

The Cognitive Enterprise: Envisioning the Business of the Future

By William Ulrich

In his book, The Design of Business, Roger Martin said that “Innovation is about seeing the world not as it is, but as it could be.”¹ One aspect of seeing the world as it could be involves reenvisioning organizations and how they maximize customer value, engage the ecosystem in which they operate, and ultimately thrive. This paper introduces the concept of the cognitive enterprise, which calls for rethinking the nature of how we represent organizations, how they work, and how they might evolve. The discussion that follows outlines the cognitive enterprise vision and its role in furthering the universal goal of business strategy execution.

What is the Cognitive Enterprise?

The “cognitive enterprise” describes a business that learns, adapts, and scales on an evolutionary basis. The cognitive enterprise seeks to achieve a deep and expansive understanding of its capabilities, internal and external stakeholders, stakeholder value proposition, and the business ecosystem in which it operates.² Cognitive enterprise scenarios span business ecosystems, extending well into partner and customer domains. Consider, for example, the following scenarios that manifest within a cognitive enterprise.

- Customer preferences, derived through a point of engagement within one division, inquiry, or product purchase, are captured and immediately reflected across all business units
- A virtual product manager conceptualizes and designs a new and unique product that automatically considers and aggregates related products that share similar capabilities, reframing entire product suites in the process
- A virtual program manager identifies cross-project impacts for proposed and inflight initiatives across business units, producing an optimized set of recommended project-oriented investments, sequenced based on strategic priorities and interdependencies

The above scenarios offer a brief glimpse into what a cognitive enterprise may look like and how it might perform, but there is much more to the story.

Cognitive Computing: The Engine Behind the Cognitive Enterprise

The technological foundation for the cognitive enterprise involves the concept of “cognitive computing”. In his book, *Cognitive Computing*, Peter Fingar states that “Cognitive computing systems learn and interact naturally with people to extend what either humans or machines could do on their own.”³ He provides vivid examples of how this cognitive shift is already underway and keen insights as to where businesses are headed in the not too distant future.

Cognitive computing concepts may be applied to a business ecosystem in aggregate, framing the underlying technology foundation for the cognitive enterprise. As Fingar explains it, “Cognitive computing systems get better over time as they build knowledge and learn a domain. Unlike expert systems of the past that required rules to be hard coded into a system by a human expert, cognitive computing systems can process natural language and unstructured data and learn by experience, much in the same way humans do.”⁴

A number of cognitive computing examples exist in practice and will continue to expand over time. Fingar cites the emergence of IBM's Watson and its growing role in areas such as healthcare, customer service, finance, and insurance. He further notes the work by IBM's Cognitive Systems Institute⁵ and its efforts to boost the performance of groups of workers engaged in collaborative tasks and decision making, an area in which the mass of workers across all industries engage on a daily basis.

Cognitive computing is comprised of a cross-section of technologies, a number of which are cited by Curt Hall in a Cutter paper titled "What Is Driving Cognitive Computing?".⁶ Hall states that "Cognitive computing refers to a class of systems that can learn at scale, reason, and interface with humans in a manner more in tune with the way people interact with one another." The underlying technologies and related design concepts that bring cognitive computing into reality include artificial intelligence (AI), rules-based solutions, state machines, neural networks, predictive analytics, quantum computing, and more traditional and emerging options. This partial list of smart technologies is expanding and maturing, meaning that the technology needed to enable cognitive computing is ready to be leveraged by organizations in the position to do so.

Applying cognitive computing to a business ecosystem is by no means farfetched, with the concept of the cognitive enterprise evolving in theory and in practice. In her book *Serious Games for Business*⁷, Phaedra Boinodiris discusses using gamification, which applies elements of game playing to other disciplines and activities, to more fully engage customers, employees, and partners. Coupling cognitive computing with game theory, including simulations, advances key aspects of transforming an organization into a cognitive enterprise.

As organizations explore cognitive computing technologies, they must also face the reality that their businesses rely on a large installed base of legacy systems. These systems, based on earlier generations of technologies and techniques, often lack the rigor that formal AI and rules-based systems demand. In addition, architecturally, legacy systems paint an opaque picture of a business, characterized by redundancies, inconsistencies, and gaps in what an organization does.

