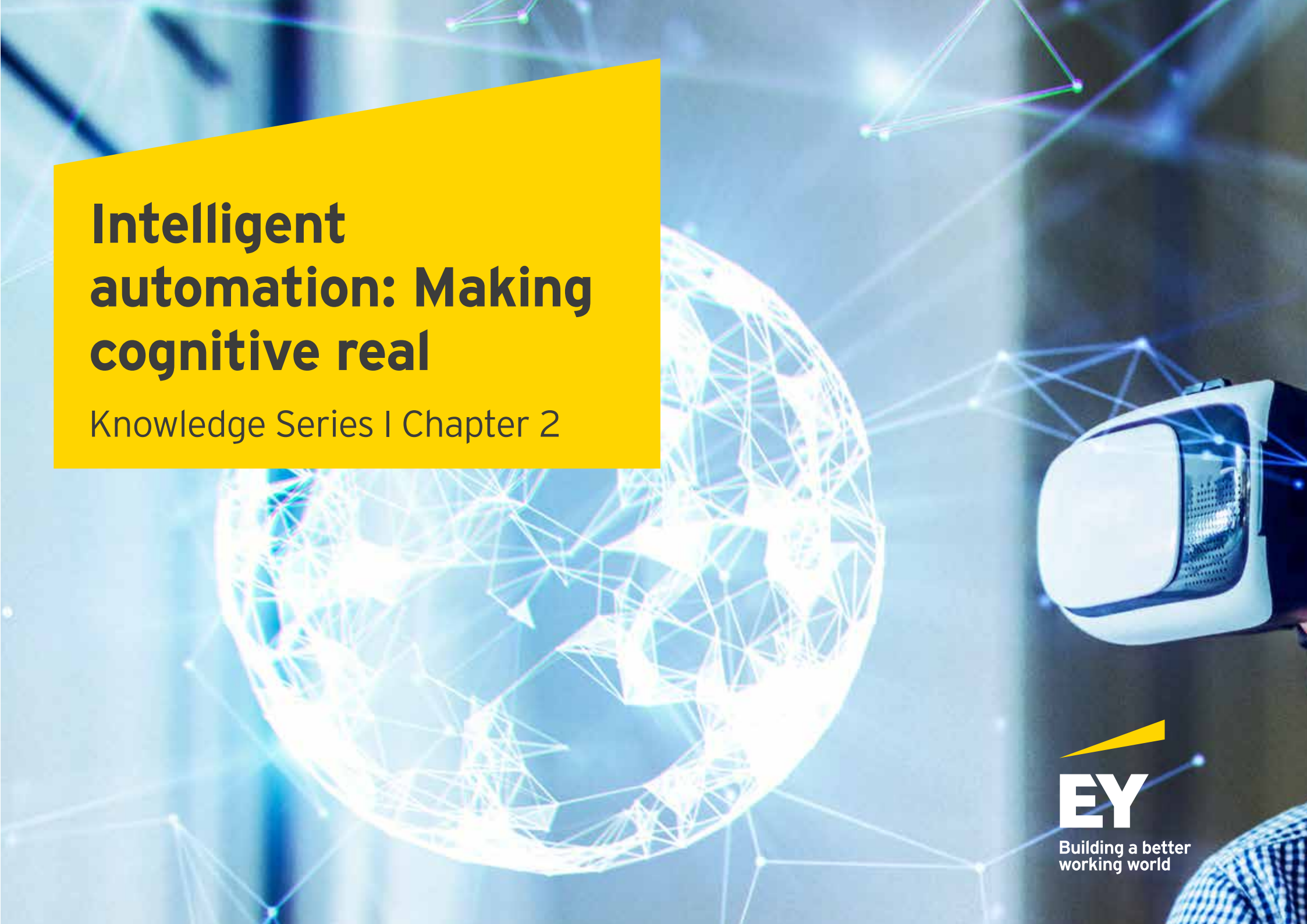
Intelligent automation: Making cognitive real

Knowledge Series I Chapter 2



EY

Building a better working world

Foreword

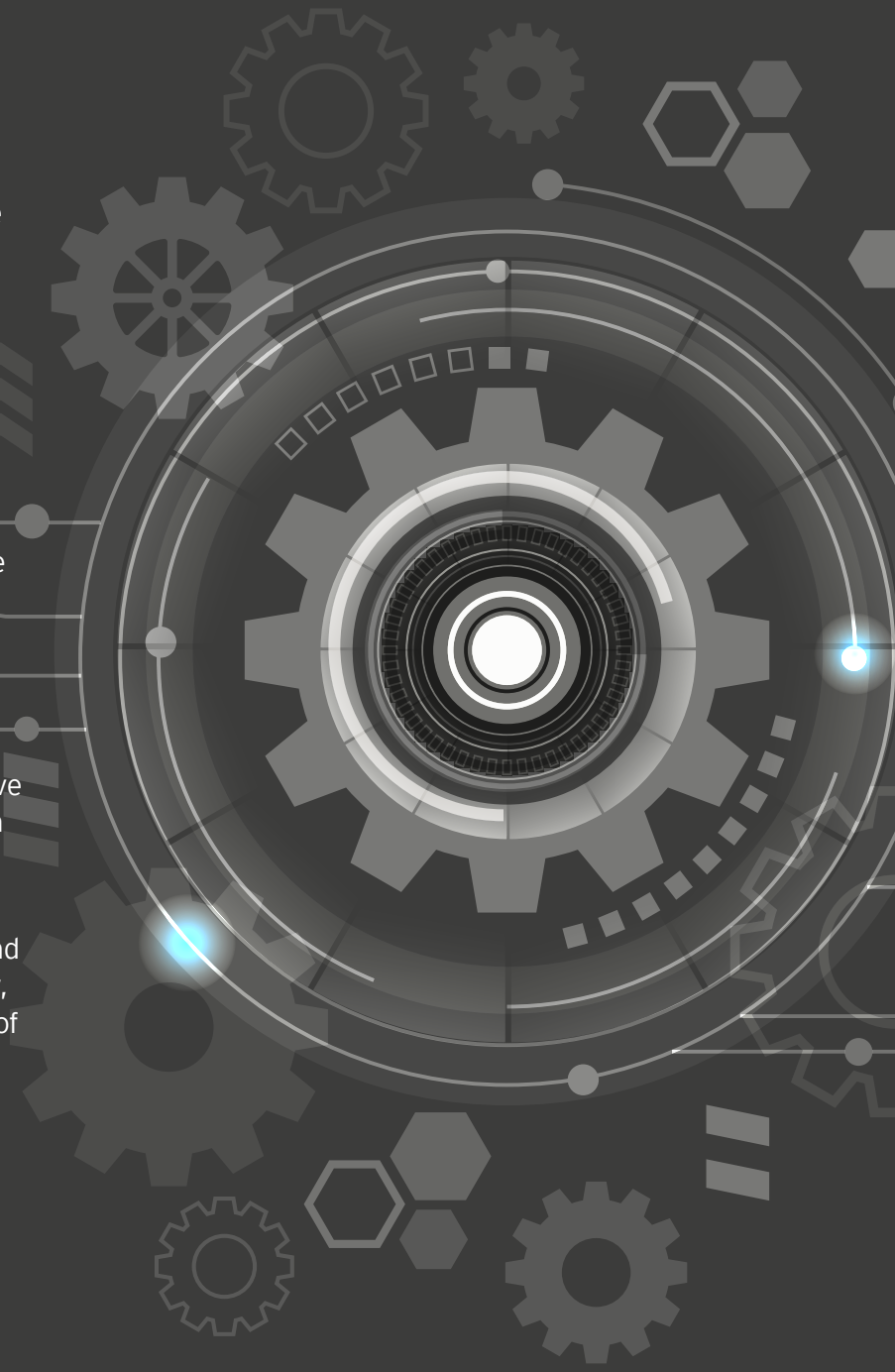
The rise of Intelligent Automation (IA) is the great story of our time. It is the fastest growing technology with the greatest power for disruption. The first edition of the knowledge series focused on RPA, as a foundation of IA journey to eliminate mundane, repetitive tasks and typically deliver a quick and high return on investment. In the second edition, we are focusing on technologies which are programmed to learn and improve. In this edition, we explain how the IA journey will evolve to imbibe an augmented ability to mirror human intelligence through machine learning (ML), natural language processing (NLP) algorithms and conversational interfaces like chatbots. More advanced Artificial intelligence algorithms will eventually replace higher-level cognitive human abilities with a far greater capacity for volume, analysis, accuracy and consistency than can currently be performed by humans.

