Your cognitive future
How next-gen computing changes the way we live and work

Part II: Kick-starting your cognitive journey

IBM Institute for Business Value

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Where do we start with cognitive?

This is a question many leaders across industries have been trying to answer. Cognitive computing is here – and this innovative capability is fundamentally changing how individuals perform their jobs, engage and interact with others, learn and make decisions. Several pioneering organizations across industries and around the world are already leveraging its capabilities to realize significant business value. Through our research, we uncover and explore lessons learned from these early adopters. We also provide recommended steps to kick-start your organization's cognitive future and begin creating new opportunities and a first-mover advantage.

Executive summary

Cognitive computing has arrived. As it becomes ubiquitous, it has the potential to radically redefine everyday life. Cognitive also represents a new era of computing that will fundamentally change how we think about, plan for, implement and engage with information technology systems. Successful organizations will identify opportunities within their mission areas that align with the emerging capability areas of cognitive computing and adequately prepare themselves for leveraging this unique and quickly evolving capability.

Early adopters of cognitive computing capabilities include numerous organizations worldwide and across industries, such as healthcare, life sciences, government and banking. Valuable lessons can be learned from these cognitive pioneers, including critical success factors and the impact and implications of this next-generation capability on an organization's people, processes and policies. Based on lessons learned from subject matter experts (SMEs) who have led early cognitive computing solution implementations, we have identified three keys to a successful implementation, as well as four recommended steps for kick-starting and accelerating your organization's cognitive journey.

This is the second in a series of reports from the IBM *Your cognitive future* research study. In the first report, "Your cognitive future: The evolution of cognitive," we explored how cognitive computing has evolved and how we expect it to continue to evolve in the future, as well as the forces likely to impact future advancement and adoption rates. In this report, we explore how organizations can prepare to take advantage of this innovative and exciting capability. Future reports in the series will take deeper dives into select industries and explore opportunities for cognitive to push new boundaries for innovation and growth.

Three key considerations to improve your cognitive ROI

Three foundational capabilities for a successful cognitive journey

Three crucial pieces of advice for managing change on your cognitive journey

Four steps to kick-start your cognitive journey

Lessons learned from cognitive computing pioneers

While computing capabilities and limits continue to evolve, many of the fundamental success factors never change. In terms of system implementation and user interaction, cognitive systems are fundamentally different than the traditional programmable systems to which most users are accustomed.[1] There is often a learning curve as organizations begin to understand this fact and determine how to best apply this new capability. Our interviews with SMEs from pioneering organizations that implemented cognitive computing solutions revealed three factors critical to a successful implementation.