While problematic, these systems are symptomatic of the disjointed nature of many organizations, where shared perspectives on terminology, what the business does, and how it delivers customer value are missing entirely. These opaque business perspectives, even more than the presence of the legacy systems they spawned, create roadblocks to achieving the cognitive enterprise vision. In other words, cognitive computing technologies alone, while important, are not enough to transform an organization into a cognitive enterprise.

Becoming a Cognitive Enterprise: The Transformation Journey Ahead

As exciting as cognitive computing ideas sound, the concept of the cognitive enterprise remains out of reach for many organizations. Most organizations are ill prepared to jump into this advanced realm of cognitive self-awareness because basic understandings of core business concepts, including cross-business vocabularies, capabilities, and stakeholder value perspectives, are at best opaque and, at worst, highly redundant, inconsistent, and conflicted.

As cited in a recent BrightTALK on crisis management, organizations find it difficult to name and define, let alone locate, all instances of and interrelations across customers, financial accounts, agreements, assets, and other critical business perspectives.⁸ Comparing and contrasting the lack of organizational self-awareness described in this crisis management discussion with the aforementioned cognitive enterprise

scenarios highlights the long journey ahead for organizations aspiring to become a cognitive enterprise.

The ability to organizationally deploy and scale the scenarios proffered at the beginning of this report is beyond the reach of the average business because most organizations lack a viable foundation for establishing a learning, evolving cognitive enterprise. The basic building blocks are missing from the puzzle. Yet some may argue that good technology is enough to transform a business into a cognitive enterprise.

Assume that an organization adopts and optimizes cognitive computing that learns, adapts, and engages automation concepts that are currently available and continuing to evolve. What will be the target of automation in such a scenario? The logical answer for many businesses would be customers, agreements, partners, assets, products, orders, workers, policies, channels, and related perspectives that expand based on a given business model. Companies similarly require rationalized views of financial transactions, financial accounts, investments, currency, payments, and monetary value. Additional targets include work items, decisions, states, and events. Vertical industry sectors, such as transportation, would additionally require rationalized views of shipments, conveyors, trips, and routes, whereas healthcare companies would need shared views of conditions, devices, symptoms, patients, and visits.

Shifting perspective from one business unit to another, one discovers that common and ideally interconnected business perspectives are inconsistently defined, often conflated, or barely implied. For example, try to find the concept of a legal contract in today's business or computing environments, or ask different individuals what they consider to be an account, product, asset, or even a customer. The inconsistencies and gaps often discovered across a business ecosystem are astounding.

If an organization cannot create a rationalized abstraction of its business ecosystem, including how it delivers customer value, then cognitive computing solutions will continue to reflect the redundant, disjointed business perspectives plaguing organizations today. Transforming that organization into a cognitive enterprise will remain out of reach because it will be repaving the well-worn "cow paths" of the past instead of building upon the business transparency of the future.

Achieving Cognitive Computing through Business Building Block Redeployment

To capitalize on cognitive computing and achieve the goal of becoming a cognitive enterprise, organizations require a unifying perspective that reframes and clarifies highly redundant, disconnected, and disjointed business perspectives. Specifically, the cognitive enterprise requires a rationalized understanding of what an organization does and how it delivers stakeholder value. Business architecture establishes the highly rationalized perspective needed to make the cognitive enterprise a reality.

Business architecture is a business discipline that delivers business ecosystem-wide transparency as a means of optimizing strategy execution. Business architecture exposes cross-divisional, global touch points among customers, partners, products, policies, initiatives, value delivery perspectives, and capabilities through a common lens. A well-articulated business architecture enables all planning and operational delivery teams to share a common understanding of the business.

Business architecture makes it easier to spot bad ideas and avoid bad investments while enabling faster react-and-response time to address customer demands, competition, risks, and crises. Just as important, articulating an organization's business architecture lays the foundation for leveraging technological innovation, including cognitive computing technologies.

Every organization has, at its core, a set of basic building blocks that makes it both unique and successful; we call these building blocks the “business DNA”.⁹ Over time, these building blocks become fragmented, replicated, and less transparent. This creates a situation where the organization functions as a collection of fragmented, disconnected parts, which undermines the customer experience, the ability to adapt to market conditions, and strategy execution on the whole. Consider the building block example in figure 1.