This report provides a perspective on the fundamental elements and underlying technologies that are important to creating a cognitive system. Big Data is one of the pillar of a Cognitive system. Machine learning is like an engine that powers the Cognitive system.

Versions of ML, which attempts to mimic the activity in the human brain, can perform feats such recognizing images and speech. Cognitive insights provided by ML differ from those available from traditional analytics the models are more data intensive and detailed and are typically trained to get better i.e their ability to use new data to make predictions or put things into categories improves over time.

It is useful for companies to look at Cognitive through the lens of business capabilities rather than standalone technologies. A truly Cognitive enterprise will be able to harness IA not just for automating business processes but to gain insights from the realm of structured and unstructured data to engage with employees and customers effectively. Enterprises should take an incremental rather than a transformative approach and focus on augmenting rather than replacing human capabilities.

Such Cognitive enterprises will be ones that behave as if they have their own intelligence and purpose. This new Cognitive era is in its infancy, but we have come up with this report because of the significant and immediate market potential of these technologies and systems.



Happy reading!

Milan Sheth
Partner & National Director – Technology | EY LLP

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Chapter 1

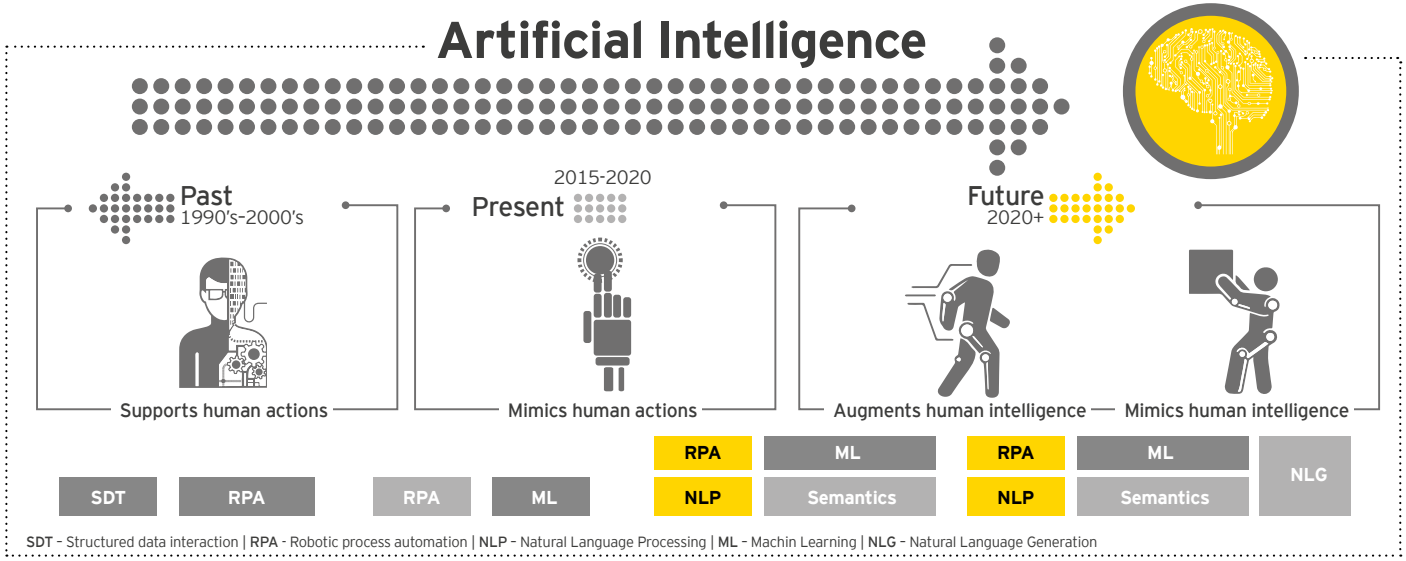
Introduction

Automation using cognitive will be the next frontier for enterprises in their intelligent automation journey

The advent of intelligent automation (IA) is resetting business expectations. It's making operations smarter and autonomous, enabled by the massive shift of data consumption and process execution capabilities from humans to machines. Enterprises are initiating their IA journey by digitalizing their process activities using robotics. Their goals are mainly to improve business efficiency, reduce costs, enhance customer experience (internal and external clients) and reach a higher level of process excellence (e.g., improve quality, accuracy).

For enterprises, IA represents a continuum with the increasing potential for disruption as they move along the maturity curve. At its most basic, it eliminates mundane, repetitive tasks through RPA- the foundation block of the IA journey. At the other extreme, through cognitive and artificial intelligence (AI) capabilities, it will begin to truly mimic human action with computing power and manage more volume, analysis, accuracy and consistency than performed by humans.

