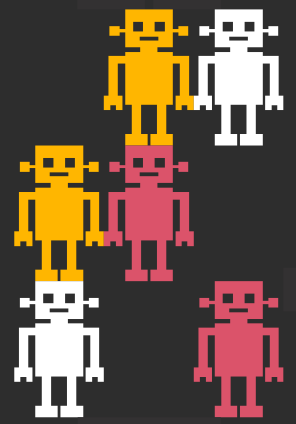
Artificial Intelligence Evolution – main trends



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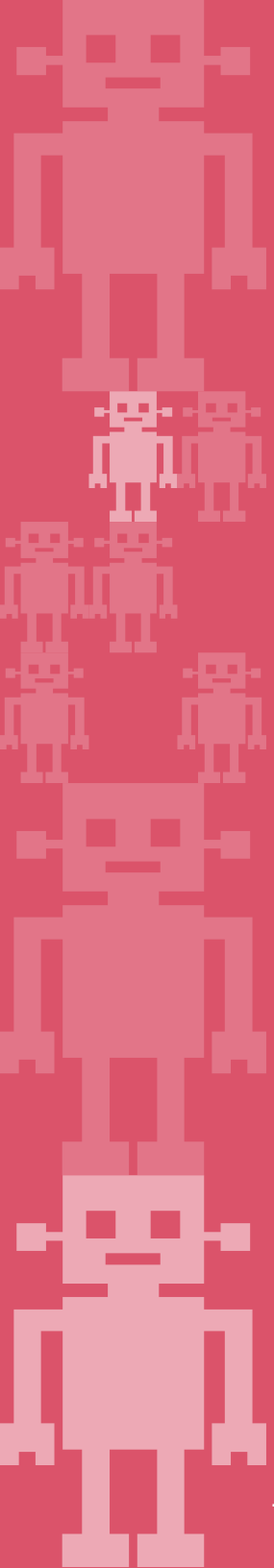

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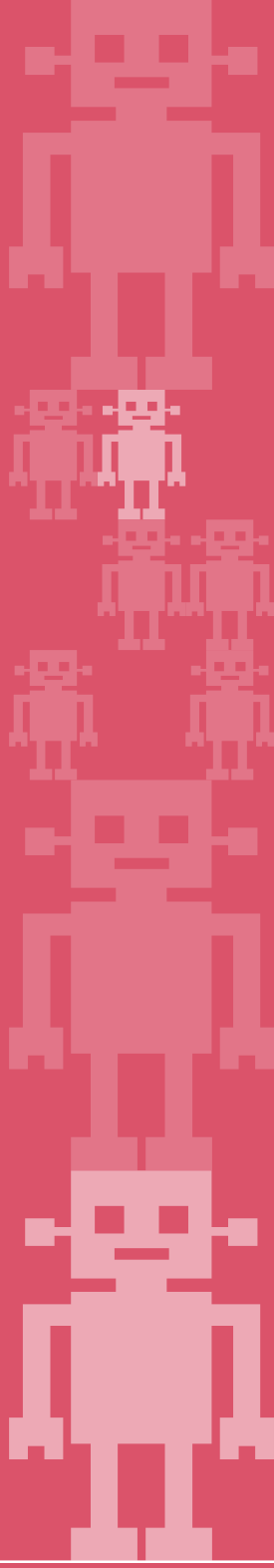
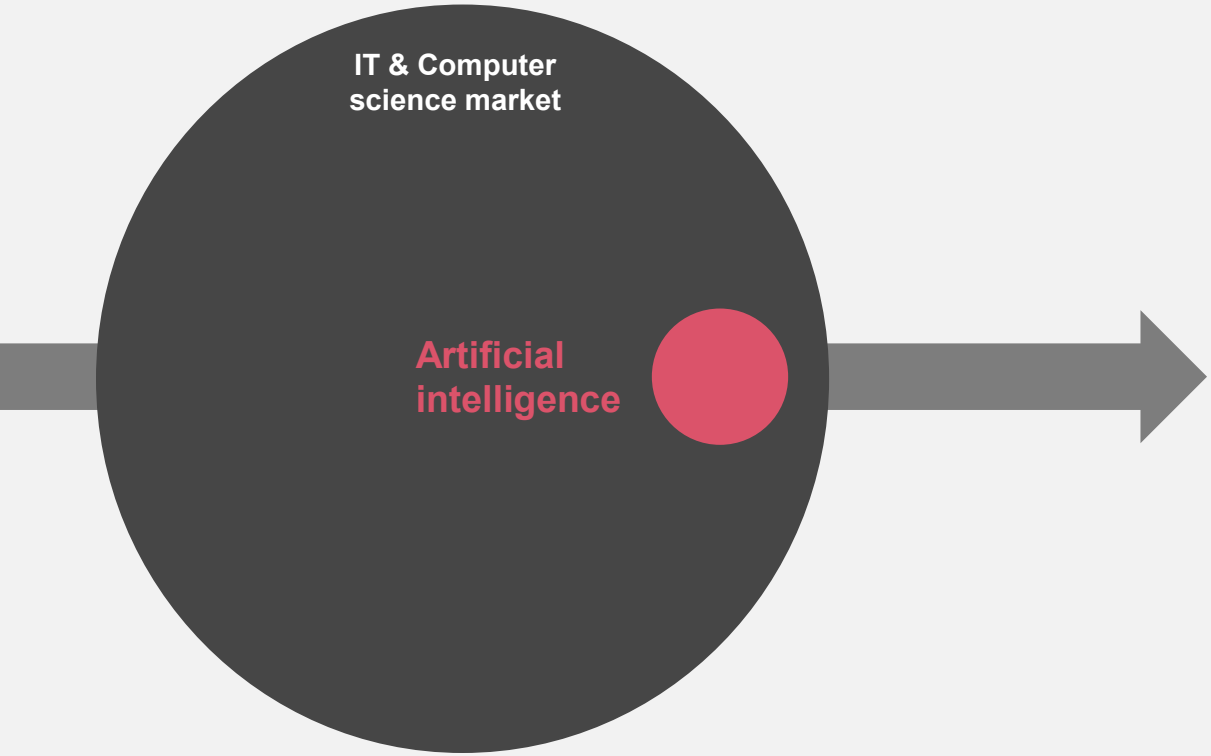
Artificial Intelligence Market - At Glance



Artificial intelligence market (1/2) – Artificial intelligence is the branch of computer science that deals with the simulation of intelligent behaviour in computers and has been recognised as one of the fastest growing technologies in recent years



Artificial intelligence market segmentation

By Technology:

- Machine learning
- Natural language processing (NLP)
- Image processing
- Speech recognition

By industry vertical:

- Enterprise
- Public market

By deployment mode:

- Cloud
- On-Premise

By end-user:

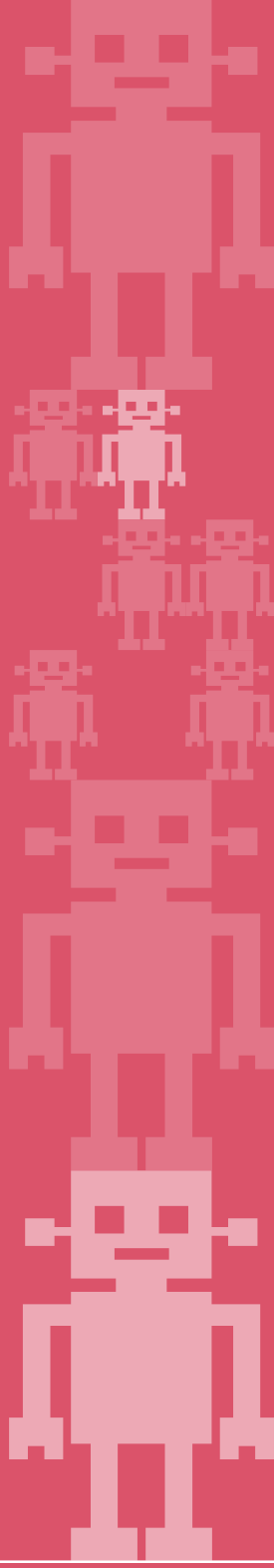
- SME
- Large enterprises

Artificial intelligence market (2/2) – The market can be segmented and analysed considering technology, industry vertical, deployment mode and end-user type

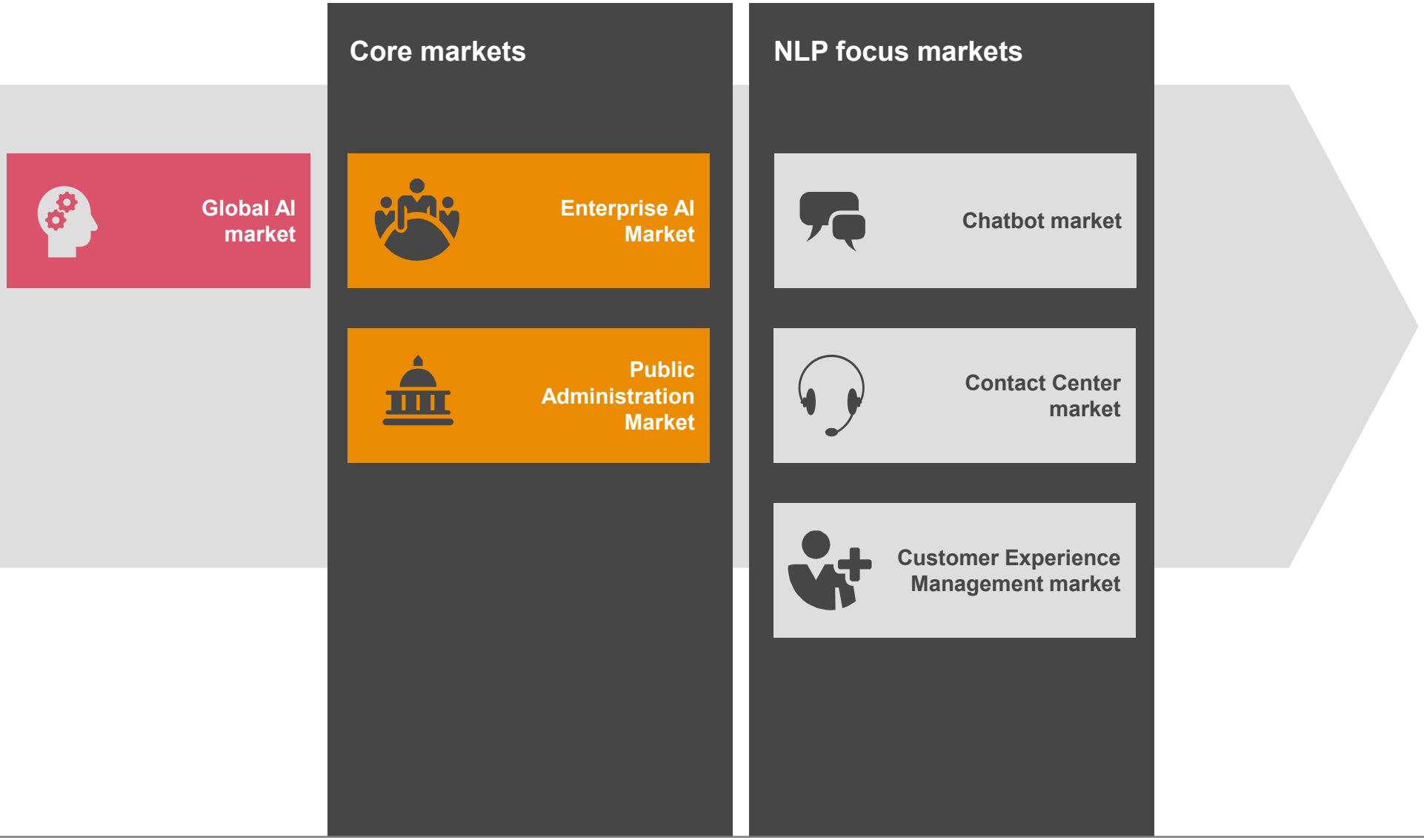
	Segment	Sub-segment	Description
Artificial intelligence	Technology	Natural language processing (NLP)	• Communication with intelligent systems in natural language • Interest in the field is growing but accuracy remains a concern
		Image processing	• Automatic extraction of information from images • Great potential, especially in specific fields such as healthcare
		Machine learning	• Allows computers or other systems to automatically learn and progress from experience • Major growth potential, especially in fields involving large amounts of data
		Speech recognition	• Allows devices to recognise and translate spoken language into text • Current applications include hands-free writing, medical dictation and customer service
	Industry Vertical	Enterprise	• Main industries include Telecom, Media, Automotive, Retail, BFSI and Healthcare • Increasing investments as organizations realize AI relevance and potential
		Public Administration	• AI occupies a leading position in governments' digital agendas • COVID-19 is accelerating digitalization transforming AI into a necessity
	Deployment mode	Cloud	• Allows training of machine learning models in the cloud • Concerns about data privacy could pose a limit to its adoption
		On-premise	• Resources are deployed within the enterprise's IT infrastructure • Used especially by industries dealing with sensitive information
	End-user	SME	• Includes enterprises with less than 250 employees • Lower degree of adoption due to high cost of AI technology deployment
		Large enterprises	• Includes enterprises with more than 250 employees • Increasing investments as AI starts to be considered as a strategic tool

