



# Empowering the Digital Workforce: The Five Tenets of Success



# IDC OPINION

Artificial intelligence (AI) and machine learning (ML) are touching every aspect of enterprise work, from digital twins and preventive maintenance to AI-based conversational interfaces that provide customer care and support. These trends are changing the nature of work and how the digital workforce is using AI-powered search to make decisions. AI is also beginning to have a profound effect on how digital workers do their jobs, by augmenting their human intelligence and helping them do their jobs faster, with fewer errors and more relevant insights.

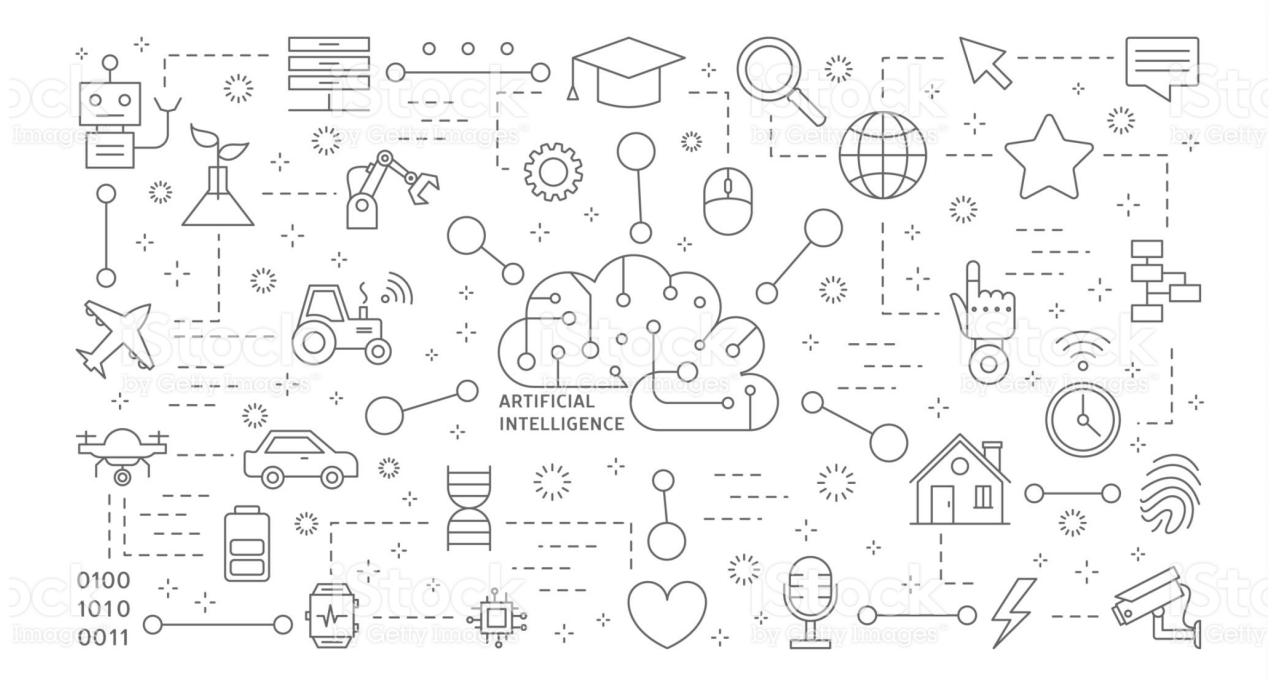
At the same time, the amount of information that digital workers need to deal with continues to expand on an exponential basis. According to IDC's Worldwide Global DataSphere Forecast, 2019–2023: Consumer Dependence on the Enterprise Widening (IDC #US44615319, January 2019), enterprise data will grow from 5 zettabytes (ZB) in 2018 to over 31ZB in 2023, a compound annual growth rate of almost 45%. The increase in unstructured information combined with the increasing pressure to improve worker productivity has made locating the right information at the right time more imperative than ever. Information-driven organizations need to improve their capabilities around enterprise search in order to maximize revenue, manage costs, and minimize risk.

IDC has determined that there are five key tenets of success to assisting today's digital workers: integrating diverse content types and sources, applied AI, search relevancy, performance at scale, and ease of use.

