncertainty is neither a positive nor a negative indication of value. Uncertainty is simply a lack of knowledge to access the strategic value of a proposal. Clarification of the definition of uncertainty and its influence on IM are critical for effective Feasibility Evaluation.

Strategic investment management assures that not all new investment opportunities require advanced proof of a desirable return on investment. Strategic investment managers take into account a wider range of considerations than certain return-on-investment justification, and in this manner help organizations to manage the period of time when the return on investment of new projects or proposals is uncertain. The IM issue of concern is determination of the Feasibility Evaluation data and presentation format required by Investment Management to make the best possible strategic investment decisions.

Feasibility Evaluation data can exhibit both qualitative and quantitative characteristics. Quantitative evaluation implies the existence of an efficient (automated) process to determine strategic investment justification. Unfortunately, an automated and well-accepted process for strategic investment management does not exist in the IM context. Detailed qualitative evaluation implies the use of comprehensive and free-format descriptions of proposal feasibility. Qualitative evaluation is vulnerable to the variability of evaluation knowledge, the ability to evaluation participants to efficiently express their knowledge, and the ability to easily compare the evaluation results of alternative proposals.

What is therefore required to remove the Feasibility Evaluation process barrier is a process that optimally uses the best characteristics of quantitative and qualitative evaluation. The solution starts with a working definition of feasibility together with a feasibility scoring process that manages uncertainty in an unbiased manner. Figure 1 defines proposal feasibility as a two dimensional combination of desirability on the vertical axis, and uncertainty in the justification of desirability on the horizontal axis. The primary relationship between desirability and uncertainty is a decreased ability to differentiate levels of desirability as uncertainty increases.

The three extreme states of proposal feasibility show in Figure 1 correspond to "good desirability", "bad desirability", and "unknown desirability" and are assigned the scores of 5, 0, and 2, respectively. The three intermediate states are "known marginal," "positive uncertain indication," and "negative uncertain indication," which have feasibility scores of 4, 3, and 1, respectively. After Feasibility Evaluation participants select the appropriate score to reflect a proposal's feasibility, they provide a qualitative justification for their score and suggestions to improve feasibility from their evaluation perspective.

The scoring system shown in Figure 1 and the follow-on qualitative justification of scoring results provides Investment Management with an efficient summary of feasibility and detailed justification data on an as-needed basis. Score data is useful to justify obvious investment decisions, while detailed qualitative data is useful to support difficult decisions. For example, a feasibility score of "zero" means a proposal is not worthy of investment for known reasons. In such a case, Investment Management may accept the zero feasibility opinion of Feasibility Evaluation without the need to reference qualitative justifications.

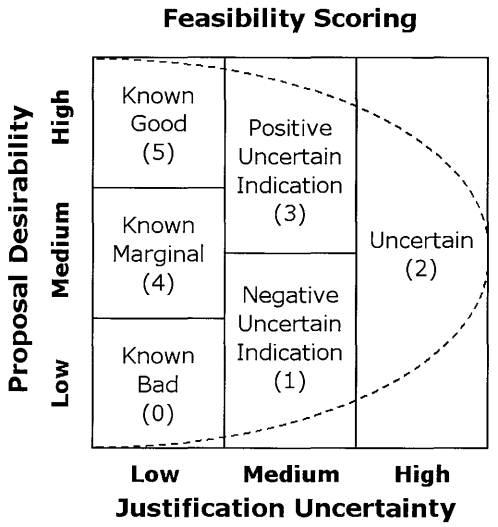


Figure 1 : Feasibility Evaluation Scoring

To make the Feasibility Evaluation function more effective, it is desirable to define evaluation topics that facilitate independent and alternative perspectives of proposal feasibility. The number of evaluation topics should be minimized to avoid confusion or the need to process scoring results before presentation to Investment Management. The use of raw score data for a small number of evaluation topics has the advantages of process transparency (who evaluated what proposal when), no loss of information from combining scores, and a maintenance of the direct linkage between scores and qualitative justifications.

Feasibility topics should be as unrelated as possible to promote independent perspectives. Additionally feasibility topics should collectively describe proposal feasibility in a comprehensive manner without the need to concentrate excessive Feasibility Evaluation information in any single topic. The five proposed feasibility topics for proposal processing that fulfill the above criteria for independence, descriptiveness, simplicity, and categorization equality are *Financial Value, Competitiveness Impact, Technology Control, Commercial Delivery, and Manufacturing Creation.*

Financial Value describes proposal return on investment and is a mandatory feasibility consideration for organizations concerned with profit and budgetary constraints. Return-on-investment calculations are particularly difficult to realize for uncertain new project proposals because cost and eventual return information is commonly unknown. At a minimum, the value of Financial Value feasibility comes from the qualitative description of what is unknown about a proposal, as much as what is known.