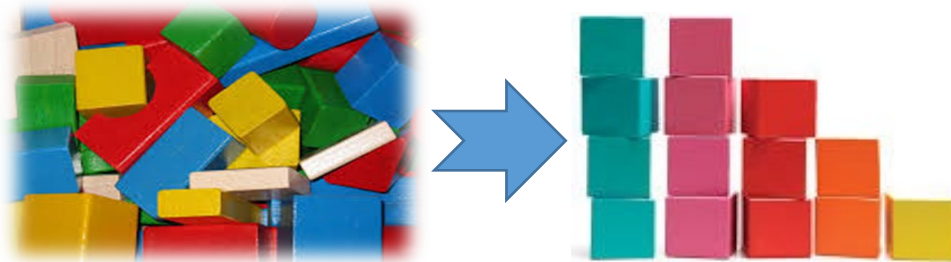


Figure 1: Disambiguating Business Building Blocks: Establishing a Cognitive Enterprise Baseline

The left side of figure 1 represents a business that has a disjointed, opaque understanding of itself, undermining the optimization of stakeholder value delivery, regulatory compliance, innovation, digital transformation, and a host of other core strategies. The right side of figure 1 represents an ecosystem-wide, highly transparent view of customers, financial accounts, agreements, partners, products, assets, and other essential business objects and interrelationships. The clearly defined set of building blocks to the right allows a business to work as a cohesive whole to deliver external and internal stakeholder value, maximizing technologies in new, innovative ways, while making the business more agile along the way.¹⁰ While business unit boundaries are recognized through organizational perspectives, those boundaries no longer deter management, planning, operations, and delivery teams from seeing the big picture.

In business architecture terms, these building blocks are called “business objects”. Decomposing a business ecosystem into business objects breaks down a business into its most fundamental elements. Every business, large or small, regardless of being in the private or public sector, can be decomposed into a well-defined, rationalized set of business objects. These business objects serve as a basis for establishing a set of business capabilities that articulate what the business does. A capability is simply a representation of an action against a business object, such as “Customer Preference Determination”.

Capabilities are one critical aspect or “domain” of business architecture, but by no means the only domain. When coupled with value streams, information, organization, strategy, initiatives, products, and stakeholders, capabilities form the foundation for enabling or addressing a variety of business scenarios, transformational or otherwise. In a nutshell, business architecture, with capabilities at its core, is the means of ensuring successful, repeatable strategy execution. The cognitive enterprise excels at rapid, effective, and highly coordinated end-to-end strategy execution.

Two points require clarification at this juncture. First, disambiguating business capabilities has nothing to do with organizational structure, although management may wish to make appropriate changes once business unit redundancies are exposed. A second point of clarification involves business processes; business architecture is not engaged in business process improvement, although businesses may pursue such efforts in parallel to streamline operating model performance. To the contrary, business architecture focuses on strategy execution and optimizing stakeholder value delivery. Performance improvements would certainly be a side effect as outlined in the aforementioned cognitive enterprise business scenarios.

Business Architecture as a Foundation for the Cognitive Enterprise

Before considering the role of business architecture in advancing an organization towards becoming a cognitive enterprise, it is important to bear in mind that every business has a business architecture; it just may not have been formally articulated. Figure 2 depicts the Business Architecture Framework™ from the Business Architecture Guild®, which offers a snapshot of how business architecture is used to frame a business and address various business scenarios.¹¹