Lucidworks provides Fusion, an AI-powered search platform that recommends personalized answers and "next best actions" to each user based on his/her context. Application-ready AI bases those recommendations on an individual's prior usage as well as the learned wisdom from all previous actions of peers and others in the organization. Machine learning, AI-based search relevancy, modern interfaces, performance at scale, and ease of use greatly improve enterprise search adoption and incremental benefits over traditional approaches. Nearly every industry can realize these benefits.

AI-powered enterprise search in Fusion enables aerospace, defense, and natural resource organizations to leverage vast troves of scientific information to drive innovation. It allows engineering and manufacturing companies to harness the power of data in unique formats, such as computer-aided design (CAD), to build predictive maintenance systems and improve product designs. For customer-facing industries such as financial services, telecommunications, and healthcare, AI-driven search empowers agents with the information and services they need to provide truly customer-centric support. Organizations should strongly consider Lucidworks Fusion to drive these types of improvements in their enterprise search systems.

## LUCIDWORKS FUSION





## IN THIS WHITE PAPER

This white paper provides guidance on the next generation of AI-powered search tools for digital workers using data-based analysis, contextual clues, and data-driven machine learning. IDC has determined that there are five key tenets of success to assisting today's digital workers: integrating diverse content types and sources, applied AI, search relevancy, performance at scale, and ease of use. Executives who read this white paper will learn about the benefits and trade-offs of these tenets. In addition, they will learn how the next generation of applications that use these capabilities will augment the intelligence of digital workers to improve their performance, decision making, and value to the organization.



# SITUATION OVERVIEW

## The Rise of AI

Artificial intelligence is the study and research of providing software and hardware that attempts to emulate a human being's thought processes. IDC defines AI as systems that learn, reason, and self-correct. The fast-emerging field of AI is everywhere, and IDC forecasts that worldwide spending on AI will grow at a CAGR of 38% through 2022 to reach over \$78 billion. A lot of this spending is driven by digital business transformation (DX) initiatives; by 2019, 40% of all DX initiatives will involve artificial intelligence. Data generated by DX initiatives will have limited value without exploiting the power of AI to extract valuable, accurate, and timely insights. AI will be the key technology that makes DX initiatives successful and enables a modern digital workforce. AI will also transform how tomorrow's digital workers will interact with information and systems.

Adoption of AI is currently low overall, but at a tipping point, as investment has tripled in recent years. The power of AI lies in its ability to derive knowledge from data and expand organizational intelligence, not just to help the individual but also to scale a company's performance and efficiency in the aggregate. By 2021, 75% of commercial enterprise apps will use AI. By 2024, AI-enabled human-computer interfaces and business process automation will replace a third of today's screen-based B2B and B2C applications, and AI-based assistance and augmentation for digital workers will be the standard.

# The Current State of Search

The world of search systems and technologies has changed dramatically in the past five years. Although organizations have used web search tools such as Google to find information on the web, their internal enterprise search solutions have lagged far behind. These enterprise search systems are often based on an outmoded view of data. Organizations are swamped by the overwhelming amount of information, emails, reports, websites, PDFs, recordings, and videos. Their company information is scattered across multiple applications and repositories in many time zones and datacenters. In addition, some of the most valuable knowledge of an organization is locked in unstructured data. Inside all of this unstructured data are facts and insights about every aspect of an organization's business. Social media, blogs, and news stories often contain information and insights about an enterprise's strategies and those of the competition. However, earlier approaches to search have created a gap for most organizations between the data they have and the insight they are able to use.

Rule-based or "guided navigation" systems for search have been around for the past decade. These systems are oriented toward heuristic-based approaches for determining search results, using a combination of hierarchical structures and deterministic rules. These rules look something like "use Chicago" if the search is "main office" or "head office." A rule-based system identifies certain keywords that trigger the applicable rules to determine search results. In many search systems today, there are thousands of different rules for many different types of search scenarios. The advantage of rule-based systems is that they completely separate knowledge from processing, and they can deal with incomplete and uncertain knowledge using heuristics. These rules are in separate structures from search indexes and can be applied to multiple types and sets of indexes. One can think of these as taxonomic structures used to help improve information discovery, much like the card catalogs that we used to use in libraries.