The advancements in AI, machine learning (ML) and natural language processing (NLP) are triggering a new wave of automation possibilities hitherto unthinkable. The convergence of process and data automation is yielding a powerful set of capabilities that are driving the next generation of digital revolution. Enterprises that combine RPA with advanced IA technologies, such ML and/or NLP will realize greater value.



1.1

IA technologies defined[1]

Structured data transaction

These are traditional systems where the integration is through exchange of information that is well structured. Examples include integration of systems through relational data base management systems (RDBMS), data transformation tools and application programming interfaces (APIs) and web services.

Robotic process automation (RPA)

It involves the automation of standardized and rule-driven system-based activities using scripts and other methods to support efficient business processes. It is suitable in scenarios where it is too expensive or inefficient for humans to execute a task or a process.

Machine Learning (ML)

It involves systems that learn through handling variations that are not anticipated upfront. These systems get trained on the go by assimilating learnings from data and decisions and may make simple predictions or classifications backed by algorithms. A simple case could be a scenario where a well-defined identifier needs to be mapped to a more descriptive/ free form text. For example, mapping of a vendor name that appears on an invoice to the vendor ID in the system. The vendor name may appear in various forms.

Natural Language Processing (NLP)

It uses statistical methods and learning algorithms to analyze text and unstructured information to understand the meaning, sentiment and intent. A sample use case could be the customer service function, where a customer raises a support ticket in the form of free text, which is analyzed to understand and determine the levels of urgency, sentiment or frustration and then determine the ticket severity/priority.

Natural Language Generation (NLG)

It is a technology that helps generate text as it is spoken or written, from structured information such as fields and numerals. It is largely applied where sections of financial analysis reports and insights are generated. For example, numbers reflecting a company's performance.

1 "Intelligent Automation: Reshaping the future of work with robots, Knowledge series, Chapter 1," EY report, April 2017

1.2

The evolution of IA journey

From RPA to AI

The IA journey framework, illustrated in the image below, describes the four main generations of robots that organizations are utilizing, their characteristics and associated benefits.

The traditional RPA generation includes software robots which can perform repetitive, rule-based actions (programmed bots). This is applicable to the largest part of the automated process activities in an enterprise (more than 60%). They deliver benefits across industries and functions.

Cognitive RPA widens the application of RPA to processes using unstructured data, which is estimated at 15%-20% of the automated processes in an enterprise. Cognitive RPA can manage information such as free text messages (e.g., emails) or scanned images (e.g., invoices or people's identities). Adding NLP capabilities to traditional RPA enables it to understand text. ML allows the bot to identify and learn patterns and contexts.

Intelligent chatbots can interpret voice/text in free form (chat) to simply respond with standard predefined answers. By using ML, chatbots can learn from conversations and actually improve over time. A simple example is the customer service function where a chatbot responds to queries.

AI is the capacity for robots to mimic human intelligence. In the future, AI bots will likely be able to autonomously

4	AI	Data analytics, insights, decision-making	<10%
3	Intelligent chatbots	Interaction with users (internal or external)	10%-15%
2	RPA cognitive	Manage unstructured data through ML and NLP	15%-20%
1	RPA traditional	Repetitive, rule based, high volume activities	60%-70%

Interactions

Sophisticated and intelligent bots
Increased costs and time to implement
Lower volume of processes
Increasing future potential
Specialized and niche bots
Qualitative and non-financial benefits

*Percentage volume of the enterprises' robotized process activities

Chapter 2

Cognitive is the next frontier in the enterprise IA journey

2.1

What is cognitive?

Cognitive is technology that emulates human performance, typically by learning and coming to its own conclusions, appearing to understand complex content, engaging in natural dialogs with people, enhancing human cognitive performance or replacing people in the execution of non-routine tasks.

Understand data

Understand unstructured information and weave together structured and unstructured data

Reasoning ability

Reason, grasp underlying concepts, form hypotheses and infer to extract ideas

Learn continuously

Make sense of constantly changing data, interactions and outcomes

Human-like interaction

Interact with humans in a natural way by leveraging NLP, NLG and text analytics

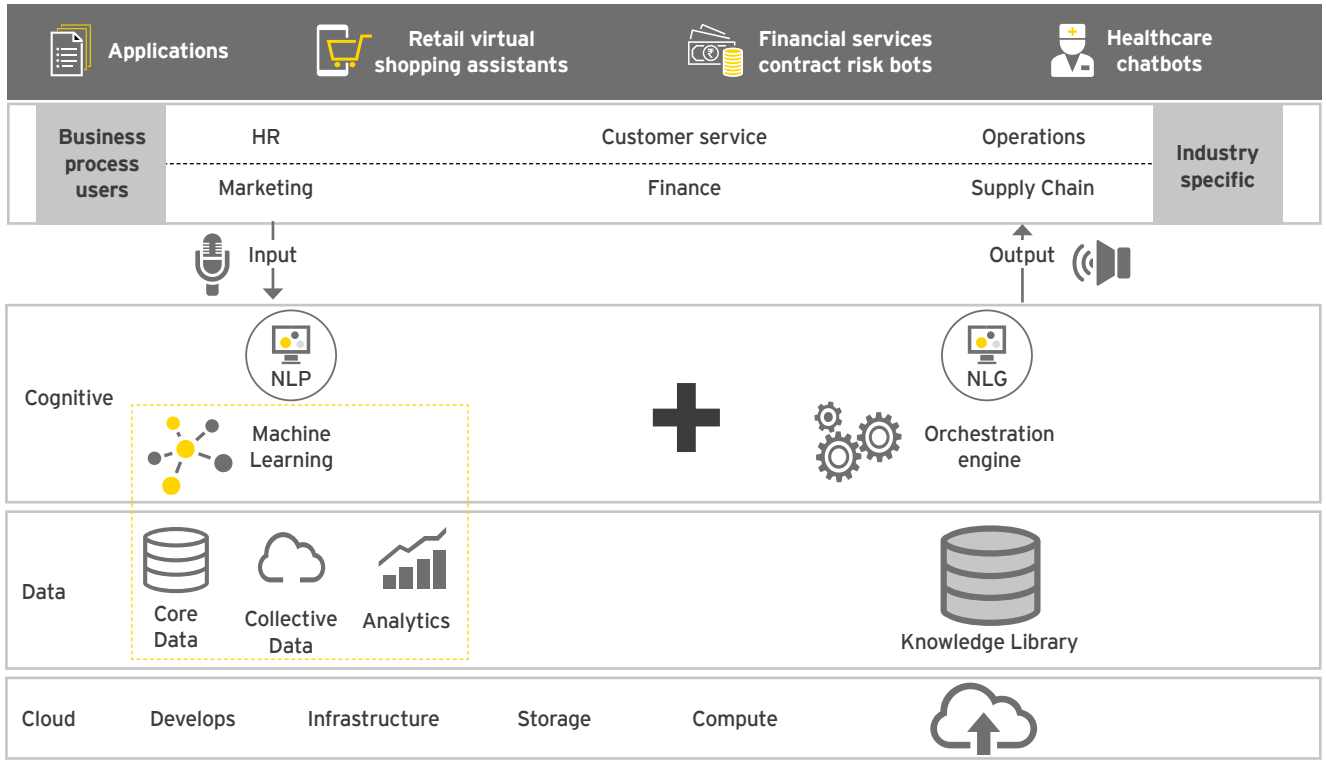
Actionable insights

Deliver meaningful insights, can make decisions and call up on intelligent automation services to execute

