

Executive Summary

Over the past three decades, product development organizations have made radical productivity gains by leveraging information systems to help streamline predictable parts of the product development lifecycle. Moreover, traditional business intelligence tools have decreased the cost of reporting on management's key performance indicators, making executives more effective at top-down decisions through which they steer corporate strategy.

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Today, product development-intensive industries are more competitive than ever. Companies are under pressure to further compress time-to-market while expanding innovation that addresses the needs of increasingly fragmented customer segments. Furthermore, the information systems that supported progress to

date have created a new challenge: mountains of enterprise information under layers of data management tools, and no practical way for the typical knowledge worker to use it. In fact, industry research shows that engineers spend as much as 30% of their time searching for information¹. Companies are often unaware of how better use of existing data could improve the product development process.

Today, lagging companies are struggling to deal with the information explosion by building an even more rigid layer of highly managed systems on top of their existing systems, as is the case with data warehousing. Meanwhile, the leaders of the next wave of innovation are now separating from the pack, taking a new approach, and leveraging a nimbler breed of technology to do so with advanced information access.

The ability to leverage existing company knowledge is vital to innovation. Advanced information access solutions go beyond simply finding and retrieving content to allowing a company to organize and utilize their full library of structured and unstructured data to provide quick, relevant results to users –regardless of their business silo. Three main benefits are realized through the implementation of an advanced information access solution:

- 1.** Increased productivity from information reuse and avoiding duplication of effort
- 2.** Decreased time spent searching for information in multiple systems and analyzing results
- 3.** Enhanced innovation by mining product development history and recycling “lost” ideas

¹ Tenopir/King, Communication Patterns of Engineers, 2004

These benefits provide cross-functional groups with in-depth information and access to a history of projects across product development phases, from ideation to launch. They can help companies reduce duplicate work, share knowledge across dispersed cross-functional teams, and gain visibility into product-related data that may have been previously hidden.

Between March and September 2007, Kalypso examined product innovation applications of information access solutions, technologies and approaches in more than 20 leading companies across multiple industries. The research sample included companies with annual sales ranging from \$200 million to more than \$10 billion.

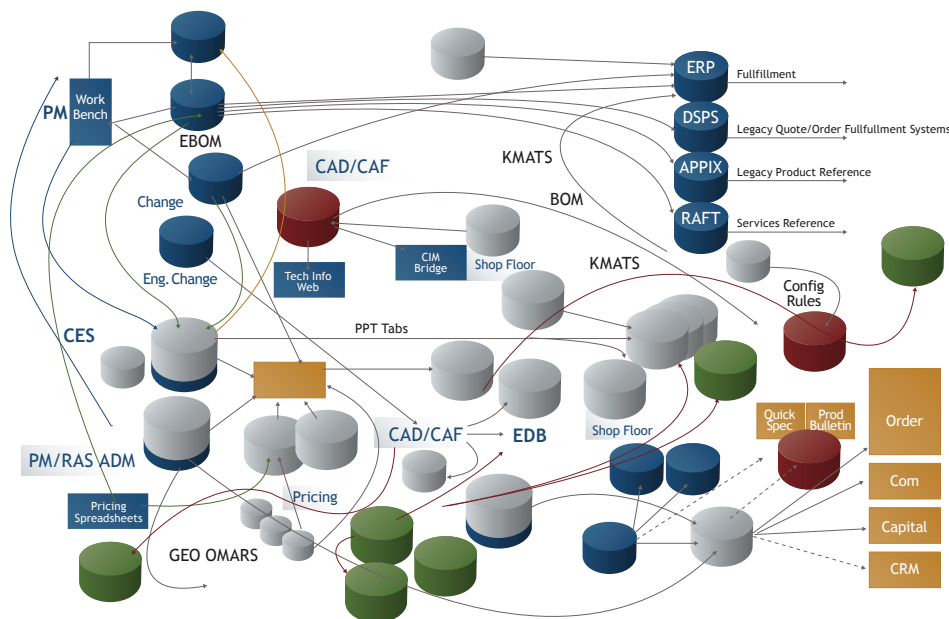
Kalypso conducted interviews and independent research to understand how Advanced information access technologies can drive increasingly efficient innovation. The interviews also covered issues and opportunities facing companies who are considering information access projects, as well as lessons learned from companies with mature deployments

