Catalysts and Barriers to the Adoption of New Innovation Methods

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Abstract: Academics have developed a wide range of tools and methods to support innovation and the product development process. Unfortunately, few of these methods and tools have been widely adopted in industry. The current work seeks to identify what catalyzes and blocks the adoption of R&D innovation tools and methods in large organizations. Semi-structured exploratory interviews were conducted at several U.S.-based Fortune 500 companies. Interviewees include executives, managers, and individual contributors. Future work includes interviews with at least two more organizations with at least eight to ten individuals per organization. Initial interviews were transcribed, and open coding sought themes (commonly called categories) containing the catalysts and barriers. Initial findings indicate six themes that catalyze adoption: Confidence in the Method, Characteristics of the Method, Characteristics of the Practitioner, Practitioner Benefits, Leadership, and Organization. Barriers identified include Organization, Characteristics of the Method, Characteristics of the Practitioner, and Practitioner Drawbacks.

Keywords: Innovation; Design Methods; Innovation Tools; Interviews; Qualitative

1 Introduction

While academia produces many methods for new product development, few see widespread adoption in industry. While methods like Six Sigma, TRIZ, and Design Thinking achieved high penetration and use, methods like biologically inspired design see mixed adoption. This research seeks to understand the catalysts and barriers to the adoption of innovation methods in large industrial R&D organizations, to provide guidelines for how

organizations can leverage new design methods, and to provide academics with best practices for method development and deployment. Within this context, we use the term "method" to include design methods, processes, and tools, including computationally supported software tools.

R&D organizations require new methods capable of generating solutions to meet existing needs while anticipating future challenges. Academic researchers continue to develop new methods with theoretical potential, but these methods provide minimal impact on industry (Frost, 1999; Dorst, 2008; Araujo *et al.*, 1996). While this trend of low adoption rates has been investigated, existing studies regarding the adoption of innovation methods are limited to personal experiences or narrow case studies (Wallace, 2011; Daalhuizen, 2014), focused on specific methods such as Model-Based System Engineering (Chami and Bruel, 2018; Purwandani and Michaud, 2021) and Green Business (Purwandani and Michaud, 2021), or fall into general organizational change management research regimes.

This research applies qualitative research approaches to understand innovation method experiences of individuals within large R&D organizations in order to formulate theories about the catalysts and barriers for adopting new innovation. By looking across organizational strata and product domains, this research seeks to discover causal factors that will guide organizations, users, and creators in developing and deploying high-impact methods to support R&D practitioners in addressing complex, modern challenges. This research-in-progress paper investigates the following exploratory research questions:

RQ1: What catalyzes or inhibits the adoption of R&D innovation methods in large R&D organizations?

The research question was further subdivided into *(a) catalysts to adoption, (b) barriers to adoption, (c) evaluation of adoption, (d) selection of design methods, and (e) origination of design methods.* Initial findings are presented, followed by areas where the authors seek feedback on their process and results.

2 Methods

Semi-structured, exploratory interviews were conducted at multiple Fortune 500 companies to develop an understanding of what catalyzes or blocks the adoption of new design methods. Participants from these organizations held a wide range of positions, ranging from individual practitioners up through managerial and executive personnel. Interviews generally lasted for one hour, though executives were only interviewed for a half hour. If an organization belonging to a given industry agreed to participate, no further organizations from that industry were sought for participation.

These interviews were conducted by three authors of this paper, a Professor of Mechanical Engineering, a research scientist, and a Ph.D. student. The professor led the interviews, the research scientist leveraged their industry background to ensure clear communication of business and academic terms, and the Ph.D. student ensured consistency between interviews, verified topics were covered during the interview, and documented terminology.

Interviews were conducted using Zoom, with call recordings transcribed using Rev, an online transcription service. Transcripts were de-identified and cleaned so that no identifying information about the participating individual or organization was present.