1 Define the value

2 Prepare the foundation

3 Manage the change
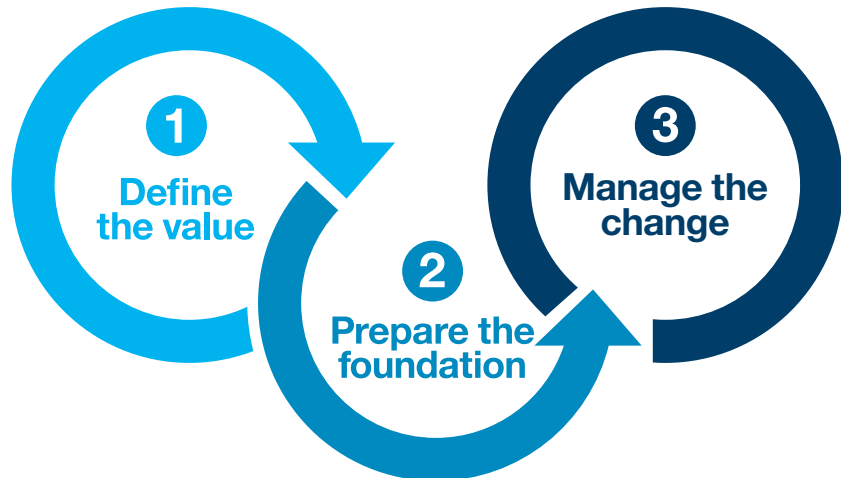
1. Define the value

Cognitive computing is a journey, and early planning helps ensure the greatest return on investment. Defining the value of cognitive to your organization is critical and includes several steps:
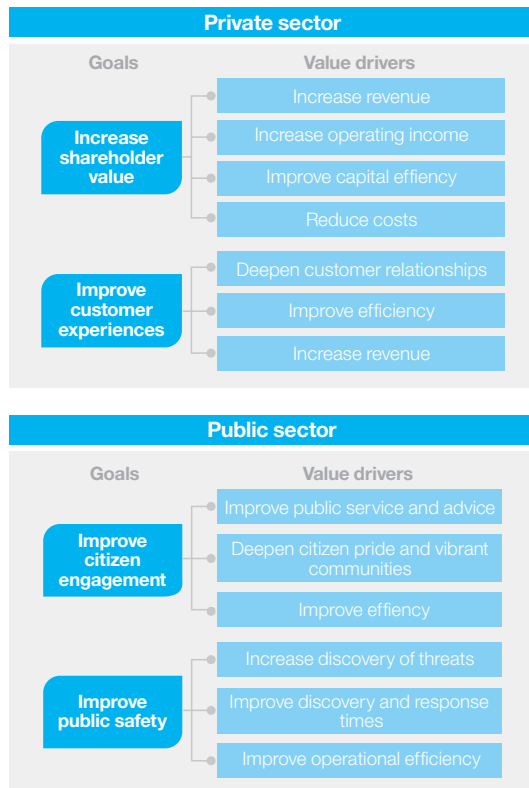
Find the right opportunity – Cognitive solutions are well suited to a defined set of challenges and not necessarily the best fit for every business problem and use case. Organizations need to think through the problem to determine if a cognitive computing solution is the right fit. Opportunities should be evaluated based on the unique capabilities of cognitive systems. Potentially high-value opportunities include:

- Business scenarios involving a process or function that today takes humans an inordinate amount of time to seek answers and insights from various information sources (i.e., corpus) to make a decision or think through a problem. This might include processes for analyzing clinical data to develop novel medical treatments or analyzing unstructured data from multiple sources in complex law enforcement investigations.

- Situations where there is a question and answer (Q&A) requirement that would require users to interact and ask questions posed in natural language. This might include complex customer engagement scenarios that require deeper understanding and insights beyond question and answer responses provided by traditional programmable customer response systems.

- Processes or functions that require transparency and supporting evidence for confidence-weighted responses to questions and queries. This might include patient diagnosis and treatment decision-making processes or advice based on interpretation of complex policy, regulatory or legal frameworks.

"USAA chose the topic of military separation for its first foray into the cognitive computing space because it provides a singular focus with a finite audience… More importantly, it will enable USAA to provide relevant guidance during one of the most emotional and financially impactful decisions our military members will make during their career."[2]

Eric Engquist, Assistant Vice President of Military Transitions, USAA

Figure 1
Example business goals and value drivers enabled by cognitive systems

Private sector		
Goals	**Value drivers**	
Increase shareholder value	Increase revenue	
	Increase operating income	
	Improve capital effiency	
	Reduce costs	
Improve customer experiences	Deepen customer relationships	
	Improve efficiency	
	Increase revenue	

Public sector		
Goals	**Value drivers**	
Improve citizen engagement	Improve public service and advice	
	Deepen citizen pride and vibrant communities	
	Improve effiency	
Improve public safety	Increase discovery of threats	
	Improve discovery and response times	
	Improve operational efficiency	

Define the value proposition and chart a course for cognitive – The differentiated value provided by cognitive computing solutions must be understood and the business value defined up front. Solutions should be mapped to an organization's business goals and the associated value drivers they support and enable. A cognitive computing vision and roadmap with executive level support and an executive sponsor is absolutely critical. Ongoing roadmap progress reviews with the executive sponsor and key stakeholders at all levels are equally important in making the vision a reality.

Track the value – The benefits of cognitive computing systems are not realized in a single "big bang" at the time of initial deployment. Rather, these systems are evolutionary by nature and, as such, improve and deliver increasing value over time. This must be understood by stakeholders at all organizational levels and accounted for in benefits realization plans. Deploying cognitive computing solutions to a subset of trusted users who truly understand their evolutionary nature is highly recommended. This approach allows organizations to test and verify that initial users see and realize benefit before deploying to a larger group. Members of this trusted user group can also be leveraged as "ambassadors" for the solution when it is deployed more broadly.