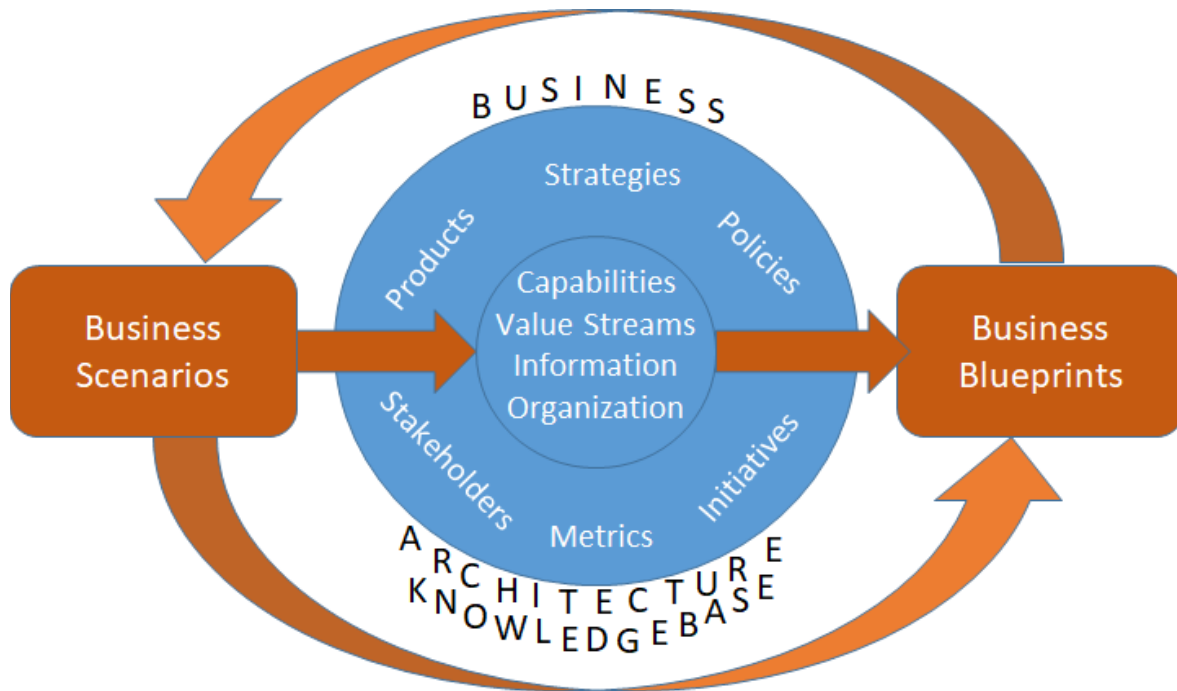


Figure 2: Business Architecture Framework¹²

The business architecture framework in figure 2 represents core business architecture domains, including capability, organization, information, and value streams, and extended business architecture domains, representing policy, strategy, stakeholders, products, and initiatives. Business metrics are another view into the business and included in the framework. Extended domains, when linked to core domains, form the foundation for end-to-end strategy execution.

The business architecture framework highlights the ability to extract various views or blueprints from the business architecture knowledgebase to enable a wide variety of business scenarios, as shown to the left. The business architecture knowledgebase is an essential aspect of establishing the cognitive enterprise as it contains all domains and relationships among those domains for a given business ecosystem.

For example, when a strategic planning team wants to envision the cross-impacts of a given set of business objectives, the objectives are added to the knowledgebase and cross-mapped to value streams and capabilities, at which point the ripple effects on information, business units, stakeholders, products, policies, and initiatives become obvious. The knowledgebase and views into the knowledgebase are readily extensible to highlight technology, requirements, process, or other operating model impacts. Most important is the fact that well-articulated, highly rationalized knowledgebase content, which evolves incrementally over time through use, forms the foundational business perspective needed to position the organization for evolving into a cognitive enterprise.

The Cognitive Enterprise: Foundation & Applications

Many organizations have launched efforts to apply cognitive computing technologies to predictive modeling, sentiment analysis or opinion mining¹³, facial recognition, medical diagnoses, speech recognition, fraud detection, high-speed trading, and many other areas. These applications tend to be consumer oriented to offer better services to customers. The interesting aspect of many of the companies employing these customer-facing applications of AI is that they are unlikely to have employed this same degree of intelligence to strategy execution.

Examples abound of opaque customer, partner, product, agreement, and related business perspectives undermining customer experience, stalling delivery of new products to market, or creating scenarios where hundreds of people are doing the same thing, oblivious to the potentially counterproductive efforts of their peers. Figure 3 highlights a number of business concepts that, when coupled with cognitive computing, enable the six cognitive enterprise scenarios to the right.