Source: PwC analysis and elaboration on Allied Market Research

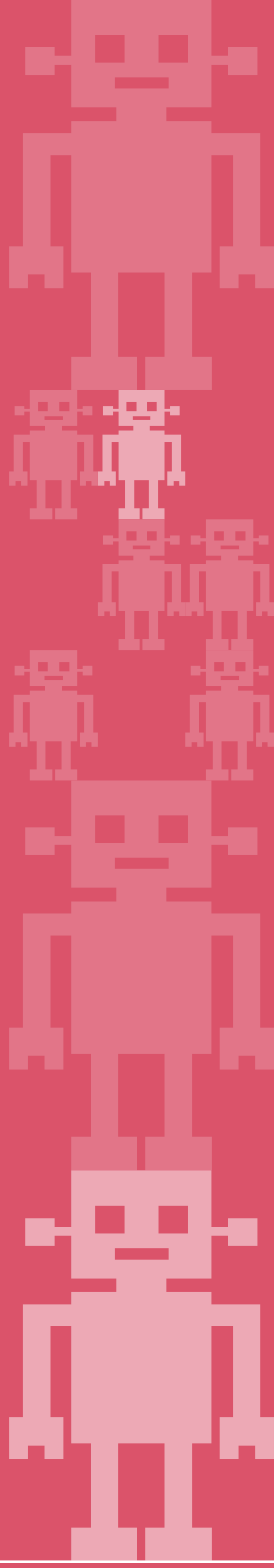
Global Market outlook



Global Market outlook – This report includes an overview of the Global AI market and a focus on the Natural Language Processing (NLP) segment

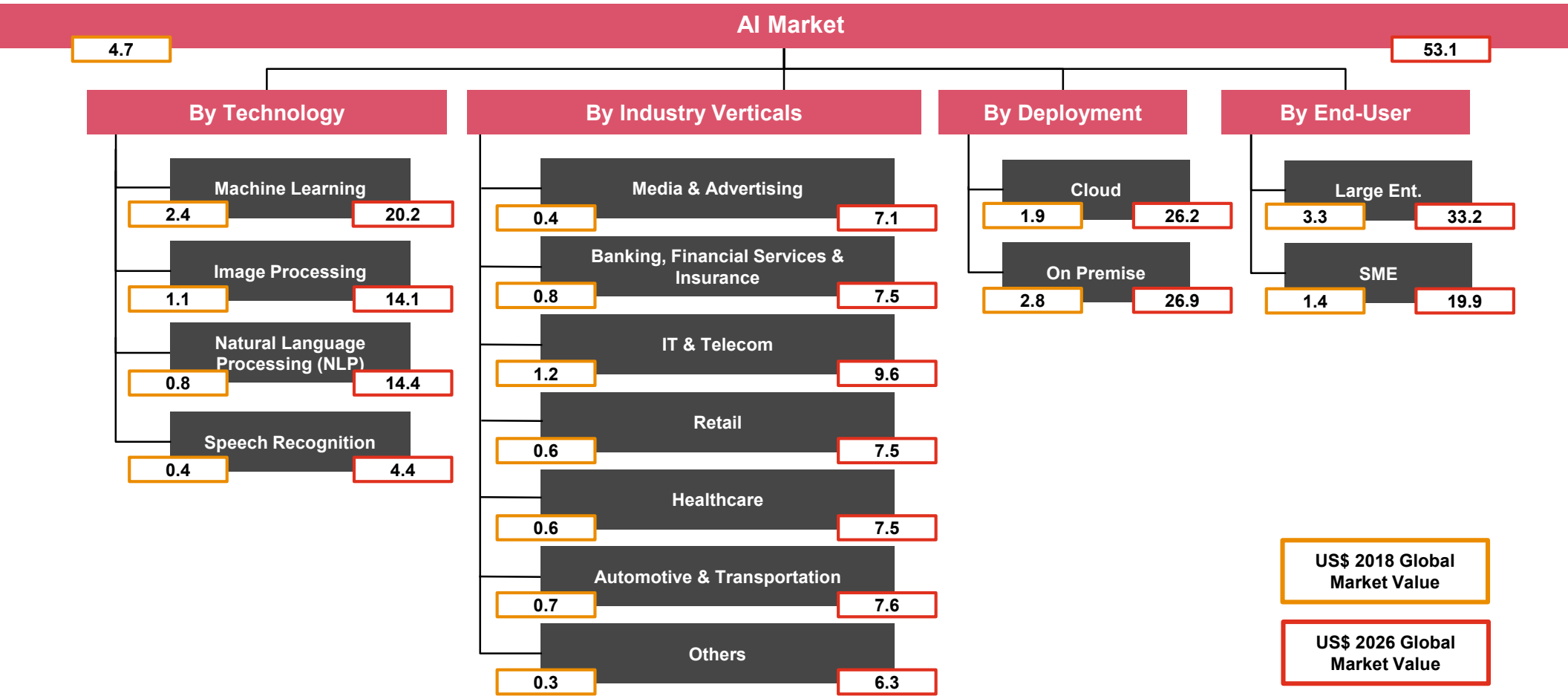


Enterprise AI market



Artificial intelligence market – The Artificial intelligence market is expected to reach a value of $53.1 Bn by 2026, registering a Cagr of 35.4% between 2019 and 2026

Enterprise Artificial Intelligence (AI) Market – Overview



Source: PwC analysis and elaboration on Gartner, Grand View Research, Allied Market Research