2.2

Complete cognitive system for value creation within an enterprise

A complete cognitive system is underpinned by infrastructure, data, cognitive/AI elements and business processes. Cloud-based distributed infrastructure is the underlying platform required to support large-scale cognitive systems. Data is the key foundation of a complete cognitive system. The main cognitive elements are NLP, NLG, ML, analytics and the orchestration engine (OE). These systems have a deep understanding of business processes across industries and can be used to design cognitive enterprise applications.


Applications
Retail virtual shopping assistants
Financial services contract risk bots
Healthcare chatbots
Business process users
HR
Customer service
Operations
Marketing
Finance
Supply Chain
Industry specific
Input
Output
Cognitive
NLP
Machine Learning
NLG
Orchestration engine
Data
Core Data
Collective Data
Analytics
Knowledge Library
Cloud
Develops
Infrastructure
Storage
Compute

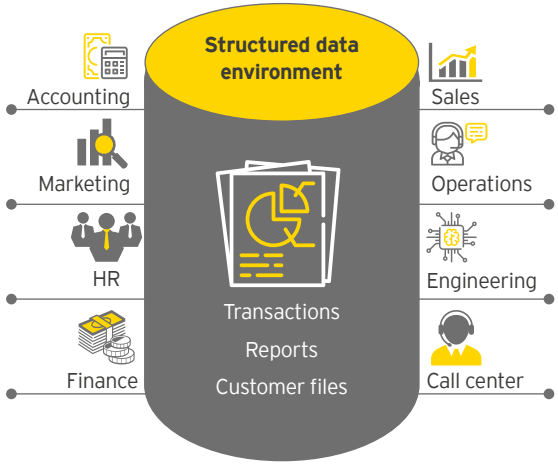
Chapter 3

Role of data in creating a complete cognitive system

3.1

Data as a foundation of the cognitive system

Cognitive is technology that emulates human performance, typically by learning and coming to its own conclusions, appearing to understand complex content, engaging in natural dialogs with people, enhancing human cognitive performance or replacing people in the execution of non-routine tasks.



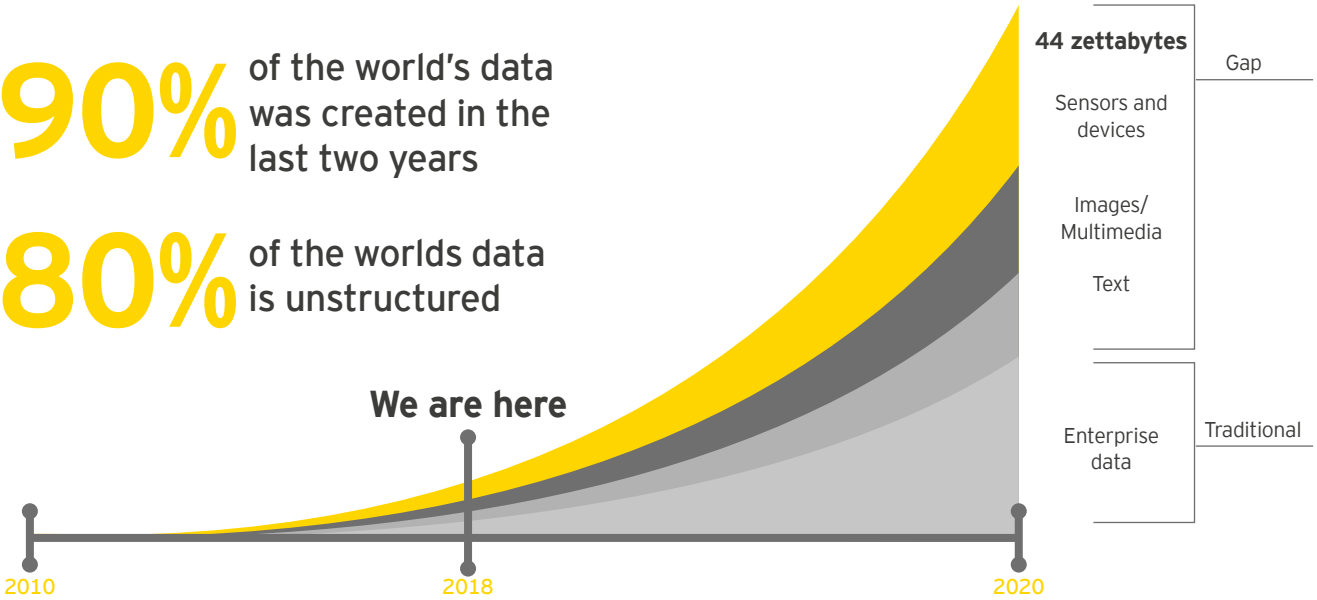
3.2

Unstructured data- a hidden treasure waiting to be found[2]

Growth in the amount of data is decisive for AI development

90% of the world's data was created in the last two years

80% of the worlds data is unstructured



"The Big (Unstructured) Data Problem," Forbes website, https://www.forbes.com/sites/forbestechcouncil/2017/06/05/the-big-unstructured-data-problem/#22277a97493a, accessed 3rd May 2018; "90% Of Today's Data Created In Two Years," Mediapost website, https://www.mediapost.com/publications/article/291358/90-of-todays-data-created-in-two-years.html, accessed 3rd May 2018