Search Capabilities in Enterprises Today

Information systems have enabled businesses to become increasingly more productive. However, the data generated by these systems has increased exponentially in both volume and complexity, often existing in various formats and stored in many locations. As a result, businesses are faced with a critical problem: the inability to access information scattered across the enterprise, resulting in the failure to utilize valuable data.

While investments in enterprise applications that create and manage stored data and unstructured content help simplify IT architectures, those same software applications are increasing the amount of unclassified data that a company stores. IT landscape maps – “spaghetti diagrams” – such as the

Figure 1: Searching Multiple Sources



one shown in Figure 1 are typical in an organization with large amounts of unstructured content.

When important information resides in silos, employees spend too much time searching and not enough time utilizing existing data. In fact, industry research shows that engineers spend as much as 30% of their time searching for information. Companies are often unaware of how much existing data could improve the product development process by increasing productivity and information reuse.

With the majority of this valuable information sitting in relational databases in enterprise systems, the conventional approach has been to leverage search technology to allow the user to ask a question, and receive in return a long list of results. Most current enterprise applications – such as enterprise resource planning (ERP), customer relationship management (CRM), and product lifecycle management (PLM) – contain basic search capabilities. Simply stated, basic search is exactly that – the capability to find and retrieve content. The quality and relevance of basic search results depend solely on the user entering the “right” keywords and structuring the query to match the content. Almost all legacy systems have incorporated basic search technology into their solutions, but they frequently do not meet the needs of users.

Even with developments to improve relevance and usability of basic search, it is still limited – and basic. In order to increase productivity and information reuse, companies need to go beyond search and leverage advanced information access capabilities that extend beyond simply finding and retrieving content.

Advanced Information Access: Evolving Search Capabilities

Advanced information access (AIA) capabilities greatly surpass those of basic search. Advanced information access capabilities connect three important elements from the search world – information sources, search and navigation engines, and end users – simplifying the ability to find, access, and understand data.

The ability to search effectively requires a system that easily transforms data into information that can be accessed, used, and applied. With an AIA system, a company can optimize its enterprise search capabilities, match user needs, and provide more relevant and concise search results. As a result, users can more quickly and easily locate valuable structured or unstructured information across the enterprise, gaining visibility into data that may be housed in different business units.

Additionally, most AIA systems include security (e.g. group and role-level access controls) that allow sensitive information to be available only to those individuals with the proper credentials.

Advanced information access capabilities typically include:

- **Content classification and clustering:** Displays search results in logical pre-defined or automatically generated categories.
- **Browse and guided navigation capabilities:** Supports a layered process of content discovery; users are presented with different views of information and can decide which path makes the most sense based on their context.
- **Advanced language analysis:** Understands the relationships of words used in context within a phrase, sentence, or paragraph text.
- **Entity extraction:** Identifies people, places, things, etc. within the text to infer a relationship with other words.
- **Enhanced presentation and analytics:** Offers business intelligence capabilities and analyzes user interactions resulting in tuning by administrators to improve its relevance.
- **The Secret Sauce:** Utilizes sophisticated proprietary algorithms and a flexible architecture to handle scale and speed.

A range of AIA capabilities can be found in everyday use, beginning with internet search engines and portals like Yahoo! and Google. While internet search engines optimize basic search, they are limited to one kind of data and a list of search results, with no other refinement capabilities available. More advanced solutions are found in eCommerce websites, where businesses such as Walmart.com provide customers with a more robust experience to keep them from searching – and buying – elsewhere.