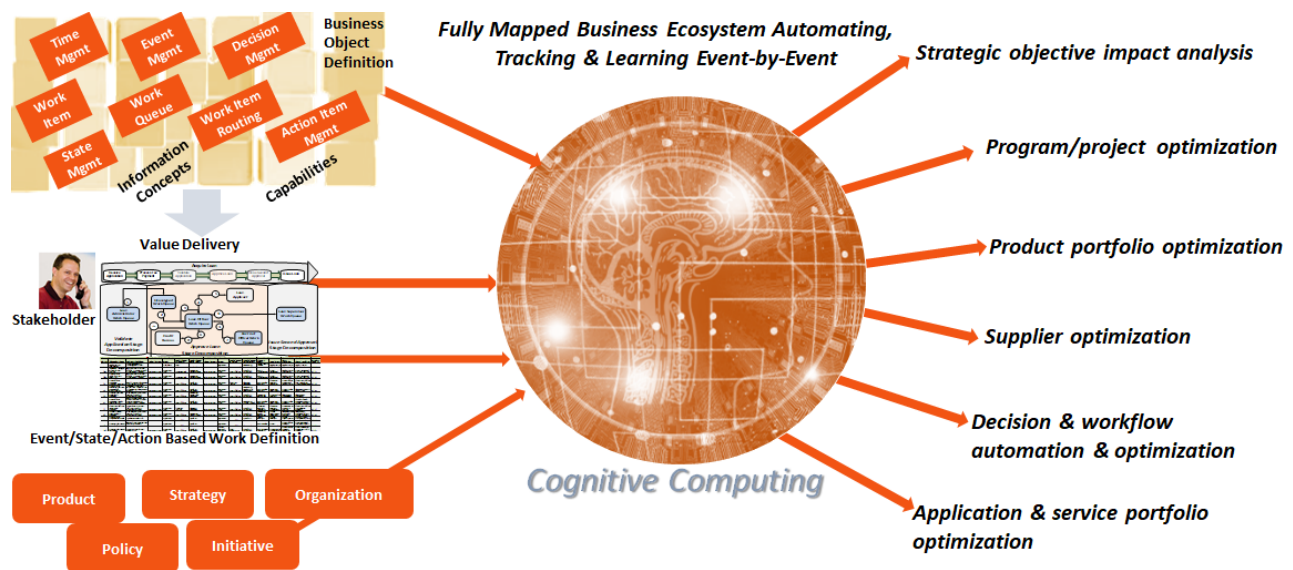


Figure 3: Fully Mapped Business Ecosystem Establishes Baseline for the Cognitive Enterprise

The baseline concepts to the left side of figure 3 represent additional details that build upon the business architecture foundation. One aspect of the capability map that is often underarticulated by organizations involves work management capabilities. Defining work management capabilities in a capability map is essential to establishing a foundation for the cognitive enterprise, as well as providing a business perspective that can be leveraged by today's technology teams. The upper left side of figure 3 identifies capabilities that include work item, work item routing, work queue, event, state, decision, time, and action item management. Work management capabilities provide the foundation for the scalable modeling of business states, decisions, and events.

The left side of figure 3 highlights how these work-related capabilities would be employed using another key business architecture domain; the value stream. End-to-end value streams establish a value-centric set of containers for encapsulating work, as enabled by the aforementioned work management capabilities. Figure 3 further depicts how value stream stages frame work items, work queues, work item routing, events, state transitions, and decisions as articulated in the dynamic rules-based routing map.¹⁴

In practice, organizations use the dynamic rule-based routing map to specify state, event, and rules-based software solutions, an approach that differs dramatically from the process-oriented modeling techniques that have historically dominated businesses and information technology (IT) development. State, event, and rules-based perspectives also happened to align more readily to cognitive computing. State machines and event-based programming are already in use in robotics and other intelligent technologies. Business architecture allows an organization to frame its business ecosystem and related requirements in a state, event-based business paradigm that is more readily understood and translated into traditional software solutions near-term and cognitive computing technologies long-term.

The third aspect shown in figure 3 highlights business architecture's incorporation of strategy, product, organization, stakeholder, and policy. Maximizing business architecture's value proposition requires engaging aspects of the business that play a direct role in strategy execution as well as improving the customer experience. Businesses are benefitting from business architecture's use today in these areas but incorporating the overall set of business domains into the cognitive enterprise ensures that business value is maximized when coupled with cognitive computing technologies.