2. Prepare the foundation
There are several foundational capabilities critical to the development and deployment of a successful cognitive computing solution. Preparing the foundation requires focus and investment in the following areas:

Invest in human talent – Cognitive solutions are "trained," not programmed, as they "learn" from interactions, outcomes and new pieces of information. This training process is often referred to as supervised learning. Cognitive systems are reliant on humans with domain-specific expertise (e.g., industry profession, scientific discipline) to train them and define Q&A pairs for the system to learn. This supervised learning requires a commitment of time and resources, including an investment of SME time. Domain SMEs must be embedded and integrated with the technical team during implementation to inform on unique aspects of the organization's mission, processes, systems and data.

In addition to domain expertise, technical skill sets that may be required include expertise in natural language processing; machine learning; database administration; and systems implementation and integration, interface design and change management. Organizations should evaluate their accessible talent base (i.e., those skills available within their existing direct workforce and other partner organizations). If they discover these critical skills are absent or insufficient, strategies to acquire or gain access to individuals with these skill sets might include use of external partners or vendors. In addition to these technical and domain-specific skills, there is also an intangible skill set required for team members: intellectual curiosity. Human team members must be willing to explore and learn just as the system does.

Build and help ensure a quality corpus – Investing adequate time in selecting data to be included in the corpus is critical. A data corpus may include structured and unstructured data from multiple databases and other data sources (e.g., spreadsheets) and even real-time data feeds and social media. Data will likely emanate from new and untapped internal and external sources (e.g., call center recordings, blogs, engineering reports, market research).

"It [a cognitive system] cannot ingest information on its own. We need humans to train it on a particular domain."

Grady Booch, IBM Fellow and Chief Scientist for Software Engineering, IBM Research

Organizations must define the solution expectations and requirements and then define the "sufficient observation space" necessary to meet them. The quality of the data corpus will determine both the robustness of the solution and the time required to implement. Assessing the observation space requires skilled resources and knowledge of enterprise data sources. A common reason many organizations struggle with business analytics is that they do not have sufficient data available to support the decisions they are trying to make. Expanding the observation space (i.e., incremental data) to build a quality corpus may require increased partnering and changes to policy.[3]

Consider requirements and impacts on processes and policies – Understanding implications on existing dependent processes and policies is imperative. The way users interact with cognitive systems is entirely different than the way they interact with traditional input/output systems. As such, these systems may disrupt existing processes and or fundamentally transform the way work is performed by domain users. Obtaining the data necessary to build a quality corpus may test the boundaries of existing data-sharing policies and require new or modifications to existing policies, regulations and agreements. Additionally, there may be requirements for entirely new policies in response to advancements in cognitive capabilities. For example, in the case of machine autonomous decision making, policies addressing the traceability of the decision-making process may need to be established to address potential scrutiny related to how a decision was made.

3. Manage the change
Investments in change management resources and activities are often the first to be chopped in attempts to reduce costs in IT system implementations. As previously stated, these are not your traditional programmable systems. As such, change management is more critical than ever!

SMEs who have lived through cognitive computing implementations offer three key pieces of advice relating to change management activities:

Ensure executive involvement in the cognitive journey – Executives must be involved throughout the entire cognitive journey. Executive involvement should begin with active participation in defining the cognitive vision and roadmap for the enterprise. This involvement must then continue on an ongoing basis through active and engaged participation in regular reviews of incremental progress and value realization. This active and ongoing executive involvement is critical to maintaining momentum.

Communicate the cognitive vision at all levels – Cognitive computing is new and will not be completely understood by most individuals in the organization. As such, regular communication at all levels is critical. Address any fears, uncertainties and doubts head on. Executive sponsors should be leveraged to spearhead communications and reinforce the value of cognitive to the organization's mission.