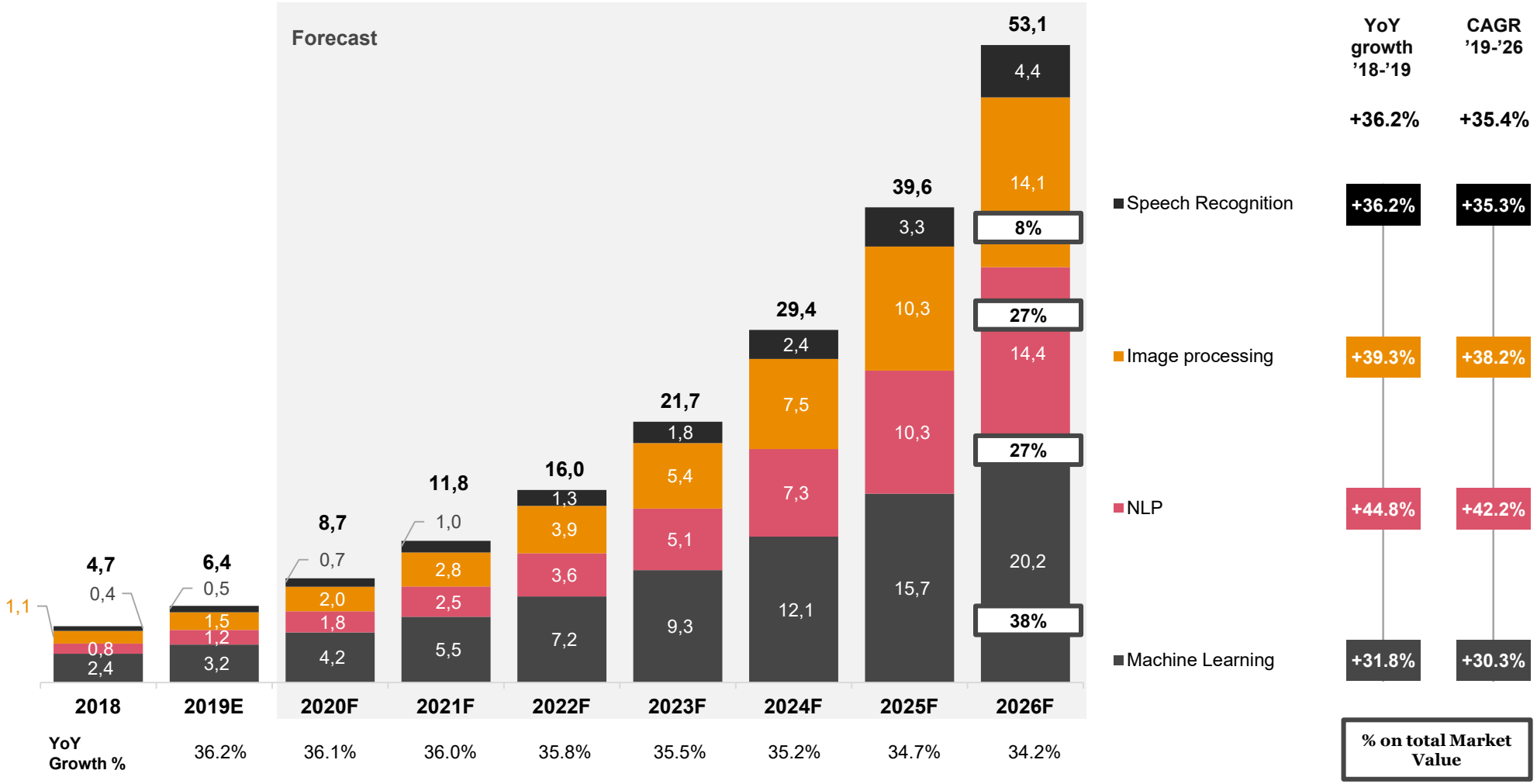
AI market by geography – North America will remain the main market in terms of market value but strong growth is expected from the Asia Pacific region, which is foreseen to surpass Europe and become the second largest market

Region	Revenue 2018 (US$ Bn)	Revenue 2026 (US$ Bn)	Cagr % '19-'26	Market dynamics
 North America	$2.0 Bn	$17.4 Bn	31.2%	• US is the highest contributor to the North American market • R&D in healthcare, autonomous vehicles and cyber security are expected to fuel market growth
 Europe	$1.3 Bn	$13.6 Bn	34.2%	• UK is the highest contributor to the European market • Strong interest in the region by tech giants such as IBM and Google is driving AI adoption in the market • Best-in-class expertise in the most evolved AI industries such as automotive, industrial manufacturing and insurance markets
 Asia Pacific	$1.0 Bn	$16.9 Bn	41.4%	• China is the highest contributor to the Asia-Pacific market • Growth is driven by advancements in algorithmic software systems and strong level of penetration of new technologies in several markets
 LAMEA	$0.4 Bn	$5.1 Bn	38.0%	• Latin America is the highest contributor to LAMEA market • Increase of automation in sectors accounting for large rate of employment such as apparel, logistics, light manufacturing and call centers will drive market growth

Source: PwC analysis and elaboration on Gartner, Grand View Research, Allied Market Research

AI market by technology (1/3) – Considering each technology category and their respective growth prospects, Natural Language Processing is expected to be the most promising segment registering a Cagr of 42.2% between 2019 and 2026

Global AI Market – by Technology
(US$ Bn, %)

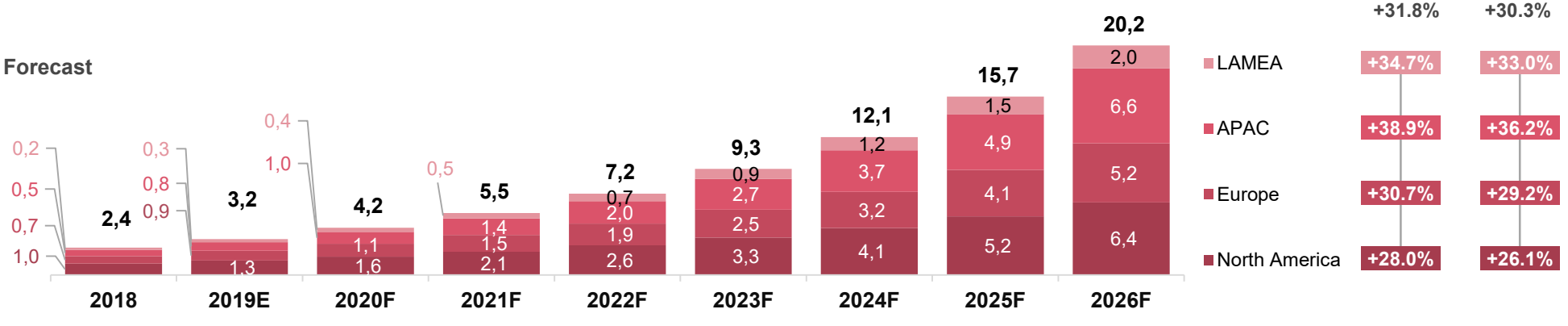


Source: PwC analysis and elaboration on Gartner, Grand View Research, Allied Market Research

AI market by technology (2/3) – Machine learning is expected to reach ca. US$ 20Bn in 2026 (CAGR 18-26: +30%) and NLP is expected to reach ca. US$ 14Bn in 2026 (from ca. US$ 1Bn in 2018); North America and APAC are the key geographies