Competitiveness Impact is a broader measurement of proposal feasibility that considers aspects of proposal value not described fully by narrowly defined return-on-investment calculations. Examples are the secondary effects of proposal investment on other projects, legal constraints, or the influence an investment may have on the reputation of an organization. Financial Value and Competitiveness Impact attempt to express an overall determination of proposal value that could result in a justified investment decision.

Technology Control describes the ability of an organization to manage the technology associated with a proposal independent of financial, commercial, or infrastructure considerations. Manufacturing Creation describes internal oriented feasibility, such as purchasing or production, while Commercial Delivery describes external oriented feasibility considerations, such as marketing or sales.

Technology Control, Commercial Delivery, and Manufacturing Creation purposefully describe only a selected portion of proposal feasibility from a focused and independent perspective. To enhance the effectiveness of Technology Control, Commercial Delivery, and Manufacturing Creation it can be desirable to separate each topic into evaluation subcategories, which are *Hardware, Software, Human Resources, and Knowledge.* When needed, these subcategories

provide Investment Management with a more detailed description of proposal feasibility.

The five Feasibility Evaluation topics described above provide a simple framework to categorize, score, and explain the desirability and uncertainty of new proposals. This is archived from the perspective of team leaders of subject-area-experts who individually evaluate proposals before expanding the thoroughness of evaluation activities on an as-needed basis. Initial evaluation by team leaders provides an overview of proposal feasibility to assure Investment Management may efficiently make simple investment decisions. Thorough evaluation follow up provides the feasibility evaluation detail to support the effectiveness of difficult Investment Management decisions.

## 4. Insufficient IM Efficiency

Organizations that successfully separate proposal and project management, implement specialization for Process Control, Feasibility Evaluation, and Investment Management, and effectively use Feasibility Evaluation topics and scoring procedures may still experience IM difficulties because of low process efficiency. The much larger number of potential ideas an organization may consider compared to the number of projects the same organization can invest in requires an IM process with significant proposal processing capacity. Additionally, the unexpected nature of idea creation requires the flexibility to respond to variations in proposal number as well as quality.

It is critical that efforts to secure IM efficiency do not negatively influence IM effectiveness. Specialization of IM functions and Feasibility Evaluation are the keys to achieving this difficult objective. The first efficiency enhancing strategy for IM is the use of screening for new proposals. Screening refers to Process Control's use of historical data to remove redundant proposals from consideration. Screening eliminates unnecessary Feasibility Evaluation or Investment Management effort and is a Process Control function because it requires automation of historical data retrieval while not requiring specialized knowledge for evaluation or investment decision-making.

The removal of redundant proposals from consideration increases the capacity of Feasibility Evaluation and Investment Management to consider new proposals without the requirement for additional IM investment. This makes screening the potentially most important IM activity for efficiency enhancement. To assure that screening does not negatively influence IM effectiveness, Investment Management should verify that all Process Control screening decisions align with an organization's current strategic investment priorities.

Proposals that are novel enough to pass through screening and thereby warrant Feasibility Evaluation should receive cursory evaluation from each evaluation perspective and Investment

Management review before proceeding to in-depth Feasibility Evaluation. A cursory evaluation helps identify obvious feasibility issues that may disqualify a proposal for further investigation without the requirement for potentially expensive evaluation activities. A cursory evaluation process also helps Investment Management identify areas of key strategic concern interest that Feasibility Evaluation teams may focus upon.

The frequency of Investment Management review of Feasibility Evaluation results is an IM implementation consideration that balances the need for Feasibility Evaluation feedback with the need for Investment Management to minimize IM investment. Organizations should conduct Investment Management meetings as frequently as is convenient for senior managers and attempt to balance the burden of IM evaluation support between the two IM functions in an equitable and financially optimal way.

The automation of Investment Management requires careful consideration of the type of decisions that are required during periodic review of Process Control and Feasibility Evaluation results. One suggested methodology is for Process Control to arrange the Investment Management agenda for review of Process Control and Feasibility Evaluation data in the following sequence: (1) screening decisions and urgent proposals, (2) seemingly obvious investment (or non-investment) decisions, (3) non-obvious decisions, and (4) consideration of procedural adjustments to improve IM performance.

The Investment Management sequence above assures completion of crucial screening and time-critical issues before investment management of proposals. Processing relatively obvious proposal investment decisions before difficult (and potentially more interesting) decisions assures continuing differentiation between the IM proposal processing and project management activities. Consideration of process adjustments after Investment Management of proposals assures consideration of the most recent proposal processing observations.