However, rule-based systems for search present disadvantages that younger "digital natives" will not accept. IDC's analysis of these systems shows that the rules become outdated and the original assumptions soon become invalid. This gap grows more noticeable as business conditions change.



The biggest flaw with rule-based systems is that they cannot adjust automatically along with inevitable shifts in content and search behavior. Keeping the rules fresh and up to date requires an administrator to continuously review, edit, and adjust them or add new rules over time. Given that an enterprise's average search installation has less than one full-time resource assigned to its care and feeding, this type of work usually goes undone. Over time, the rules get out of sync from both the indexed content and user queries.

## What Organizations Need in Search

Increasingly, organizations need to produce better business outcomes without a corresponding increase in head count. This impacts sourcing, hiring, training, and retaining a modern workforce that expects connectivity to social technology and instant access to information. Internet and project management technologies have also expanded the ability to break processes into microtasks and distribute the work differently, using elastic work models, which will impact the type of work that employees will do. Organizations need the following as they compete for top talent:



Real-time intelligence to inform thousands of data-driven decisions per day



Personalized, contextualized information for each digital worker



Efficient research methodologies to speed the pace of innovation



Unified visualization of knowledge assets to bridge information silos



Dramatic reductions in the time team members waste searching for information

The modern digital worker must nimbly adapt to constantly changing business dynamics. The digital worker's relationship with information technology supports that agility — or blocks it. However, the biggest shift is in the activities themselves. The modern digital worker applies experience and knowledge to business decisions while using new AI tools integrated with data and analytics technologies. New deep learning technologies such as digital assistants, chatbots, and question answering (QA) systems use artificial intelligence to augment every worker's human intelligence. A wide variety of such tools and solutions will reach the market over the next three to five years. These systems will empower the new digital worker to make far more decisions based on evidence and data that was previously unavailable to them.

For their digital workplace initiatives to succeed, organizations need to focus on the following key areas:



- **Integrating Diverse Content Types and Sources** — Today, organizations have both structured and unstructured data in CRM systems, ERP systems, corporate email, collaboration systems, content management systems, HR systems, production systems, and order management systems. To give digital workers the most relevant answers, workplace systems need to provide a unified view of information within all systems across the enterprise. They also need to unlock the information located in the unstructured information, using capabilities such as natural language processing (NLP) and entity extraction.



- **Applied AI** — As discussed previously in this white paper, AI and machine learning provide the foundation of technical capabilities to group information and make it relevant to each individual's work. Applied AI personalizes insight to particular needs and questions. While most companies have pursued a homegrown, “project driven” path to adopting AI, this is slow, costly, and risky. It requires well-coordinated teams and cross-functional alignment. In contrast, applied AI supports a product-driven approach to AI adoption. It can be far safer and more affordable to bring in a product that includes AI in its core and that also solves a universal problem like customer support, scientific research, or investment advisory services. The company's data scientists can still optimize the built-in algorithms or create new algorithms and apply them to a platform that's already built and works.



- **Search Relevancy** — Search vendors have pursued greater results relevancy for decades. Digital workers want the best results to help them do their job, but they do not want to sift through superfluous results to find the information they need. Applied AI can deliver that insight personalization.



- **Performance at Scale** — As noted previously, the amount of information held by organizations is increasing at a rapid rate, and it is not unusual for organizations to store tens or hundreds of millions of documents, emails, and records. Extracting insight from so many records in human interactive time can be done only by applications capable of processing thousands of queries per second at a scale that used to be the sole province of online search vendors. And yet, organizations must do it with infrastructure that doesn't blow the corporate budget.





- **Ease of Use** — In his wonderful book *Ambient Findability*, Peter Morville discusses how important it is for human beings to locate and find information, and he describes the systems that have been devised to easily meet that demand. Today, AI-based systems are providing “just in time” pop-ups and surfacing relevant content as the digital worker goes about his/her job. Organizations are embedding better tools for using search to drill down to the most pertinent data, with AI personalizing results to the individual’s role, current task, and demonstrated content preferences.