1 Global Machine Learning Technology – Revenues by Geography

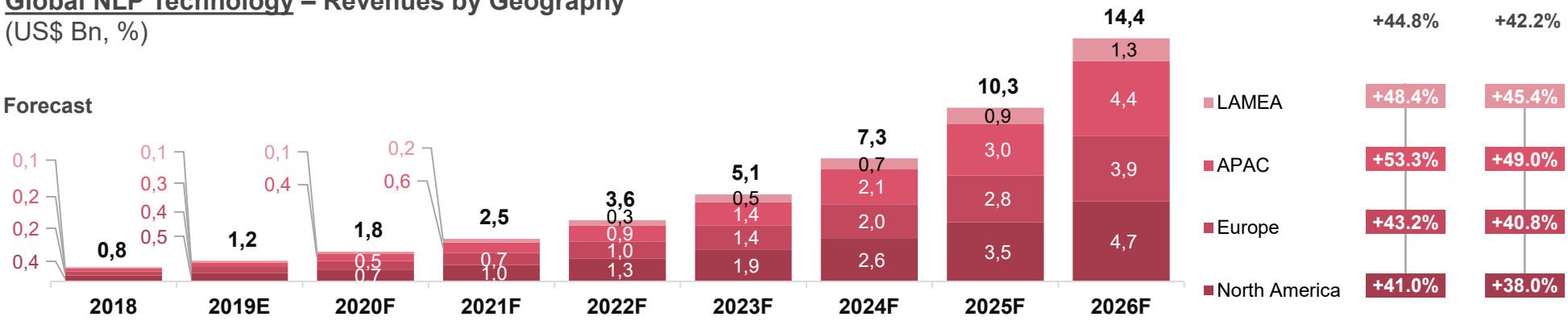
(US$ Bn, %)



YoY Growth %	31.8%	31.6%	31.3%	31.0%	30.5%	30.0%	29.4%	28.6%

2 Global NLP Technology – Revenues by Geography

(US$ Bn, %)

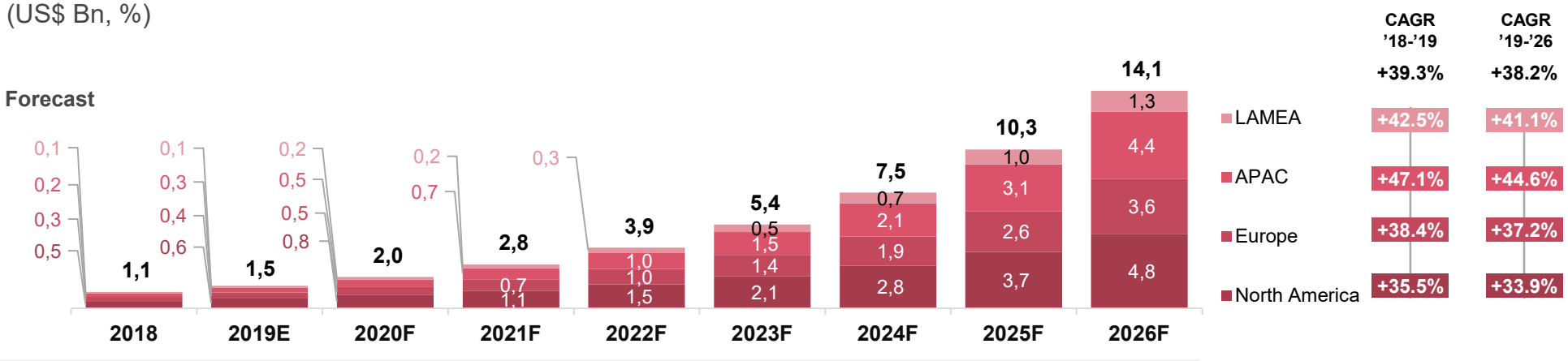


YoY Growth %	44.8%	44.2%	43.6%	43.0%	42.4%	41.7%	40.9%	40.0%

Source: PwC analysis and elaboration on Gartner, Grand View Research, Allied Market Research

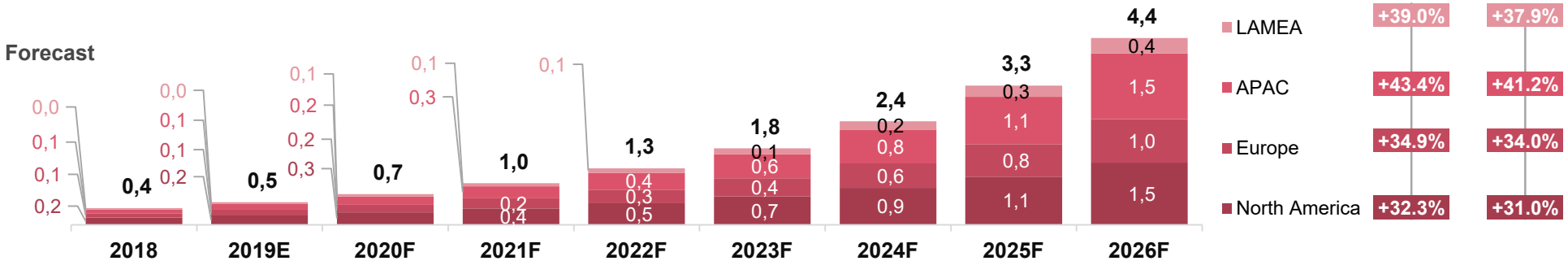
AI market by technology (3/3) – Image Processing is expected to reach US$ 14Bn in 2026 (CAGR 18-26 +38%) while the Speech Recognition market is expected to be worth US$ 4.4Bn by 2026; North America and APAC are the key geographies

3 **Global Image Processing Technology – Revenues by Geography**
(US$ Bn, %)



YoY Growth %	39.3%	39.1%	38.9%	38.7%	38.4%	38.0%	37.5%	36.8%

4 **Global Speech Recognition Technology – Revenues by Geography**
(US$ Bn, %)