For example, searching for an item on Walmart.com presents users with search results along with links to related items. The search query places results into pre-defined categories, presents related search terms, and when an item is selected, the feature shows other related items in categories such as “Similar Items,” “You Might Also Like,” and “Complete the Look.” This method has proved so successful that 62% of leading online retailers are investing in analysis tools and methods to personalize internet content based on an improved understanding of the user and their intent².

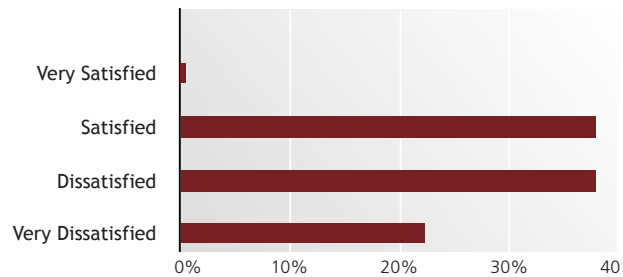
2 Aberdeen, Online Retailers Flex their “Searchandising” Muscles, 2006.

Lagging Internal Enterprise Adoption

“Seventy-seven percent of respondents search for data in multiple places, then manually combine the results.”

While eCommerce enterprise search capabilities have advanced, many companies' internal enterprise search capabilities have not. With AIA adoption lagging, employees are reporting that it is too hard to find the information they need to perform their job functions. As industry estimates show that up to 80% of a company's information is unstructured, this is no surprise.

Figure 2: Search Capability Satisfaction

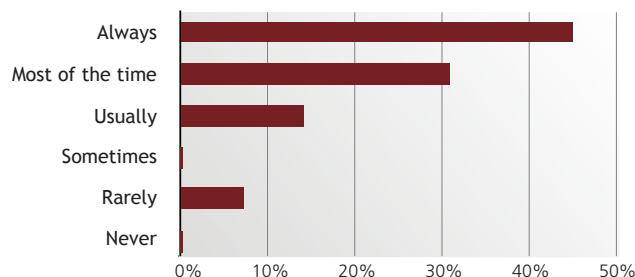


Kalypso research examined how companies are using their existing capabilities to access information and results indicated the clear need for AIA functionality in distributed enterprises. In fact, 63% percent of survey respondents were dissatisfied with their current search capabilities (see Figure 2).

According to Kalypso interviews, major challenges of current search capabilities include:

- **Employees going to great lengths to make data useful.** Seventy-seven percent of respondents indicate that either most of the time or always, they search for data in multiple places, then manually combine the results before the uncovered data is useful (see Figure 3).
- **Information is generally stored in separate systems,** functions, locations, and business units that require a significant investment of time to uncover.
- **There is a large learning curve for new employees** before they begin to understand where information is stored within the company and how to access it.

Figure 3: Searching Multiple Sources



Kalypso research indicates that the same basic needs exist for accessing information in enterprise systems. Enterprise users need a system that brings together content from multiple sources within a company, increasing the ability to

effectively and efficiently search within and beyond their primary business systems and functions.

To combat weaknesses in their current information access capabilities, interviews revealed that some companies developed ad-hoc processes to get by. Typically, these efforts focused on either a specific function or a high impact issue that affected a single source of content. A few of the most innovative companies incorporated search capabilities into composite solutions and enabled social networking as a result.

Inadequate Search Affects Product Development

When it comes to product innovation, time spent searching for data is time wasted. In a study conducted by IDC , it was estimated that for an organization of 1,000 employees, the annual cost of ineffective search is over \$5 million, with the cost to recreate content adding another \$4.5 million³.

Inadequate search capabilities affect any company dependent on product innovation. The need for AIA is critical. Cross-functional teams developing and commercializing products work in an information environment where a staggering amount of product-related content exists. The task of locating and reviewing all related information assets during development can be extremely daunting. Adding to this complexity are research and development centers located in geographically dispersed locations around the world, each generating and managing enormous amounts of content contained in multiple systems.