Many companies will thrive by augmenting existing processes with AI-based agile applications and methods, allowing them to proactively deliver contextually relevant insights to knowledge workers at the exact moment of need. But as the working environment covers many more collaboration modalities and disparate devices, content and information will become even more dispersed. To manage this collaboration cloud and enable the workforce to make more data-driven decisions in real time and in context, organizations must augment existing business processes by adopting AI-powered assistive technologies for data discovery.

## Emergence of AI-Enabled Digital Assistants

AI-enabled digital assistants make up a new class of technologies that facilitates the discovery, use, and sharing of insights. These technologies include digital assistants, chatbots, or question answering systems, and they use search and machine learning to help workers answer questions, predict future events, and provide personalized recommendations to clients in real time. They use a wide range of processes such as natural language processing, entity extraction, knowledge graphs, and head/tail analysis to provide expert assistance in the workplace.



Getting correct and relevant information to a digital worker at the right time and in the right work context should be a straightforward concept, but it has eluded most organizations for over a decade now. According to IDC research, finding experts or locating relevant information is often the biggest challenge facing professional knowledge workers. This is because information about people and their skills and expertise is usually held in systems that are separate from the systems where the work

is performed. Because information is siloed in separate repositories, email systems, collaboration systems, or organizational archives, a digital worker must use additional systems or applications to find information about the right path to get an approval or complete a task. While many workplace applications offer some search capabilities, they are usually an afterthought.

Bringing information together from many applications into an advanced search platform that personalizes and contextualizes the presentation of results can provide digital workers with just the information they need to solve their thorniest business challenges at the instant that they need to solve them. Moreover, search is a universally accessible interface that requires no training. It can quickly deliver information across data silos, as if those silos did not exist.

In this way, AI-powered search technologies can meet the immediate need for information and data discovery, with context personalized to the individual worker. Research by IDC has found that a typical organization employing 1,000 digital workers wastes over \$5.7 million annually searching for information. Some of IDC's other findings on knowledge work are as follows:

- **61%** of digital workers regularly access **4+** systems to get the information they need to do their jobs, and close to 15% access 11+ systems.
- **36%** of a typical digital worker's day is spent looking for and consolidating information spread across a variety of systems. These workers can find the information required to do their jobs only **56%** of the time.

AI capabilities such as machine learning, natural language processing, and predictive recommendations are changing the experience of search and discovery to give every digital worker personally relevant insight exactly at his/her moment of need. Lucidworks is a company providing such tools and capabilities.