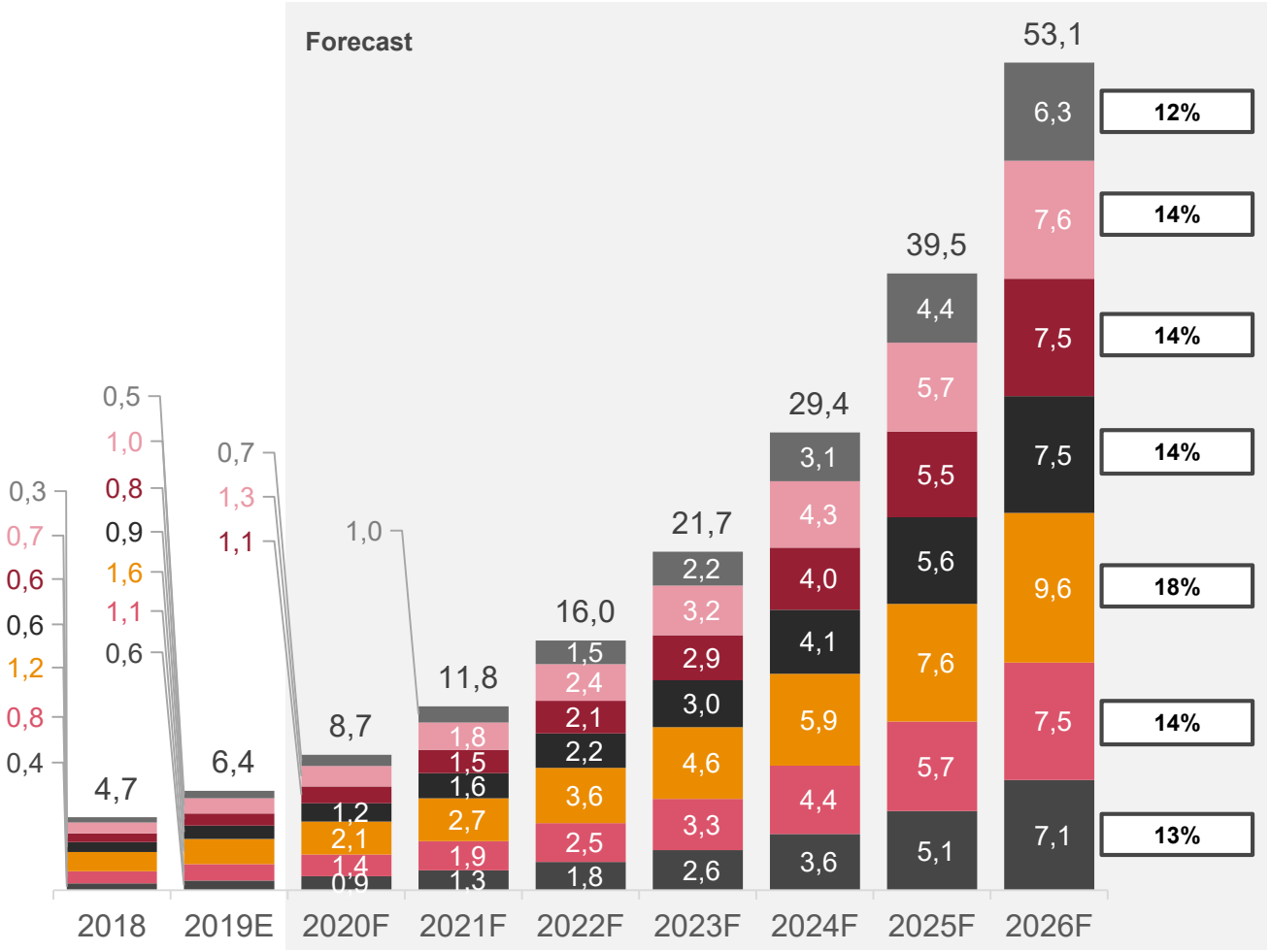


YoY Growth %	36.2%	36.1%	35.9%	35.8%	35.5%	35.2%	34.7%	34.1%

Source: PwC analysis and elaboration on Gartner, Grand View Research, Allied Market Research

AI market by industry vertical – Although IT & Telecom is expected to remain the highest contributor in terms of market value, AI is expected to have a significant impact across all industries. Healthcare and media exhibit the highest growth prospects

Global AI Market – by Industry Vertical
(US$ Bn, %)



	CAGR '18-'19	CAGR '19-'26
	+36.2%	+35.4%
Others	+47.9%	+44.1%
Automotive & Transportation	+35.1%	+34.3%
Healthcare	+39.6%	+38.4%
Retail	+37.1%	+36.3%
IT & Telecom	+30.8%	+29.0%
BFSI	+33.5%	+32.4%
Media & Advertising	+43.7%	+41.5%

% on total Market Value

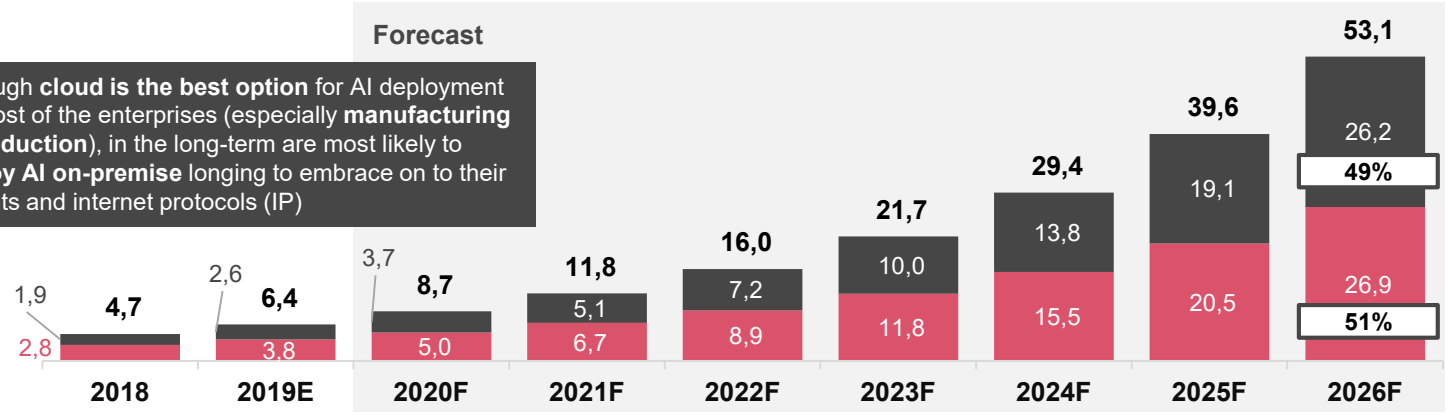
Source: PwC analysis and elaboration on Grand View Research, Allied Market Research

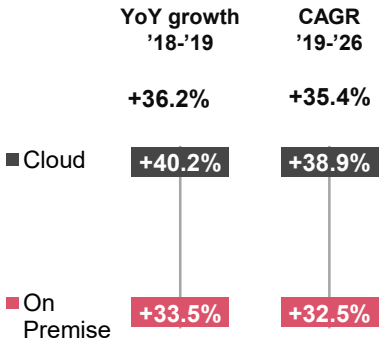
AI market by deployment & End-user – Cloud is expected to experience a strong acceleration over the next 6 years reaching a share of 49% by 2026. Large enterprises will continue to drive AI adoption, representing the main portion of the market

Global Enterprise AI – by Deployment type

(US$ Bn, %)