Screening, Feasibility Evaluation sequencing, and optimizing the agenda for Investment Management review of evaluation results all increase the efficiency of IM. However, none of these measures positively influences the potential of proposal processing to compensate for periods of active and inactive new idea creation. What is required is a procedure that modifies the proposal processing capacity of IM without creating an overall loss of innovative potential.

Choices for adjusting processing capacity lie in each of the three functions introduced above. Process Control can vary the screening standard as needed to provide Feasibility Evaluation and Investment Management with a steady number of proposals to consider. Feasibility Evaluation could adjust evaluation standards as required to achieve the same result, or Investment management could adjust the strategic investment standard as required to conform to variability in proposal quantity and quality.

The proposed solution is for Investment Management to compensate for proposal variability

through regulation of the number of proposals returned for additional evaluation. The reason is the desire for Process Control to maintain a consistent standard for screening and evaluation that idea creators may rely upon. Investment Management control of proposal processing flow also avoids putting Process Control or Feasibility Evaluation in the position of making strategic investment decisions. Investment Management should also review a cursory evaluation of new proposals before making decisions regarding proposal investment priority.

Process Control also has a role to play in regulating the capacity of proposal evaluation. All undesirable proposals require archiving so Process Control can create a special category of marginal proposals to reserve for periods of comparatively inactive idea creation. The combination of release of marginal proposals during inactive periods and the strict termination of marginal proposal evaluation processes during peak activity periods creates a system to control dynamic range of proposal processing capacity while maintaining overall IM process efficiency.

## Conclusion

The process of removing the barriers to IM requires cumulative and deliberate effort to manage proposal processing as a strategic project. Cumulative effort refers to the need to remove the barriers to IM in the order presented above. For example, no amount of IM efficiency enhancement can improve a process that does not recognize and adjust to the fundamental difference between uncertain proposal and certain project management. Additionally, an optimal proposal processing system builds upon fundamental Process Control and Feasibility Evaluation requirements without the need to address the burdens of uncertain project management.

After establishment of specialized IM management roles, the next critical IM process is implementation of a Feasibility Evaluation process that equitably manages the broad range of uncertainty inherent in unevaluated proposals. Providing Feasibility Evaluation teams with scoring and evaluation tools eases evaluation difficulty by defining procedures to manage uncertainty. Using this process, Feasibility Evaluation team members can concentrate on the underlying reasons for uncertainty instead of the nearly impossible tasks of redefining pure uncertainty as desirability, or attempting to efficiently pursue evaluation activities that fall outside their areas of expertise.

IM requires a balance of efficiency and effectiveness considerations because imbalance is frequently the cause of IM difficulties. For example, the use of cross-functional teams or senior management time to process uncertain proposals is effective from the perspective of the individual proposals, but so systematically inefficient that the effectiveness of the IM process as a whole suffers. The opposite situation can exist when one person efficiently pursues the objectives of Process Control, Feasibility Evaluation and Investment Management. In this case, the process

as a whole is efficient, while the single controlling manager will ineffectively process proposals that fall outside his/her area of expertise.

IM specialization helps achieve an optimal balance between IM efficiency and effectiveness by assuring Process Control focuses on process efficiency to the maximum extent allowed by Investment Management control over strategic investment effectiveness. The hard separation of responsibilities for implementing IM efficiency and effectiveness assures that the delicate balance between sometimes-contradictory objectives is not subject to personal bias or external influences. Additionally, individual evaluation topics and pre-programmed requirements for interaction with Investment Management greatly simplify the otherwise challenging Feasibility Evaluation responsibility to balance evaluation efficiency and effectiveness.

Most additional barriers to IM performance are subordinate to the four primary considerations presented above. For example, implementation is a common IM problem associated with processes that do not separate project and proposal management. Whenever a new project or proposal management methodology requires adjustment in all on-going activities, it cannot help but be disruptive. The separation of project and proposal management makes it possible to incrementally implement an organized proposal processing procedure while not interfering with on-going projects.

An additional example of a subordinate IM barrier is the effective use of performance metrics. Specialization enables each function to measure and continuously improve its own performance independently from other functions. Specialization improves efficiency concentrating IM participant efforts on the activities that each person is best prepared to pursue and measure. Separation of project and proposal management also enables the measurement of the financial value created by the proposal processing as a whole in similar way that organizations already measure the value of other strategic projects.

The four barriers to IM are real and exist within nearly every organization that actively pursues innovative objectives. The pressure for improved innovative performance by addressing the barriers to innovation management will increase proportionately with globalization and competition demands. Partial measures to improve IM performance, such as increasing the sensitivity of project teams to innovation or creating unresponsive suggestions boxes, are insufficient to achieve overall innovative success. What all organizations require is a well understood, minimally disruptive, and continuously improving procedure that aggressively removes the four key barriers to Innovation Management.

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