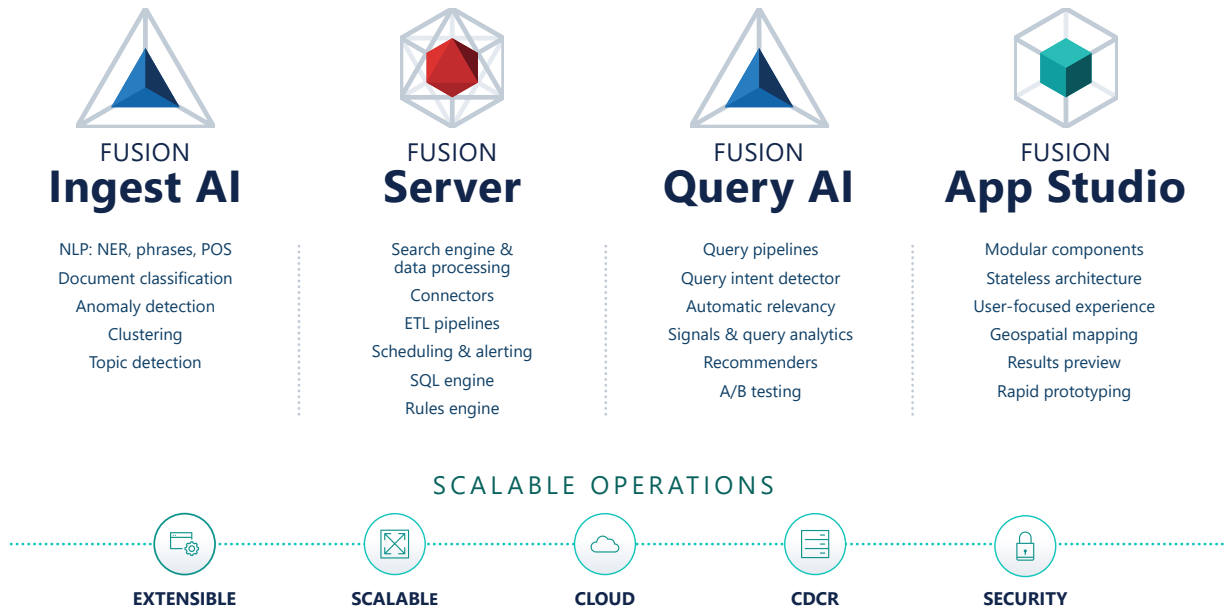
## Lucidworks Fusion

Lucidworks, based in San Francisco, builds search-driven digital workplace solutions for some of the world's largest brands. Lucidworks Fusion is a data discovery platform that gives users contextual, personally relevant search results and proactive recommendations via integrated artificial intelligence. Digital workers can discover insights immediately when they have a question, even across billions of documents or records.

Lucidworks Fusion, the company's product platform, provides the enterprise-grade capabilities needed to design, develop, and deploy intelligent search applications at scale, with Apache Solr and Apache Spark open source search technologies at its core. The platform supports low-latency queries over as many as trillions of documents from an unlimited number of data sources and formats, making search applications easier to develop and faster to deploy.

Fusion comes with prebuilt connectors to file systems, databases, and other data stores; an experience management tool to tune search results and relevancy, as well as the end-user interface; data analytics, visualization, and dashboarding; signal processing and recommendation tuning; and an intuitive management and monitoring console (see Figure 1). The Fusion platform supports both unstructured and structured data, enabling analysis of virtually any type of information. Apache Spark provides the processing framework that performs complex processing and powers machine learning algorithms on massive amounts of raw data.

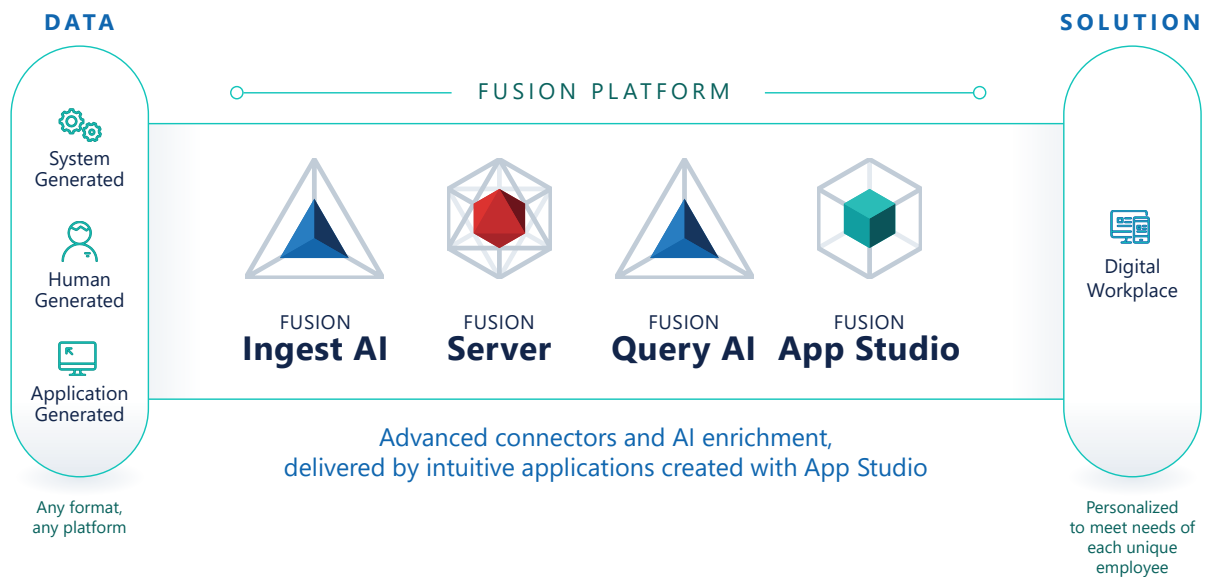
Figure 1. Lucidworks Fusion Architecture



Lucidworks Fusion weaves AI into every layer of its search architecture (refer back to Figure 1). Fusion AI applies the power of machine learning to capture signals from users and provide a hyper-personalized experience. Fusion provides support for recommendations via the aggregation of signals using machine learning and deep learning. Machine learning algorithms generate recommendations based on aggregated signals and document information, which are then applied to a set of search results from a query. Fusion provides item-to-query recommendations (improved query results), query-to-item recommendations (top queries that lead to an item), and item-to-item recommendations (e.g., “workers who read this also read that”).