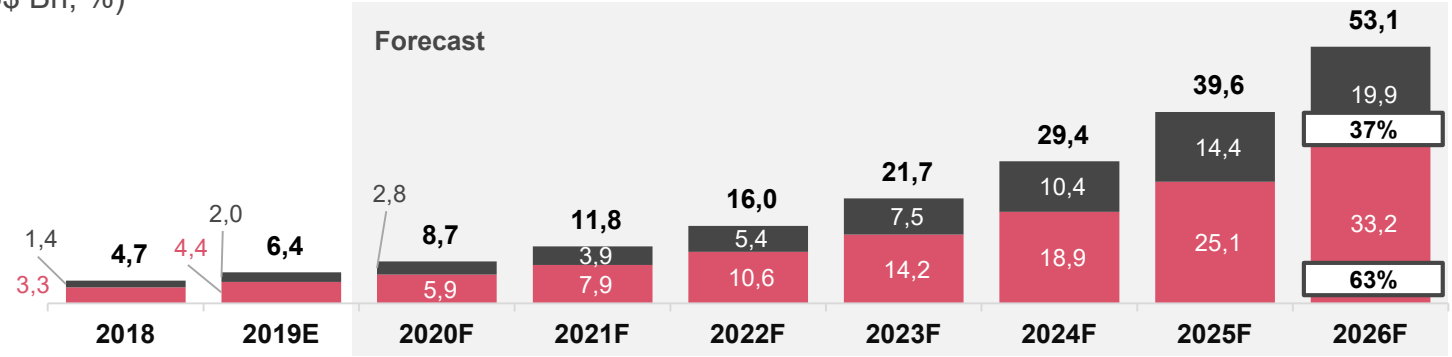
Although **cloud is the best option** for AI deployment for most of the enterprises (especially **manufacturing & production**), in the long-term are most likely to **deploy AI on-premise** longing to embrace on to their insights and internet protocols (IP)

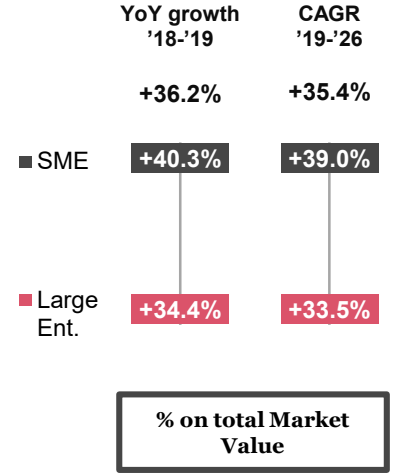




Global Enterprise AI – by End-User

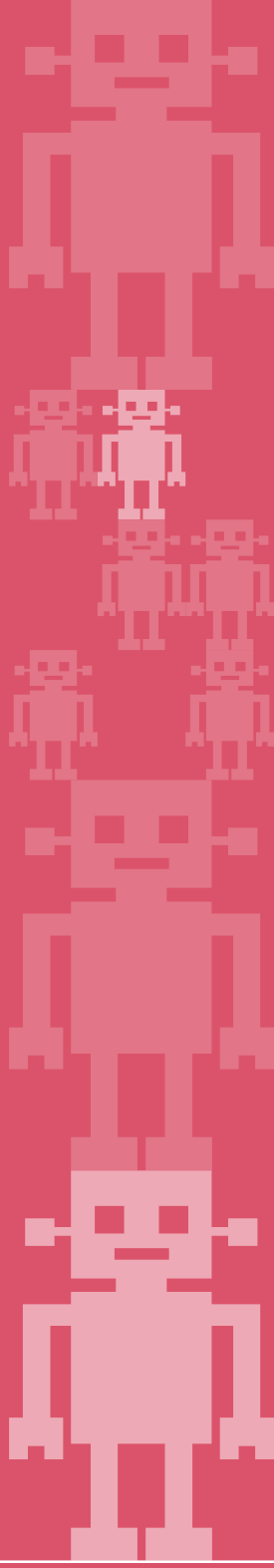
(US$ Bn, %)





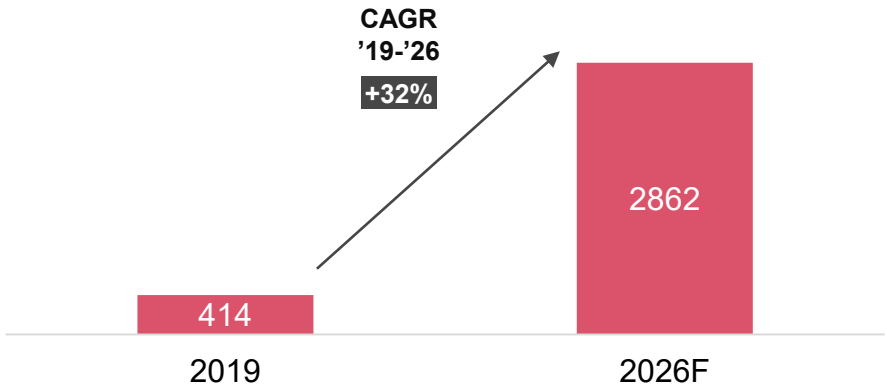
Source: PwC analysis and elaboration on Grand View Research, Allied Market Research

Public Administration market

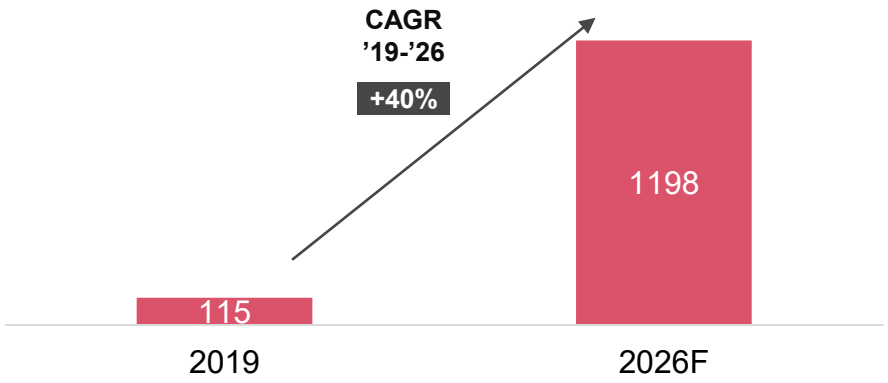


Public Administration AI market (1/2) – Increase in public expenditure for NLP, Text analytics and Intelligent Virtual Assistants fostered by governments' digital agendas worldwide is going to drive AI growth in the Public sector

Global Public Administration AI – Text Analytics, NLP
(US$ Mn, %)



Global Public Administration AI – Intelligent Virtual Assistant
(US$ Mn, %)



AI is gaining momentum in countries' digital agendas. Artificial intelligence will be crucial to:

- help governments to **design better policies** and make better decisions
- **improve the level of communication and engagement** with citizens both at national/federal and local levels
- **enhance the effectiveness** (quality and speed) with which public services are delivered to citizens
- improve interaction and cooperation among different public organizations
- redefine public employees roles and daily tasks from mundane to high-value work

Several OECD countries have already developed a digital strategy with AI as one of the key enablers of digital transformation