Continue to raise the cognitive IQ of the organization – Education on this new technology is critical to help ensure it is understood and adopted by users. Of particular importance is effective management of expectations related to system-generated recommendations. Cognitive systems are probabilistic and not deterministic. The accuracy rates of these systems will improve as they learn over time. Improving the accuracy rates of system recommendations is one of the greatest challenges of implementing a cognitive computing solution. The reality is that a system will never achieve an accuracy rate of 100 percent. As such, stakeholders should be educated early on about accuracy rates, and regular reviews should be conducted on incremental improvements.

"The traceability of the machine recommendations (i.e., why a recommendation was made) will be important in fostering confidence and trust."
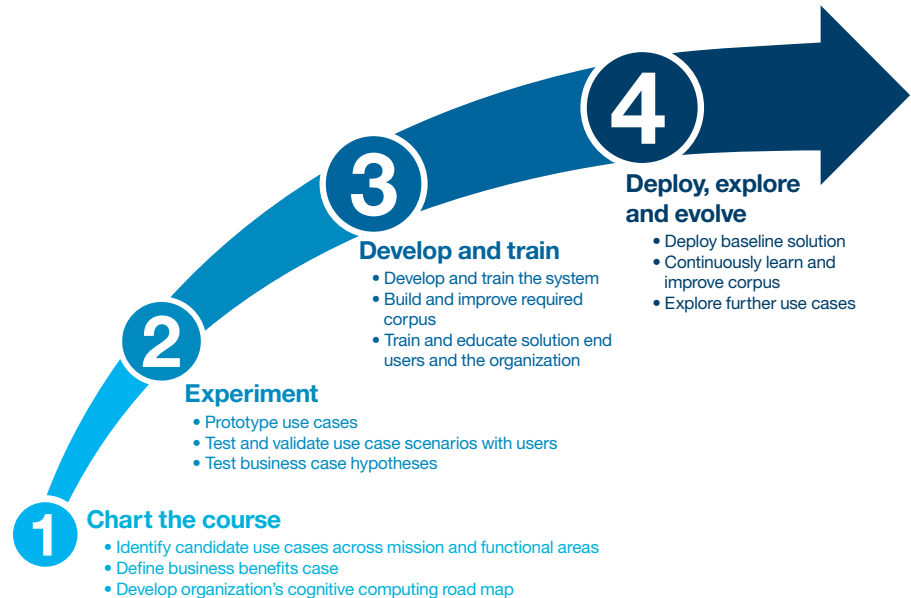
Dr. Francesca Rossi, Professor of Computer Science, University of Padova and Harvard University

Envisioning and jump-starting your cognitive future

The opportunities for cognitive computing are compelling. We offer four recommended steps for moving forward based on the valuable insights and lessons learned from pioneering early adopters. As an organization moves toward a cognitive future, it's important to remember that cognitive computing is a journey – and that journeys evolve over time. This guiding principle should be constantly reinforced within the organization. As such, underpinning all of these steps is an active change management strategy and plan.

Figure 2
Four recommended steps for moving forward with your cognitive journey

4

Deploy, explore and evolve
- Deploy baseline solution
- Continuously learn and improve corpus
- Explore further use cases

3

Develop and train
- Develop and train the system
- Build and improve required corpus
- Train and educate solution end users and the organization

2

Experiment
- Prototype use cases
- Test and validate use case scenarios with users
- Test business case hypotheses

1

Chart the course
- Identify candidate use cases across mission and functional areas
- Define business benefits case
- Develop organization's cognitive computing road map

Step 1: Chart the course for your organization's cognitive journey

Every successful journey starts with a clearly defined strategy and plan. This step includes the following:

Identify candidate use cases – Candidate use cases should be identified across your organization's enterprise mission and functional areas. These use cases should consider the potential opportunities enabled by the three emerging capability areas for cognitive computing systems:

- *Engagement* – These systems fundamentally change the way humans and systems interact and significantly extend the capabilities of humans by leveraging their ability to provide expert assistance and to understand.
- *Decision* – These systems have evidence-based decision-making capabilities and decisions continually evolve based on new information, outcomes and actions.
- *Discovery* – These systems can uncover insights that perhaps could not be discovered by even the most brilliant human beings by finding insights and connections and understanding the vast amounts of information available around the world.

Identifying candidate use cases will also entail identifying target processes to be disrupted with cognitive solutions.