The transcripts were analyzed using Open Coding for qualitative analysis (Saldaña, 2016). This approach was selected because it allows for the categorization of a wide variety of observations. To provide structure to the coding process, initial top-level "parent" codes were established for each research sub-question. This research-in-progress paper covers the results of the *catalyst to adoption* and *barrier to adoption* parent codes only.

The data presented in this work contains an analysis of 20 interviews conducted at two companies, a consumer packaged goods (CPG) company and a chemical company. After coding the interviews, catalyst and barrier codes were clustered into themes, the results of which we report here. Further interviews are in the process of being coded and scheduled and will provide a broader set of data that will inform the categorization of catalysts and barriers to method adoption.

3 Findings- Catalysts

Thematic analysis of the data finds six themes that catalyze an organization's adoption of a new product development method: Confidence in the Method, Characteristics of the Method, Characteristics of the Practitioner, Practitioner Benefits, Leadership, and Organization. In Table 1 through Table 6, each theme is divided into sub-themes, for which definitions are provided. While the number of references does not necessarily correlate with importance, for brevity, all sub-themes with fewer than 5 references are excluded.

Table 1. Confidence in the Method catalysts.

Catalyst	Definition
Examples of successful internal use of the method	Confidence in the method is increased when case studies internal to the organization are used to communicate the value.
Examples of successful external use of the method	Confidence in the method is increased when case studies external to the organization are used to communicate the value in the results.
Support from existing successful practitioners	Confidence is increased when individuals can receive support from others who are already successfully using the method.

Table 2. Characteristics of the Method catalysts.

Catalyst	Definition
Method provides formal structure	A method provides formal structure to an otherwise unstructured or informal process.
Method has low barrier to getting started	The method has a low barrier to start using because it provides clear starting points, guidance, or resources that help direct practitioners.
Method leverages large amounts of data	The method is backed by quantitative data and/or provides results that are quantitative.

Table 3. Characteristics of the Practitioner catalysts.

Catalyst	Definition
Practitioner was previously aware of the method prior to its introduction at the organization	The practitioner already possesses awareness of a given method before the introduction at the organization.
Practitioner's workstyle aligns well with the method	The practitioner finds working with the method to be compatible with their pre-existing work style.
Practitioner enjoyed using the method	The practitioner finds working with the method to be enjoyable and fun.

Table 4. Practitioner Benefits catalysts.

Catalyst	Definition
Results of the method are easy to use	The practitioner finds the end product of a method appealing, easy to use, easy to understand, and/or can be communicated easily.
Results of the method cannot easily be obtained elsewhere	The method provides results that are often unique or cannot be obtained without great effort using alternative approaches
Method use saves my time	The practitioner finds that the method reduces the time necessary to complete a task
Method use directly benefits me	The practitioner is able to generate more, or more valuable results, thereby increasing their perceived value to the organization.

Table 5. Leadership catalysts.

Catalyst	Definition
Executives sponsor the method	An executive called for, directed, and took personal responsibility for the integration of a method into the organization.
Executive leadership buy-in	Senior executives discussed the method at important meetings and demonstrated interest in the results.
Leadership understands the costs and benefits of the method	Executives and management understand the requirements for method implementation, use, and value obtained.
Influential individuals champion the method	Someone the practitioners respect demonstrates the value of and support for the method.

Table 6. Organization catalysts.

Catalyst	Definition
The organization's domain and products fit the method	The method's purpose applies to the organization's domain or products, with little customization required.
The organization customized the method to meet their needs	The organization made necessary changes to an "off the shelf" method so that the method meets their needs results.
The organization allows localized customization	The organization permits or encourages methods to be customized to better fit the needs of a subset of the organization.
The organization has made significant financial investment in the method	The organization has spent a significant amount of capital on the implementation of the method.
The organization has consistent language for the method	The organization refers to the method using standardized terminology.
The organization is comfortable with learning from failure	The organization understands and accepts that new initiatives sometimes do not work immediately and require refinement over time.
The organization provided effective training	The training is sufficiently robust, tailored to the organization's product and needs.
The organization dedicates a team to oversee implementation.	A dedicated team is funded and tasked with institutionalizing a method.
The organization uses effective change management	The organization was explicit and deliberate in addressing organizational change management issues that accompanied the rollout.
The organization mandates use of method	Method use was required by a group with authority, whether executive or management.