Lucidworks Fusion’s signals and AI capabilities, as shown in Figure 2, connect to Solr through APIs, extending the capabilities of Fusion and making it a powerful platform for a new generation of data-driven applications. Signals and Fusion AI make search results far more relevant than a “rules based” approach. The combination of these capabilities and features provides an extremely powerful system that delivers personalized relevance and recommendations with far less manual intervention and custom coding than previous rule-based systems.

**Figure 2.** Hyper-Personalization via Fusion Signals and AI



Lucidworks Fusion makes search results personally relevant by using a combination of tools, including natural language processing, clustering and categorization, machine learning, user signals, and query rule matching. This precise relevance provides knowledge workers with exactly the information they need, at the time they need it, to make more decisions that are informed by data.

### *Recent Releases of Lucidworks Fusion*

- New NLP capabilities that leverage the popular open source John Snow library from Spark to provide entity recognition, sentence detection, and part of speech tagging for better semantic processing
- Automatic misspelling and synonym detection that maps misspellings submitted in user queries to their corrected spellings (When Fusion receives a query containing a known misspelling, it rewrites the query using the corrected spelling and returns relevant results, instead of showing the shopper nothing and asking him/her to try again.)
- Deep learning integrated with Google’s TensorFlow library, which enables Fusion to use pretrained TensorFlow models to calculate runtime predictions such as sentiment analysis within query and indexing pipelines

Fusion App Studio enables organizations to quickly create easy-to-use search and data discovery applications — delivered to web and mobile devices — for digital workers. Application designers and developers can choose from a comprehensive suite of modular components for faceted navigation, data visualization, geospatial mapping, detail pages, and topic landing pages. In addition, Fusion App Studio offers collaboration tools and workflows that allow applications to store user-generated information and to share this information among groups of authenticated users. These capabilities work together to make personalized search simple and present results intuitively so that digital workers can get the information they need and move on to the next task.



# FUTURE OUTLOOK

IDC sees several factors driving the growth of revenue in the AI applications market. These include:

- Machine learning is a key component of most AI applications. Improvements in the variety, efficiency, and reliability of machine learning will make these systems more usable and stable and help increase their popularity. New types of learning, such as reinforcement learning and generative adversarial networks (GANs), are also creating opportunities to add AI to an even more diverse array of workplace applications.
- Digitization of everything and the increase in the number of data producers are driving greater demand in data capture, management, and analysis software. IoT, consumer behavior tracking, and risk management requirements are some of the biggest factors contributing to this market driver. New sources of data are emerging both on-premises and in the cloud, leading to additional silos of information.

These trends are driving dramatic increases in the number of AI applications and tools, ranging from chatbots and conversational interfaces to predictive and prescriptive applications that offer advice and recommendations. These technologies are using machine learning to analyze data and information to drive better outcomes for digital workers. Fast access to pertinent information and “relevance” are no longer enough; AI-enabled intermediaries and hyper-personalized results are necessary to augment the human intelligence of users, improving search results and relevance for each individual. Industry leaders are now using contextual clues, machine learning, and user interaction data to provide results and recommendations in context, further personalizing the workplace experience.

AI, therefore, provides a platform for the analysis, organization, and interpretation of unstructured data. It can hypothesize and formulate possible answers to questions and searches based on available evidence. It can be trained through the ingestion of vast amounts of content and can automatically adapt and learn from previous mistakes and failures. But AI provides more than just information; it provides context about entities (people, places, and things) as well as actions and relationships. Advanced AI extends beyond intelligent search and powers applications such as speech recognition, machine translation, and text-to-speech and conversational question-answer interfaces.