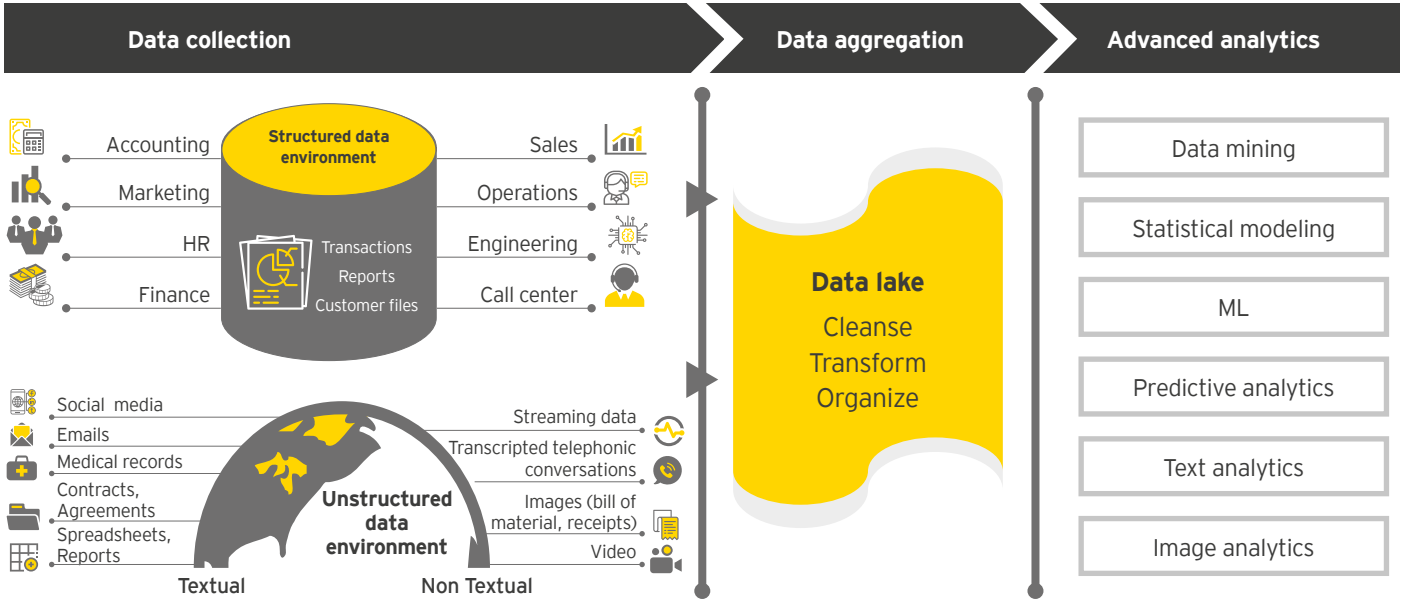
A significant category of data often found in enterprises is unstructured or semi-structured data. There are several forms- textual unstructured data (emails, reports, documents, medical records and spread-sheets) and non-textual unstructured data (images, video, audio, sounds and shapes). One of the most important characteristic of unstructured data that enterprise are beginning to see is data in motion or streaming data. The examples of streaming data range from data coming from equipment sensors to medical devices to temperature sensors to stock market financial data and video streams.

There is no format, structure or repeatability to unstructured data. It is so pervasive, ubiquitous and has so many variations that is hard to classify. However, a world of promise and opportunity in information is buried in the unstructured data that can help enterprises to make informed decisions. In today's dynamic world, enterprises that look only at their structured data- usually transaction-based data- are missing out on an entire class of information that has the potential to uncover meaningful insights for decision making. It is akin to a manager making decisions solely on revenue numbers for a particular month. While it is an important metric to consider, a lot of other information needs to be factored in as well, including customer feedback, new product announcements, projections, etc. In short, unstructured data occurs almost everywhere and represents both, a challenge and an opportunity, to the enterprises that want to use it for their decision making processes.

3.3

Information flow through a cognitive system

Raw data from various data sources goes through multiple steps before it is actually used. It is aggregated and enhanced when blended with other data sources and this enhanced data is ultimately transformed into results or insights by applying advanced analytical techniques.



3.4

Complete cognitive system for value creation within an enterprise

Data collection is the entry point

The first step in creating value from data is ensuring access to all relevant data. This is easier said than done. Traditional enterprise systems have been designed primarily to support highly structured data. However, the new data environment includes data from unstructured sources (for e.g., social media data, news or stock market data feeds, spatial data from sensors), that were never considered to be part of enterprises' systems of record. These newer sources of data provide new dimensions, insights and answers to some challenging questions.

There are connections between structured and unstructured data that are often understood but are seldom used. For instance, executives know that customer support systems contain extensive notes about the problems and future requirements of customers. However, no one has the time to manually search through these systems to see if there is any correlation between specific customer issues and a drop in sales of a specific item in a retail store. Similarly, companies are saving massive amounts of data coming from sensors. Although they might save that data for years, it is simply too big to analyze.

Data lakes are used for aggregation of data from multiple sources

The need and ability to gain business value from larger volumes and varieties of data adds a lot of complexity. The structured information about the operations of the business is most frequently stored and managed in a relational database management system (RDMS). The unstructured data, on the other hand, is typically used with non-relational databases (NoSQL), due to its volume and variety. The siloed approach implies that an enterprise may manage its data in different RDMSs. For example, transaction data and customer information could be stored in different databases.

Technologies such as data lakes are a promising concept for overcoming these issues. They simplify access across the enterprise by integrating all types of data into one easily accessible and flexible repository. Data lakes can integrate information from different sources relatively easily- structured data from relational databases, unstructured data from sources such as multimedia files and emails, or even information that appears in raw, inconsistent form. The entire organization can access the information contained in data lakes via an easy-to-use search layer.

Advanced analytics is the next frontier- combines traditional analytics and ML

The role of analytics in an enterprise's operational processes has changed significantly over the years. While traditional analytics presented a "rear view mirror" analysis- using current and historical data to test human hypotheses, advanced analytics enables "windshield" view to solve complex business problems- and helps in decision making by identifying the relative consequences of the actions. The ability to deliver near real-time (within 3-15 seconds) analytics mean that they can be used in place of human judgment and decision making. For instance, a CRM application may require iterative analytics process that incorporates current information from customer interactions and provides outcomes to support real-time decision making to ensure customer satisfaction

Advanced analytics refers to a collection of techniques and algorithms for identifying patterns and anomalies in large, complex or high-velocity data sets with varying degrees of structure. It includes sophisticated statistical models, predictive analytics, ML, text analytics and other advanced data mining techniques.

Chapter 4

How to begin your journey to a cognitive enterprise

Faced with myriad IA opportunities, most enterprises are jumping straight to the IA technology implementation question. In fact, viewing IA as a technology is short sightedness. To make the most of IA technologies and tools, enterprises need to assess areas where cognitive will create business value. Enterprises that think that spending on a big data solution- extracting smart, intelligent data out of it and having ML solutions- can transform their business are simply falling into a trap. In every successful transformation, creative business leaders have assessed how a process was being executed, identified the gaps and re-engineered the business process by using IA to improve effectiveness and efficiency.