4 Findings- Barriers

Thematic analysis of the data finds four themes that create barriers to an organization's adoption of a new product development method: Organization, Characteristics of the Method, Characteristics of the Practitioner, and Practitioner Drawbacks. Table 7 through Table 10 document each theme within the barrier category.

Table 7. Organization barriers.

Barrier	Definition
The organization's domain and products do **not** fit the method	The method's original purpose does not apply to the organization's domain or products.
The organization had inconsistent deployments of the method.	The organization had multiple non-standardized implementations of the method.
Lack of financial support	The organization made insufficient financial investment in the method
The organization has inconsistent language for the method.	The organization refers to the method using non-standardized terminology.
The organization did not use effective change management	The organization was unable to address organizational change management issues that accompanied the rollout.
The organization mandates use of the method	Method use was required by a group with authority, whether executive or management.
Lack of continued support	The organization provided little support or funding to ensure the method was adopted, leading to users abandoning the method
Lack of subject matter experts	The organization does not have users who are subject matter experts regarding the method.
Lack of institutional knowledge relevant to the method	The organization lacks background material and knowledge to adequately inform and teach practitioners about the method.
Lack of dedicated manpower	The organization provided too few people to implement and support the method, or where the existing staff was overwhelmed with other work.

Table 8. Characteristics of the Method barriers.

Barrier	Definition
Method has bugs or flaws	The method possesses unintentional bugs or flaws that impede use or undermine the confidence of results.
Method automation lacks transparency	Method automation processes are not clear or are not inspectable by the user.
Method needs too much documentation	User finds an overabundance of need for documentation discourages them from implementing a method.
Method is not user friendly	User has a poor user experience includes things that are ambiguous or confusing, are difficult to understand, or are otherwise difficult to use.
Method as too rigorous or complex	User finds that the effort required due to complexity or rigor does not match the value provided by the method.
Expectations of the method do not match my actual results	User's perceptions of the impact or results of methods are inaccurate when compared with the actual outcomes

Table 9. Characteristics of the Practitioner barriers.

Barrier	Definition
Practitioner workstyle does not align well with the method	The practitioner finds working with the method to be incompatible with their pre-existing work style.
Practitioner dislikes change in work processes	Practitioner does not want to change their system due to familiarity, time to change, or some other reason.
Personal risk aversion	Practitioner does not want to risk failure by using a new method.

Table 10. Practitioner Drawbacks barriers.

Barrier	Definition
Results of the method are difficult to use	User finds the end product of using a method is something that is off-putting, difficult to use/understand, and/or cannot be communicated easily.
Method use slows practitioner down	The practitioner finds that the method hinders their productivity.
Method provides little or unclear value	The practitioner finds a method did not provide value to those using it or the value that it did provide was not visible or understood by the users

We note that while some themes in barriers have reciprocal themes in catalysts, for example "Method saves time" vs "Method slows me down," other themes are asymmetric, appearing as a catalyst or barrier, but not both, for example "Method provides formal structure" appears as a catalyst, but there is not corresponding barrier for a method that does not do so. In particular, none of the catalysts within the leadership theme show reciprocal barriers. We suspect the later arises at least in part due to interviewee concern about mentioning negative comments with respect to leadership, and in general we note

such asymmetry arises in instances where the opposite of a theme is the non-existence of it e.g. one can identify a bug in software, but rarely does one note the non-existence of bugs.

5 Areas for feedback & development

The primary feedback that the authors are seeking is to determine if the identified catalysts and barriers align with the lived experiences of the industry members. Further, the authors' current background literature is limited to work within the realm of design science and therefore, would benefit from recommendations of other works that may have investigated the adoption of design tools from other perspectives and backgrounds. We would also welcome feedback on our process and how to make the results more impactful for industry.

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References and Notes

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