The right side of figure 3 provides six sample scenarios that highlight high profile targets of the cognitive enterprise vision. These scenarios are summarized as follows.

1. Strategic Objective Impact Analysis: Business architecture's main value proposition is enabling strategy execution and the cognitive enterprise expedites rapid impact analysis across a business ecosystem to expedite strategy realization. The business architecture knowledgebase provides the connected perspectives required to simulate what happens when one objective and related action items are selected over others. AI-based simulations, leveraging the business architecture knowledgebase, expedite and improve the reliability of business impact analysis beyond the ability of traditional analysis techniques.¹⁵ Simulating business objective impact analysis exposes unworkable ideas quickly while providing more realistic insights into the complexity and costs of high priority objectives.
2. Program/Project Optimization: In spite of all of the work around project management, program management, and deployment methodologies, challenged and failed projects remain the norm. While there have been some improvements over the decades, successful projects are achieved less than 30% of the time according to 25 years of data.¹⁶ The culprit is often inadequate scope and impact analysis based on a lack of business transparency. The cognitive enterprise would employ a virtual program manager that leverages the business architecture knowledgebase to ensure that the real impacts of strategic objectives are incorporated into program and project definition. A virtual program manager would assist human planning efforts to expose business ecosystem impacts of proposed programs, highlight cross-program impacts, and ensure that a fully coordinated set of programs are deployed where teams can define and stay within their lanes, while ensuring that cross-program coordination is not left to trial and error.
3. Product Portfolio Optimization: Product planning is often done by multiple managers across multiple business units with little insight into other planned or deployed products, capability dependencies, and related automation deployments. In a cognitive enterprise, a virtual product manager would leverage business architecture to deliver a rapid assessment of overlapping products across product lines and business units for proposed and existing products. The business architecture knowledgebase incorporates this perspective through a technique called product mapping, which links products to

enabling capabilities. A virtual product manager would examine a cross-section of product, capability, stakeholder, business unit, information, and other views to provide recommended product options and cross-product consolidation and alignment. The virtual product manager would also deliver rapid assessment of technology impacts based on business-to-IT architecture cross-mappings.

4. Supplier Optimization: One often overlooked aspect of business architecture is that it looks at an ecosystem from an outside-in as well as an inside-out perspective, which means that all third-party touchpoints are highlighted through a combination of value stream and stakeholder cross-mapping. Stakeholder engagement includes all customer, partner, and internally directed human resources where a given stakeholder may be a partner in one scenario and an internally directed human resource in another scenario. This frame of reference, coupled with cognitive computing technologies, enables “what if” simulations to optimize, maximize, or modify partner-related, stakeholder engagement.
5. Decision & Workflow Automation & Optimization: The previously introduced work management capabilities and event and state decompositions, a natural outgrowth of business architecture, establish a strong foundation for reevaluating how work is performed to enable stakeholder value delivery. When value stream, capability, and stakeholder mappings are cross-mapped and coupled with dynamic rules-based routing maps, it allows organizations to envision workflow and work automation in highly formal ways. Optimized work management perspectives help surface opportunities where automation can take up the role of a given stakeholder and provides the added benefit of highlighting the state and event-based work that can be taken over by cognitive computing technologies, including robots. The absence of these value-centric cross-business perspectives will continue to lead organizations to invest in “cow path repaving”, spending more while gaining less in return.
6. Application & Service Portfolio Optimization: Experience to date highlights two interesting factors. First, the number of technology deployments per capability is very high, where, for example, agreement management may be replicated and fragmented across hundreds or thousands of technology deployments. A second finding is that many capabilities lack automation entirely. The combination of these and related factors is called “business/IT alignment debt”. The cognitive enterprise would leverage an expanded business architecture knowledgebase, linked to IT architecture, as a basis for highlighting business/IT alignment debt and aligning strategy execution with improved technology deployments that reduce debt and improve the overall value and return on technology investments. This scenario should be of strong interest to organizations looking to maximize the value of IT investments while concurrently seeking to shrink their IT portfolio footprint.