This underscores the need for a cognitive value assessment. Enterprises must conduct analysis of what the most valuable cognitive use cases are. They should also build out the supporting digital assets and capabilities. Indeed, the core elements of a successful transformation includes defining the automation strategy, building the data ecosystem, adopting the right techniques and tools, integrating technology into workplace processes and adopting an open, collaborative culture while reskilling the workforce.

4.1

The cognitive value assessment

The cognitive value assessment (CVA) is an accelerated approach to identifying transformational opportunities and associated business value in various processes like finance, procurement, supply chain, HR, sales and customer service.

1 Initiate

Confirm objectives and initial process scope based on value expectations

Set your Cognitive strategy

- Identify business need, pressure points in key processes
- Understand intended users and define their attributes
- Create business case

2 Gather

For each of the in-scope processes gather the unstructured data and measure the rule complexity

Evaluate the Data ecosystem

- Identify and acquire high-value data
- Create and define the corpus- prepare, ingest and expand data
- Integrate data silos

3 Assess

Analyze the processes in detail to verify cognitive solutions and prerequisites

Prepare for change

- Choose the right fit-for-purpose IA solution
- Take an agile "test and learn approach"
- Adopt open and collaborative culture

4 Deliver

Prioritize pilot processes and mid-term roadmap including benefits realization

Start with Cognitive

- Develop a prototype
- Test and validate new cognitive application with end-users
- Assess usage benefits after deployment
- Refine workflows to optimize for cognitive
- Expand to other domains

Initiate

Set your cognitive strategy

CVA is a multistep process that begins with identifying the business need and establishing a solid business case. A majority of the cognitive applications fall under three main categories:

- Product/service applications for customer engagement: Designed to provide end-user benefits by embedding cognitive technologies. For example, recommendation engines, chatbots
- Process applications for addressing pain points: Build to integrate cognitive in a process workflow to alleviate bottle necks in a process that hinders the efficiency. For example, compliance check, medical records management, manual network monitoring activities
- Insight applications for real-time decision making: Apply cognitive to uncover opportunities to maximize revenue, detect risks and enable innovation. Examples include genomic exploration, security analysis or threat prevention

Enterprises should first focus on proven use cases that have been adopted at scale, such as RPA and simple ML. Going further, enterprises can identify use cases where a technology is emerging but not yet proven at scale.

1010110
100100
110101

Gather

Evaluate the data ecosystem

Data fuels cognitive applications. Performance of a cognitive system is determined by the quality of data. One of the most critical aspects of CVA is selecting, accessing, acquiring and preparing data for the knowledge base/corpus. When developing a corpus, the most relevant data sources should be determined. This is challenging because what type of insights users might require is dynamic as their needs change over time. Enterprises also need to recognize potential data types that can create a competitive edge in cognitive applications. Customer sentiment and geo-locational real-time event data are examples of differentiating data. Furthermore, the creation of corpus is not a one-time process. The process of creating a corpus includes preparing the data, ingesting the data, refining the data and governing that data throughout its lifecycle.

Assess

Prepare for change

Traditionally enterprises have relied heavily on past experience in order to predict the future. What makes a cognitive approach different is that these systems are designed to learn and built to change based on the captured knowledge base and the capability to identify patterns and linkages between data elements that the enterprises might not even know existed. For enterprises, such a transformation entails changing the mindsets of hundreds of thousands of people to be future-ready.

Preparing the data

- Data validation to ensure readability, searchability and comprehensiveness
- Algorithms to identify schemas a and profile data

Ingesting the data

- Real-time ingestion of data sources
- Checkpointing-trace back errors resulting in an unexpected halt in the ingestion process
- Monitor the ingestion process to ensure security compliance

Governance of data

- Compliance with data privacy and security requirements
- Regulatory restrictions on data storage
- E.g., Protecting customer's credit card data in retail systems

Refining and expanding the corpora

- Establish an ongoing process of updating data requirements
- Use expansion algorithms
- Enrich data by providing lookups to additional sources

Deliver

Start with cognitive

Implementing a cognitive solution involves iterative process of model development, training, testing and validation. Deploying a scalable training and testing strategy can ensure that the application works as intended when it is deployed. Cognitive systems are designed` to learn from failure and improve through feedback continuously. The most important part of the training process is to have enough data so that the hypothesis can be tested and the data needs to be added and updated to ensure the corpus can support the cognitive system. A well-designed cognitive system can be expanded across domains for gaining significant business value.

Integrate to capture benefits

- Process redesign to incorporate cognitive into the existing workflow
- Optimize employee-machine interface

Reskill the workforce

- Reskill the workforce to ensure complementary abilities
- Design employee training timeframes and approach

Track business value

- Articulate business value
- Assess RoI and cost benefits

Chapter 5

Case studies

5.1

Automated monitoring of escalation mailbox and identification and triage of priority emails

What were the trigger points to move beyond RPA to other IA technologies?

Client was receiving over 50,000 emails in its shared mailbox per year. Mails covered a wide variety of escalations with different severity, complaints and repeated follow-ups. While RPA was able to perform the rule-based repetitive tasks like opening the escalation mailbox, creating logs and producing reports on most important incidents, it was, however, limited in its ability to handle unstructured information and judgement activities- measuring the tone of the email to determine the severity of the incident, in this case. It was getting challenging to identify which escalation was important to track. The client was expending a significant manual effort to resolve large volumes of queries in time and to customer satisfaction.

What was the need for CVA?

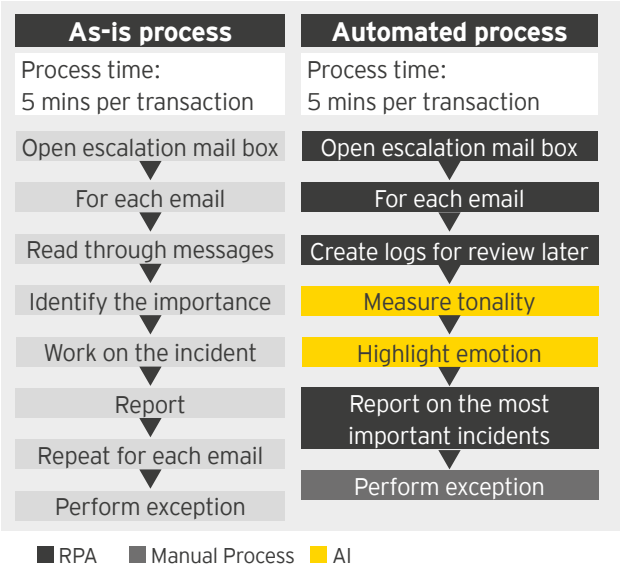
The traditional RPA included software robots which performed repetitive, rule-based actions. This was applicable to the majority part (~80%) of the current process. Benefits delivered were large in terms of cost savings, quality and accuracy. The limitations faced by traditional RPA could be mitigated through cognitive RPA. Cognitive RPA could deliver similar benefits to traditional RPA, but unlock the capacity for the bot to manage unstructured data, such as free text messages (e.g., emails). Adding the functions of textual and linguistic analytics to the traditional RPA bot could enable it to understand the tone of the emails. To achieve maximum value, effective interactions between traditional and cognitive RPA was required.