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Legacy applications containing basic search capabilities are restricted to a single source and frequently do not meet the needs of users, as they are only able to search one piece of the product record during each query. Additionally, there is an emphasis on the need for added perspective; query results must provide context and be detailed for the user to determine their relevance.

Kalypso research revealed that less than one out of 12 respondents felt confident that their current search results contained all of the relevant content available. As a result, users are continually faced with the tradeoff of either continuing to search or recreating the desired data. As shown In

³ IDC, “The Hidden Cost of Information Work,” 2005.

Figures 4 and 5, 46% of respondents indicated that they perform multiple searches and approximately 50% are ultimately forced to recreate data.

Figure 4: Recreating Lost Content

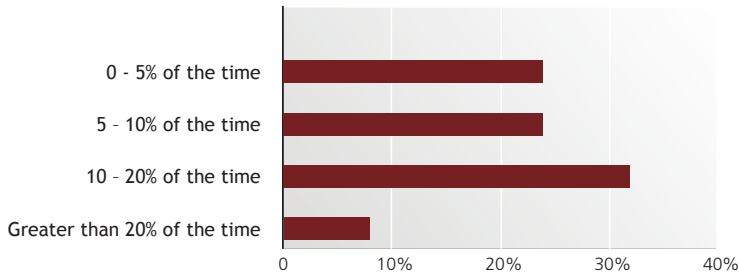
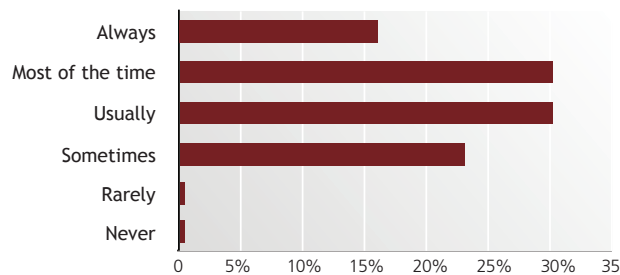


Figure 5: Frequency of Multiple Searches



Consider performing a search for a standardized test in an engineering company. This search could return hundreds, even thousands of individual results for a large number of products. If only a handful of valid results existed among hundreds of results available, users must spend an inordinate amount of time combing through results, causing them to become frustrated and either to run another query or simply to assume that the needed data does not exist.

One company Kalypso interviewed had over 900 discrete business systems and millions of electronic records of product information, accumulated over many years of innovation and acquisitions. Most of this valuable history was inaccessible to the current team of product development professionals. An informal network of people could help point engineers in the direction of relevant information, but it was often more time-consuming to find something than to recreate it or proceed without it.

With AIA the company was able to index and link the majority of its legacy product systems, making decades of history available to engineers. Employees are now able to search for content and receive results that are categorized, prioritized, and personalized. The company expects to save its engineers significant amounts of time and millions of dollars by making access to relevant information easier.

Advanced Information Access Can Improve Product Development

Early adopters can gain a competitive advantage through the adoption of AIA capabilities. As basic search limits information stored in separate locations to be accessed only by the group that initially created the data, AIA capabilities bring together content from all sources within a company. This allows for one application to become the single access point for all systems, dramatically increasing the ability to effectively and efficiently search an entire corporate infrastructure.

Through the use of AIA, users are able to search in their natural language and find relevant content without the use of exact phrase matches. Its capabilities also allow for the personalization of search so that once a user completes a profile, results can be filtered and ranked based upon preferences.

The inability of basic search to leverage knowledge from past research and experimentation results in duplicating research and development and extending the time needed to formulate samples. With AIA capabilities, companies are able to leverage product-related information across the business, capitalize on existing information, and gain better visibility into valuable data. Cross-functional groups with access to a history of projects across development phases – from ideation to launch – can help to reduce duplicate work and discover information to help improve the product development process.