Machine learning enables an organization to provide a hyper-personalized work environment to its employees. In fact, IDC believes that augmented intelligence must be part of every digital workplace. With so much data and information being generated, businesses must enable their teams to analyze and curate that data. AI will augment human decision making, automate much of the analysis and recommendation process, and provide the digital assistance that modern digital workers need.







# CHALLENGES/OPPORTUNITIES

## Challenges

For enterprise leaders to trust AI-based task automation, the logic underlying algorithms making AI-based decision recommendations must be somewhat transparent. This can prove challenging when the algorithms themselves operate in a “black box” manner: The machine learning code doesn’t know why a recommendation will work; it just knows that it will work. Today, every enterprise leader faces pressure from customers, shareholders, and regulators to define AI strategies that create value in ways that are fair, transparent, and predictable. For AI-based solutions to succeed, the decisions they automate must be explainable in simple, visual terms. Customers and regulatory agencies will demand that the owners of every AI application answer three key questions: Which decisions were aided by AI? What data was used to make those decisions? How would changing specific inputs have led to different decisions? Application developers and operators will need to explain why systems making AI-aided decisions made the decisions they did and also how to alter subsequent related decisions.

As organizations begin to implement applications and capabilities based on AI, this explainability will be a key requirement. Lucidworks Fusion already gives workers and end users intuitive tools to understand and explain how and why results were personalized for them so that they can earn the end user's trust.

Enterprises worldwide have unique business workflows. When buyers are researching the right enterprise search solution for their business, it's important that they be able to determine that the solution will meet the needs of their unique business processes and strategies. Lucidworks Fusion ships with intuitive visual interfaces that ensure that administrators and end users can do that easily. This reduces the time, cost, human effort, and risk involved in deploying and implementing digital workplace solutions.

## Opportunities

### *Attract and Retain Top Talent*

It's difficult and expensive to attract and retain smart talent that can set your organization apart. AI-based applications powered by Lucidworks Fusion can make workers more effective, engaged, and loyal, so organizations spend less time finding employees and more time praising and rewarding them.

### *Introduce AI Without Treating Employees and Customers Like Robots*

Artificial intelligence is here to stay, but most organizations still haven't learned how to introduce its efficiency-enhancing benefits while maintaining the warm, personal touch that only humans can provide. Augment human intelligence with artificial intelligence and enjoy the best of both worlds.

### *Unleash the Competitive Advantages Trapped Inside Organizational Data*

Large, complex organizations generate data as part of doing business. That data can inform better decisions provided it doesn't go into an irretrievable place to "be stored." Lucidworks Fusion's AI-powered search can turn "exhaust data" into a valuable and highly available strategic asset that organizations can turn into competitive advantage.

### *Integrate with Other Workplace Platforms*

Lucidworks Fusion offers a full range of APIs and microservices that make it a “glue” product to present contextual content within existing applications ranging from content management systems and collaboration systems to ERP and CRM tools. The opportunity to provide hyper-personalized information to digital workers using these products boosts productivity and helps speed the return on investment from those other systems.



## CONCLUSION

Over the next 5–10 years, assistive technology and AI-enabled applications will become ubiquitous. Assistive systems using AI and machine learning capabilities will be the next major disruption in the world of technology, transforming the workplace. These systems are essentially power tools for the human mind, and using them correctly will be the equivalent of hanging up the handsaw or brace and bit. Almost every discipline that uses or touches information in one way or another is a candidate for these next-generation systems, and many large technology companies are moving to include these technologies in their offerings.

Enterprises should actively consider and plan for including assistive technologies and systems such as Lucidworks Fusion within their organizations. They should also develop prototypes and pilot applications that amplify their workers' capabilities in the digital workplace.

# About IDC

International Data Corporation (IDC) is the premier global provider of market intelligence, advisory services, and events for the information technology, telecommunications and consumer technology markets. IDC helps IT professionals, business executives, and the investment community make fact-based decisions on technology purchases and business strategy. More than 1,100 IDC analysts provide global, regional, and local expertise on technology and industry opportunities and trends in over 110 countries worldwide. For 50 years, IDC has provided strategic insights to help our clients achieve their key business objectives. IDC is a subsidiary of IDG, the world's leading technology media, research, and events company.



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