What were the key cognitive opportunities identified in the process?

Integrated an RPA solution with IA capability- tone analyzer to detect emotional and language tones in written text. RPA reads the contents of the shared email box and tone analyzer identifies the emotion in the message and subsequently notifies the relevant stakeholder on which email needs to be monitored.

What were the benefits achieved by the client?

- Reduction in manual effort
- Prioritization of incidents
- Identification of the most important e mail to work on
- True voice of customer report

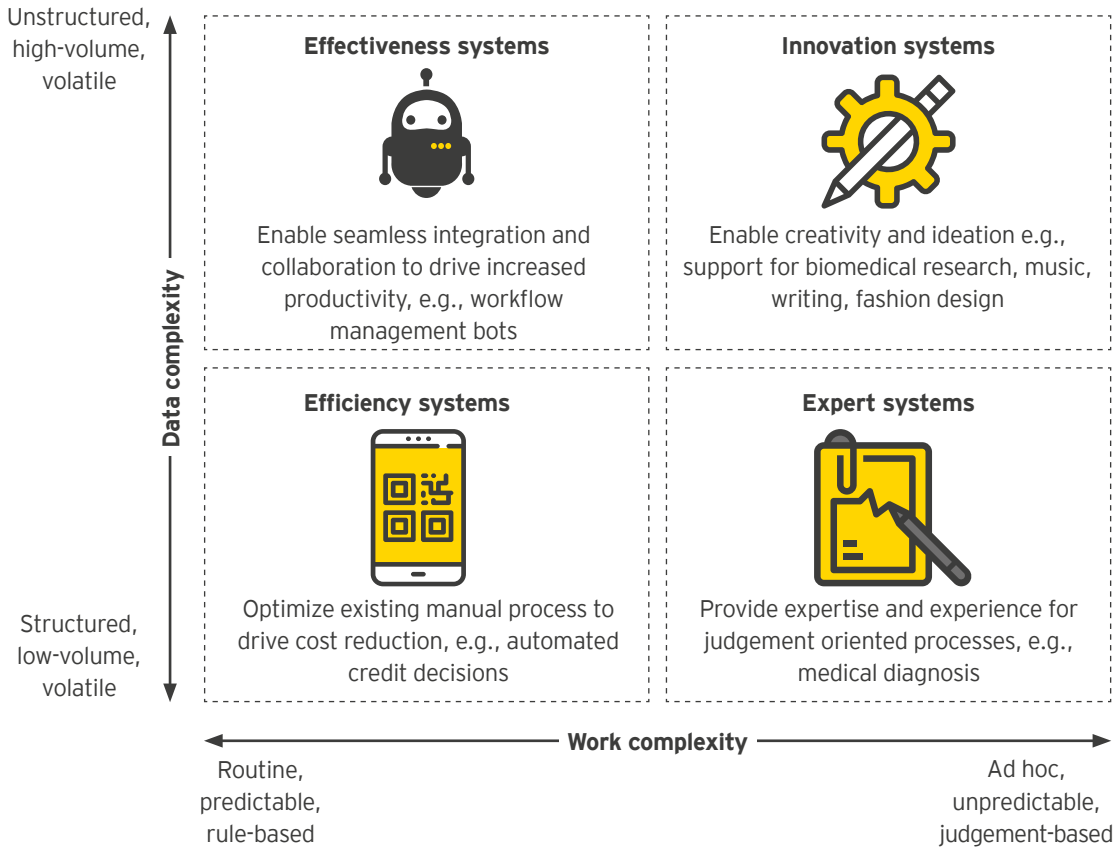


Chapter 6

What will a cognitive enterprise look like in the future?

The development of cognitive is at the early stages. A majority of the enterprises are still in the efficiency and effectiveness quadrant in the IA matrix given below. The entry of enterprises into the cognitive era will be marked by the expert and innovation quadrants. Expert dimension will drive the use of cognitive algorithms to take on traditionally associated with human-level expertise. Innovation will be the last big frontier. This quadrant will leverage other emerging technologies, such as the IoT and blockchain.

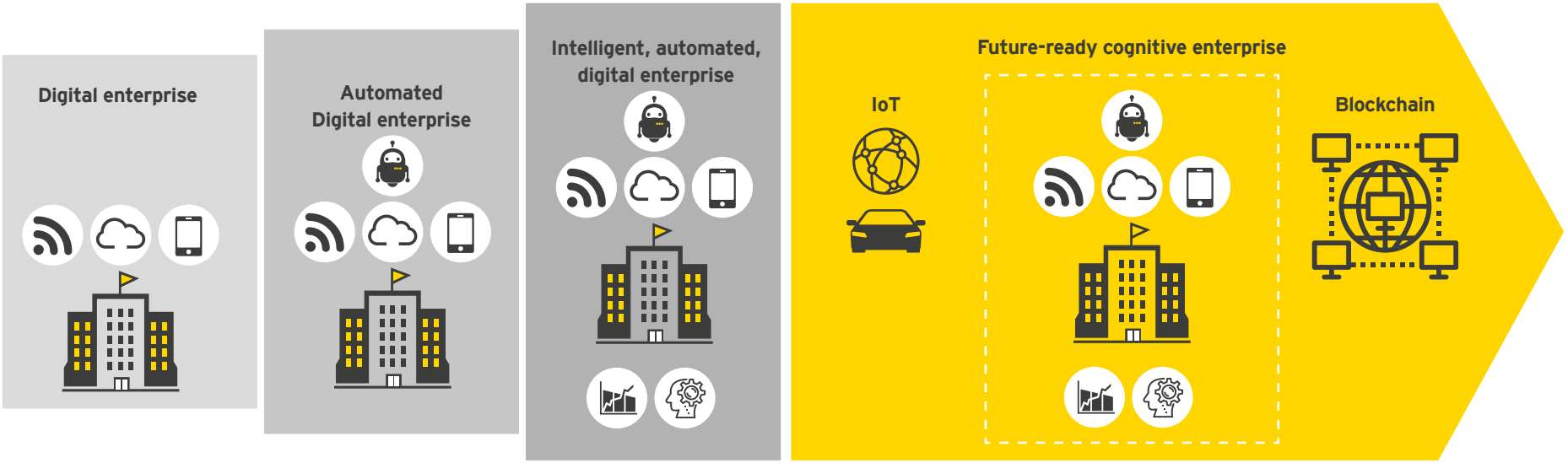
The future of cognitive will be a combination of evolution and revolution. The evolutionary aspects of cognitive are foundational technologies such as ML, NLP, data cleansing, visualization, management, security and governance. There will be revolutions in the convergence of Cognitive with other technologies like IoT and blockchain to improve human-to-machine interactions and create intelligent enterprises. The span and tenor of the applications in this area will be almost boundless.