The above scenarios highlight key aspects of strategy execution that are transformed in the cognitive enterprise but these scenarios are by no means the only areas of opportunity. The cognitive enterprise will also see improved risk reduction, more effective crisis management, streamlined agreement, financial account, acquisition, and fulfillment management, improved customer experience, and a wide range of other benefits. In addition, laborious and often misdirected requirements definition and interpretation will see dramatic advancements based on highly transparent business ecosystems combined with cognitive computing technologies. Ultimately, most aspects of strategy formulation through strategy realization will see improvements in the cognitive enterprise.

The Cognitive Enterprise's Incremental Shift: Re-architecting Technology Solutions

Transitioning to a cognitive enterprise requires understanding the current state of an organization's technologies and establishing a roadmap and measurable milestones along the way to make that transition. Moving towards a cognitive enterprise is a good example of the journey being the reward.¹⁷ This viewpoint is not meant to diminish the ultimate goal, but to highlight that significant value is achieved along the way. One part of this journey involves incrementally improving the business value of IT investments, driven by business strategy.

Business architecture plays an important role in helping organizations define the target state IT architectures necessary to move them towards a cognitive enterprise while reducing business/IT alignment debt along the way. Figure 4 depicts a business and IT transformation perspective where business strategy is viewed through value streams, capabilities, and information, which in turn are used to frame and specify target state IT architecture on the right. Capabilities play an important role in helping the IT organization specify rationalized, reusable software services and microservices¹⁸, a widely held goal.

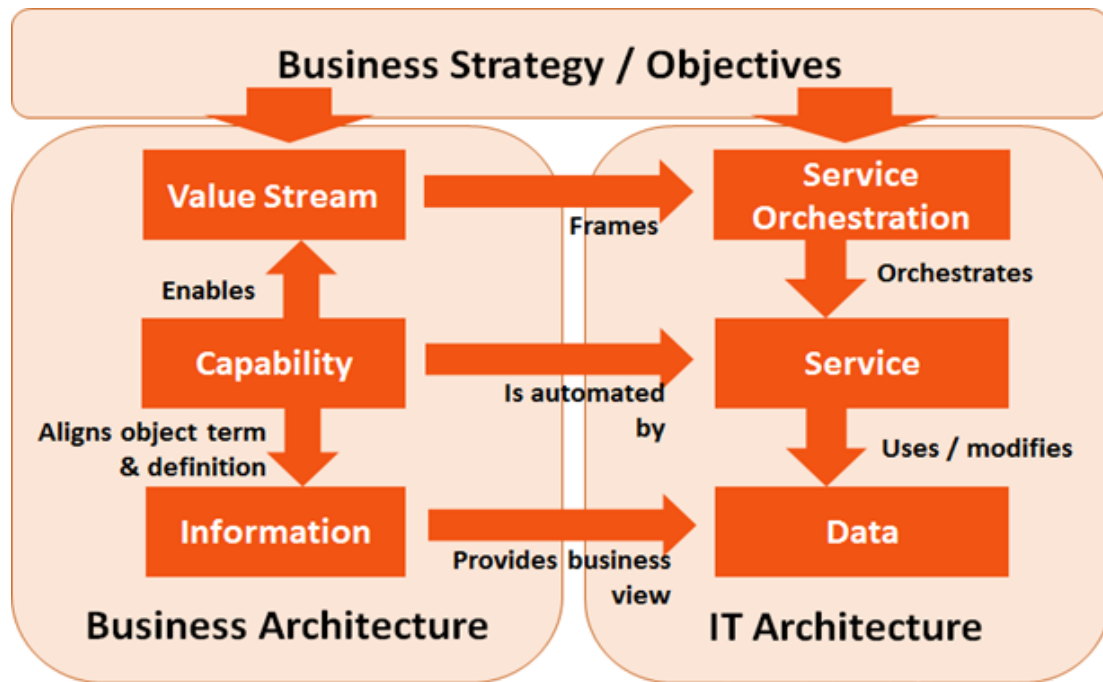


Figure 4: Leveraging Business Architecture to Frame IT Architecture Solutions

The sample IT architecture view on the right of figure 4 depicts a service-oriented architecture, but business architecture and related transformation perspective are not restricted to any given IT architecture target. To the contrary, business architecture may be used to frame business and IT transformations to any number and variety of traditional or cognitive computing architectures. The key point highlighted by figure 4 is that business architecture provides the disambiguated business perspective necessary to clearly frame automation options.