Additionally, AIA capabilities can help companies to access data across functional layers. Dimensions of data can be placed into logical categories (e.g. products, components, suppliers, specifications) that allow for easier navigation and the ability to drill-down level by level. Analytics can be added to provide business intelligence capabilities that allow products and components to be easily analyzed to determine their value for reuse. Unlike basic search, AIA provides context to capture different perspectives and relationships in the query results, resulting in higher information access effectiveness.

For example, a scientist at a consumer packaged goods manufacturer is able to enter an ingredient into a query upon beginning a new project. Using an AIA system, the query outputs all products using that ingredient, related test requirements, methods, and results. The scientist can then apply a filter, eliminating any applications not related to the current project. Other categories such as target market and application criteria (e.g. temperature, viscosity) can then be easily navigated, continuing to narrow the relevant content within the same query, and preventing recreating past experiments.

Findings and Recommendations

Real benefits achieved with advanced information access capabilities include the ability to:

- Increase component and design reuse
- Streamline new product introduction processes
- Enhance productivity by reducing time searching for data
- Improve inventory control and sourcing with real-time data
- Increase visibility into internal resources and projects
- Reduce duplicate work on new products being developed

Although the concept of advanced information access is simple, making it a reality is not. The capabilities and technologies to connect global databases exist; however, strategies to evaluate and include valuable content residing elsewhere (e.g. desktop files, network drives, etc.) are needed.

Lessons learned from early adopters indicate that effectively bringing together AIA capabilities for applications in product innovation requires several things to be considered:

Integration of results: In order for deep levels of data to be searched, retrieved, and accessed, they must be indexed by the AIA system. AIA systems enables this by sending the query to individual databases, then merging the results and presenting them in a simple format that alleviates duplication. Results are either presorted or users are allowed to sort using their own criteria.

Adding Context to Content: Information access vendors provide tools that enhance content from data sources using meta-tags (i.e. “post-it notes” for your data that assist in understanding the data’s context and relevance). Formal processes to tag content can be time-consuming and resource-intensive. A hybrid approach based on the relative value of the content is a best practice.

User Interface: It is important that companies develop an interface based on an understanding of how business users interact with information; user experiences should match their roles and work patterns. Research indicates one-size-fits-all user interface strategies can result in low rates of adoption.

Content Notification: Many users have specialized technical expertise or areas of interest. Companies should use alerts to notify users when content matching their interests is developed. This capability becomes more useful when combined with collaboration tools that enable social networking.

Secure Access: The system should have the flexibility to support a multi-tiered security model that limits and provides restrictions for sensitive information, respects and inherits access privileges from the data's sources, and provides easy access to vast amounts of non-confidential information.

User-Driven Refinement: Best practice systems consistently place emphasis on user involvement as a key to adoption and continued business value. Establishing information access as part of the business culture is an effective approach to enable continuous improvement. Some companies have included the ability for users to rank content and have rewarded users that provide valuable content.

Evaluation and Justification: It is still early on, and platform vendors may have limited experience with applications targeting product innovation. Conducting a formal assessment of requirements and capabilities is recommended to reduce the risk of false starts and low user adoption. More time should be allocated to educating users, raising organizational awareness, understanding how each user utilizes search, and investigating what each vendor's reference customers learned from their deployments.

Companies

The research sample included companies from the following industries: 18% Consumer Packaged Goods, 28% Food & Beverage, 18% Aerospace & Defense, 9% Life Sciences, 9% Semiconductor and 18% Energy.

Job Function

The research sample included respondents from the following functional areas supporting Product Innovation: Engineering, Product Management & Product Lifecycle Management (42%), Information Technology roles; Corporate, R&D & Product Lifecycle Management (58%).

About Kalypso

Kalypso is a consulting firm serving the world's most innovative companies. The firm helps clients to deliver on the promise of innovation. Service offerings encompass all aspects of innovation including product strategy, development, introduction, commercialization, lifecycle management, and PLM systems selection and implementation. In addition to the firm's deep industry, technology, operational, and training expertise, Kalypso provides a flexible, collaborative approach to deliver unparalleled client satisfaction.

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