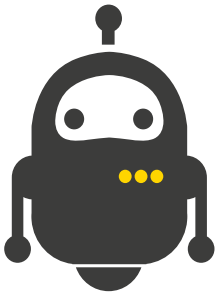


6.1

Building a future-ready cognitive enterprise

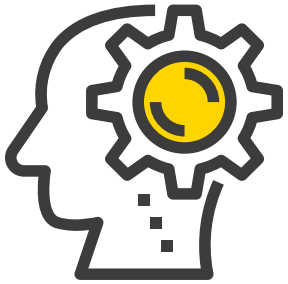
The evolution of a future-ready cognitive enterprise is illustrated below:





Creating intuitive human-to-machine interfaces in cognitive enterprises

Cognitive will be integral to the architectural fabric of cognitive enterprises. ML and advanced analytics will be built into every application. Natural language interfaces will continue to be the foundation of how users interact with enterprise systems, however, these interfaces will continue to become more context-aware. For example, improvements in voice recognition technology that can detect emotions such as fear through detection of hesitance could be useful in guiding a user and system through a complex process. When the voice indicates that the instructions are unclear, the system will react with a new explanation. Over time, the system could begin to create new sets of directions that are clear to majority of the users.



Data technologies advancements that will shape cognitive enterprises

Cognitive enterprises will find more automated methods of capturing and ingesting massive amounts of data to create solutions. Learning will happen in near real-time and increasingly be influenced by unstructured information such as gestures, facial expressions, etc. Real-time processing is at the heart of fast learning. With personal devices and sensor-based assistants, hardware embedded at the end points will provide processing at the source. Data will be analyzed in real-time especially to process information in data-rich environments such as video, images, voice and signals from sensors. As the data corpora expands with more experience, it will be possible to determine next best actions or to correlate data to find hidden patterns.

Looking ahead, interplay of IoT and blockchain will make cognitive enterprises future-ready

We are already in an era where the internet is ubiquitous, but in the coming era, connectivity will be given. As more devices with embedded sensors become pervasive, the level of data and actions will explode. On the other hand, blockchain technology-the distributed ledger has the potential to automate not just key processes but entire industries.

Contact us

Weston Jones
Partner & Global Solution Leader
Intelligent Automation
EY Americas
weston.jones@ey.com

Milan Sheth
Partner & Leader
Intelligent Automation
Africa, India and Middle East Advisory
milan.sheth@in.ey.com

Vivek Nijhon
Partner & Leader
Intelligent Automation – EMEIA
EY UK
vivek.nijhon@uk.ey.com

N Kamal Anand
Partner
Advisory
EY
kamalanand.N@in.ey.com

Vijay Shankar B
Partner
Advisory
EY
bvijay.shankar@in.ey.com

Sandeep Parikh
Partner
Advisory
EY
sandeep.parikh@in.ey.com

Anuj Jain
Director
Advisory
EY
anuj8.jain@in.ey.com

Kadhambari Suresh
Assistant Manager
EY Knowledge
kadhambari.suresh@in.ey.com

Our offices

Ahmedabad
2nd floor, Shivalik Ishaan
Near C.N. Vidhyalaya
Ambawadi
Ahmedabad - 380 015
Tel: + 91 79 6608 3800
Fax: + 91 79 6608 3900

Bengaluru
6th, 12th & 13th floor
"UB City", Canberra Block
No.24 Vittal Mallya Road
Bengaluru - 560 001
Tel: + 91 80 4027 5000
+ 91 80 6727 5000
+ 91 80 2224 0696
Fax: + 91 80 2210 6000

Ground Floor, 'A' wing
Divyasree Chambers
11, O'Shaughnessy Road
Langford Gardens
Bengaluru - 560 025
Tel: +91 80 6727 5000
Fax: +91 80 2222 9914

Chandigarh
1st Floor, SCO: 166-167
Sector 9-C, Madhya Marg
Chandigarh - 160 009
Tel: +91 172 331 7800
Fax: +91 172 331 7888

Chennai
Tidel Park, 6th & 7th Floor
A Block (Module 601,701-702)
No.4, Rajiv Gandhi Salai
Taramani, Chennai - 600 113
Tel: + 91 44 6654 8100
Fax: + 91 44 2254 0120

Delhi NCR
Golf View Corporate Tower B
Sector 42, Sector Road
Gurgaon - 122 002
Tel: + 91 124 464 4000
Fax: + 91 124 464 4050

3rd & 6th Floor, Worldmark-1
IGI Airport Hospitality District
Aerocity, New Delhi - 110 037
Tel: + 91 11 6671 8000
Fax + 91 11 6671 9999
4th & 5th Floor, Plot No 2B
Tower 2, Sector 126

NOIDA - 201 304
Gautam Budh Nagar, U.P.
Tel: + 91 120 671 7000
Fax: + 91 120 671 7171

Hyderabad
Oval Office, 18, iLabs Centre
Hitech City, Madhapur
Hyderabad - 500 081
Tel: + 91 40 6736 2000
Fax: + 91 40 6736 2200

Jamshedpur
1st Floor, Shantiniketan
Building Holding No. 1,
SB Shop Area Bistupur,
Jamshedpur – 831 001
Tel: +91 657 663 1000
BSNL: +91 657 223 0441

Kochi
9th Floor, ABAD Nucleus
NH-49, Maradu PO
Kochi - 682 304
Tel: + 91 484 304 4000
Fax: + 91 484 270 5393

Kolkata
22 Camac Street
3rd Floor, Block 'C'
Kolkata - 700 016
Tel: + 91 33 6615 3400
Fax: + 91 33 2281 7750

Mumbai
14th Floor, The Ruby
29 Senapati Bapat Marg
Dadar (W), Mumbai - 400 028
Tel: + 91 22 6192 0000
Fax: + 91 22 6192 1000

5th Floor, Block B-2
Nirlon Knowledge Park
Off. Western Express Highway
Goregaon (E)
Mumbai - 400 063
Tel: + 91 22 6192 0000
Fax: + 91 22 6192 3000

Pune
C-401, 4th floor
Panchshil Tech Park
Yerwada
(Near Don Bosco School)
Pune - 411 006
Tel: + 91 20 6603 6000
Fax: + 91 20 6601 5900

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