The mapping depicted in figure 4 allows a business to visualize automation gaps that IT organizations cannot readily envision because they only see what is automated versus what is not. If applied effectively, the incremental journey towards becoming a cognitive enterprise will subsume or enable technology trends that include virtualization, cloud enablement, digital transformation, and IT modernization.

Few organizations are actually seeking to increase business/IT alignment debt, which degrades the performance of a business as a whole, yet this is exactly what happens year-after-year, project-after-project, at organizations around the globe. Fortunately, the path to becoming a cognitive enterprise includes reversing this problematic trend.

Cognitive Enterprise Transformation: Action Items for Getting Started

Transforming an organization to a cognitive enterprise involves a long-term commitment to a coordinated strategy and recognition of the incremental steps leading towards adoption. A comparison to AI adoption patterns provides insight into this journey. IDC recently published a paper outlining the transitional stages towards AI.¹⁹

1. Human Led
2. Human Led, Machine Supported
3. Machine Led, Human Supported
4. Machine Led, Human Governed
5. Machine Controlled

This phased AI adoption model is a good way to think about the overall evolution of cognitive computing as organizations transition incrementally towards becoming a cognitive enterprise. The journey is incremental in both cases, as is the road towards becoming a cognitive enterprise, which is fortunately paved with numerous opportunities and benefits.

The previously discussed scenarios provide a point of reference for the human-led-to-machine-controlled transition. A virtual product manager or a virtual program manager, for example, would initially help the human worker as it learned and took over more and more of the role.

The following action items highlight five steps for getting started on the journey towards becoming a cognitive enterprise.

1. Establish a vision. Organizations seeking to reap the benefits of the cognitive enterprise will not do so by employing a single technology or methodology. A clear vision that has the capacity to withstand organizational disruptions is required to chart a path towards becoming a cognitive enterprise and to stay on that path, making progress at each step of the journey.
2. Chart a roadmap towards that vision. The journey towards becoming a cognitive enterprise will be measured in years and the only way to sustain that journey and reap the benefits along the way is to have a milestone-oriented roadmap that achieves business value at each phase of the journey. Roadmaps are critical because they focus priorities, given that no organization can undertake every strategic goal or business scenario concurrently. The lack of an agreed upon roadmap will doom any chances of achieving incremental and long-term benefits.
3. Articulate a business architecture baseline. Articulating a business architecture is the easiest step in the journey and delivers benefits in and of itself. Planning teams can begin leveraging a partially articulated business architecture early in the cycle to assist with strategy formulation and realization. While business architectures take a bit of time to articulate, they too evolve incrementally. It is important to note that industry reference models help expedite this process dramatically, allowing organizations to establish a baseline in short order.²⁰

4. Explore and invest in cognitive computing technologies. As stated at the onset in this paper, cognitive computing involves a number of different technologies. Organizations should establish a cognitive computing center of excellence to gain familiarity with the cross-section of technologies that may be leveraged downstream and to begin applying them in practice.
5. Reverse growing business/IT alignment debt. One benefit of using business architecture to frame business-driven IT investments is that it is the most effective way to target the growing divide over what the business does, what it needs to do, and the ability of IT architecture to deliver on those needs. Reversing business/IT alignment debt must align to and be driven by end-to-end business strategy execution.

Cognitive Enterprise: Vision or Dream

Is the future of the cognitive enterprise a vision or just a dream? This is a fair question to raise but as one ponders the answer, consider that the journey towards becoming a cognitive enterprise will transform organizations in many positive ways. At a minimum, improving business transparency in the near-term using business architecture will provide immediate value in terms of expediting and improving strategy execution. For example, many of the steps along the journey deliver value in terms of optimizing product and program deployment, improving customer experience, optimizing IT transformation investments, and a host of other scenarios, all while positioning the organization for maximizing the adoption of cognitive computing.

If nothing else consider this; an organization that sits on the sidelines and delays the start of the journey towards becoming a cognitive enterprise will slip behind competitors, many of which are unlikely to sit idle as the vision of the cognitive enterprise comes into focus.

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