Define the business benefits case – This includes identifying, developing and testing benefits hypotheses for various use cases selected. This also entails defining key metrics to track the value of each use case.

Develop your organization's cognitive computing roadmap – This includes a definition of the target cognitive computing solutions to address priority use cases selected and committing to a strategy. The organization's roadmap should also include a clearly defined change management strategy addressing plans for governance, organizational communications and benefits tracking.

Step 2: Experiment to validate your organization's cognitive strategy
Innovation requires experimentation. This step is focused on testing and validating your organization's cognitive use cases through prototyping. The purpose of developing a prototype is to allow users to see what the end state of their developed use case could look like using visual design treatments and focusing on the workflow for the use case scenarios. This is a critical step in validating and refining use cases, increasing user understanding and gaining buy-in, and further testing the underlying business case hypotheses.

Step 3: Develop your solution and train "the team"
With a cognitive vision and strategy clearly defined and vetted with key stakeholders, it's now time to begin implementation. Step three is where the real work begins and where investments in human resources and the core technology are required. The focus of this step is developing the solution around the priority use cases(s) defined in the previous steps and training both the system and the users. Investments will be driven by the requirements and analysis conducted in these prior steps. As previously discussed, the system training process is ongoing and will continue well after the initial deployment.

Step 4: Deploy the solution and continue to evolve your organization's cognitive capabilities

Deployment of your organization's cognitive computing solution is just a celebratory port-of-call on your overall journey. Once the solution is deployed, even greater learning can begin – for both the system and the solution users and stakeholders. Step four includes deploying the solution into your organization's operations, continuous learning (for both the system and the system's users and stakeholders), continuous improvement of the corpus, further evolution of the system and domain processes, and exploration of further use cases for the application of cognitive computing in your organization. As discussed previously, continuous tracking of business benefits and accuracy levels of the solution is critical to assess and evaluate progress against key metrics. This must be an ongoing activity over the life of the solution.

Ready or not? Ask yourself these questions

- What opportunities exist to create more engaging and personalized experiences for your constituents?

- What data aren't you leveraging that – if converted to knowledge – would allow you to meet key objectives and business requirements? What is the cost to your organization associated with making non-evidence-based decisions or not having the full array of possible options to consider when actions are taken?

- What benefit would you gain in being able to detect hidden patterns locked away in your data? How would this accelerate research, product development, customer services and the like?

- What is your organizational expertise skill gap? What would change if you could equip every employee to be as effective as the leading expert in that position or field?

- How will your organization leverage strategic partners to implement cognitive solutions?

Cognitive computing has the potential to provide significant business and economic value to organizations across industries. Stay tuned for the next in the series of reports from the IBM *Your cognitive future* study, where we will take deeper dives into select industries and explore opportunities for this innovative capability to push new boundaries for growth and competition.

Study approach and methodology

In the summer of 2014, the IBM Institute for Business Value initiated a study focused on addressing three questions related to cognitive computing:

1. What is the current state of cognitive computing and how is it expected to evolve?

2. What lessons can be learned from pioneering organizations that have implemented cognitive computing solutions across various industries?

3. What are the key strategy and planning considerations and what steps can leaders take to make cognitive computing a reality in their organization?

To address these questions, we conducted interviews with dozens of global subject matter experts (SMEs) in various areas related to the emerging field of cognitive computing. SMEs included members of industry with experience in implementing real-world cognitive computing solutions across multiple domains (e.g., program executives and technical leaders of cognitive computing system implementations) and members of industry and academia focused on cognitive computing research and development across multiple research areas (e.g., professors of computer science at leading universities, members of the Association for the Advancement of Artificial Intelligence [AAAI]). Interviews focused on gaining insights on the future of cognitive computing and the forces likely to impact the direction of this technology, as well as harvesting lessons learned from real-world systems being implemented by pioneering organizations.

About the study executive leaders

Jay Bellissimo is the General Manager of Watson Transformations in IBM's Watson Group. Jay is responsible for helping drive the next era of computing – cognitive computing – by creating markets, transforming industries and helping clients explore new business models to take advantage of the many benefits of cognitive computing. He can be reached at joseph.bellissimo@us.ibm.com.

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Notes and sources

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For more information

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