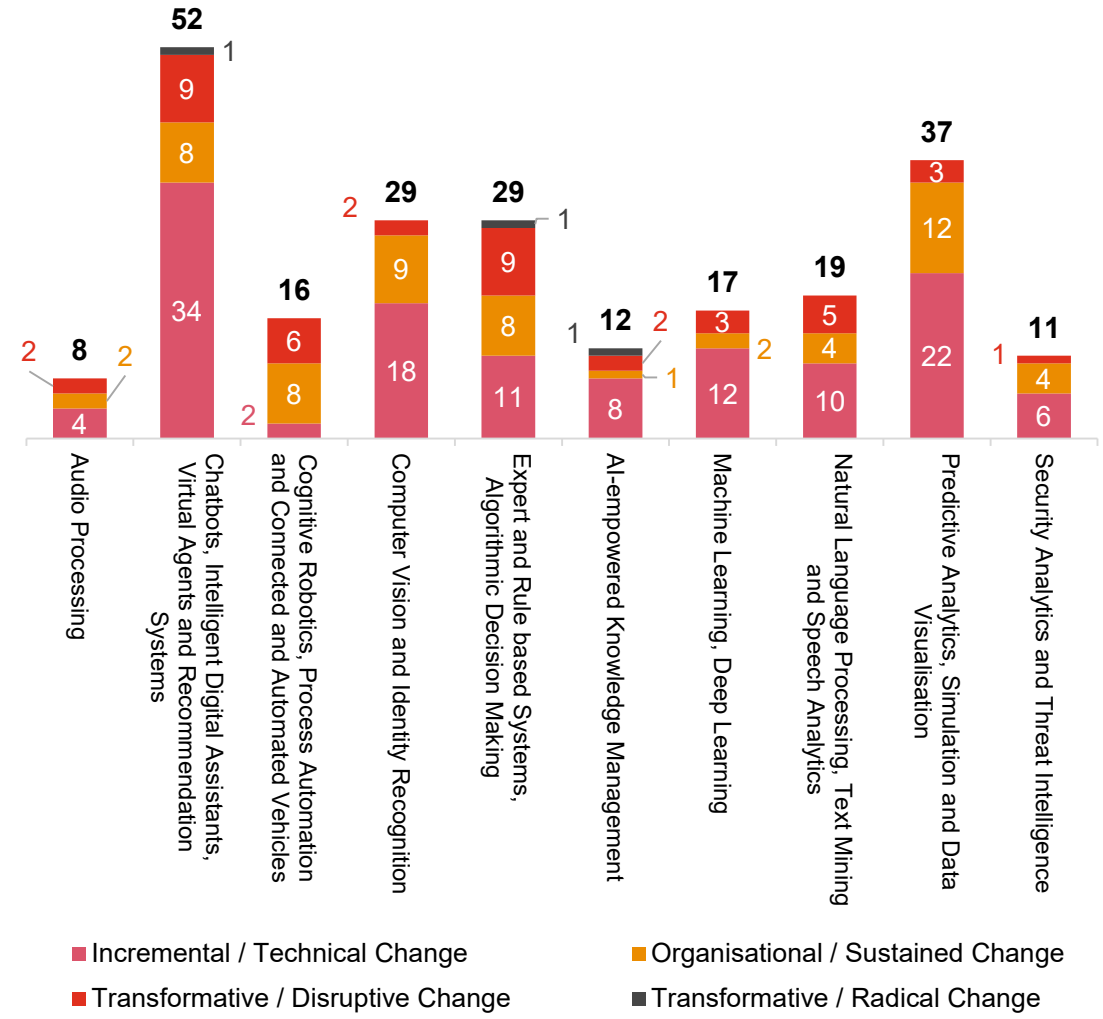
Digital technology platforms are emerging across government agencies as they allow governments to retire legacy systems and infrastructure and therefore achieve greater economies of scale

Gartner

Source: PwC analysis and elaboration on Allied Market Research; Grand View Research; Gartner; OECD (OPSI)

Public Administration AI market (2/2) – NLP and IVAs are gaining momentum. PAs are still implementing AI solutions (NLP and Chatbots) with moderate levels of disruptiveness, suggesting significant potential growth margins in the future

European Survey of AI in Public Administrations – Number of use cases mapped per AI typology



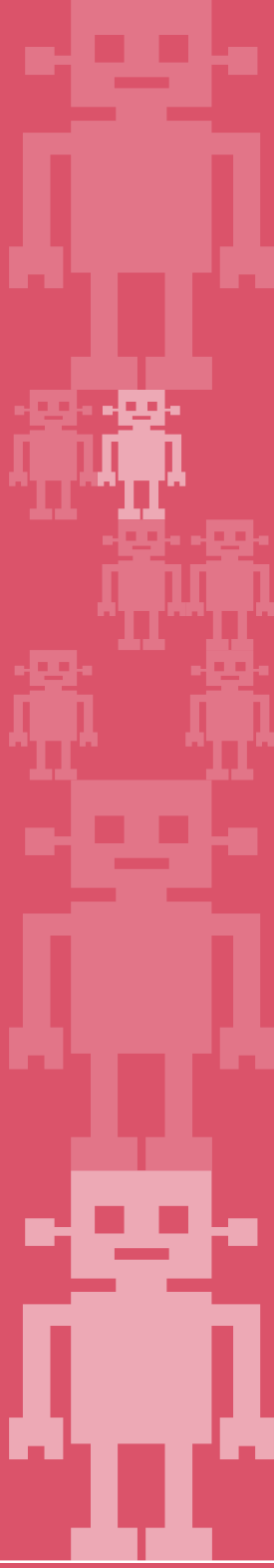
European Commission research

In a Survey conducted at the **beginning of 2020** by the European Commission, a total of **230 use cases** collected from **EU Public Administrations** were identified and analysed

- Of these, the vast majority belonged to the "Incremental/Technical Change" and "Organizational / Sustained Change" categories, suggesting that countries are **currently exploiting AI on a superficial level without exploiting its full potential**
- **Chatbots and IVAs** are the **most popular technologies** according to the number of use cases

Source: European commission, PwC analysis and elaboration

NLP focus markets



Chatbot Market (1/2) – The Chatbot market is a strong growth segment undergoing significant changes in terms of technological development. Speech recognition, contextualization capabilities and multilingual functionality are key to market success

Market definition

- Chatbots represent a **segment of the Intelligent virtual assistant (IVA) market** which was valued at US$ 3.4 bn in 2019
- By simulating human conversations with users, chatbots are able to provide **24/7 assistance**, allowingcompanies to **answer to customer needs in a quicker manner and improve customer experience**

Growth drivers

- Increasing **smartphone penetration** and customer engagement through **social media platforms** are expected to play a significant role in the future market growth
- Increasing use of IVAs in **healthcare sector** for patient management and doctor assistance
- Increasing adoption of chatbots in the travelling **hospitality industry** to improve passenger experience
- Emergence of the **smart factory** concept and introduction of technological advancements to **transform workstation into digital and interactive environments**
- **COVID-19 acts as an accelerator for conversational AI**

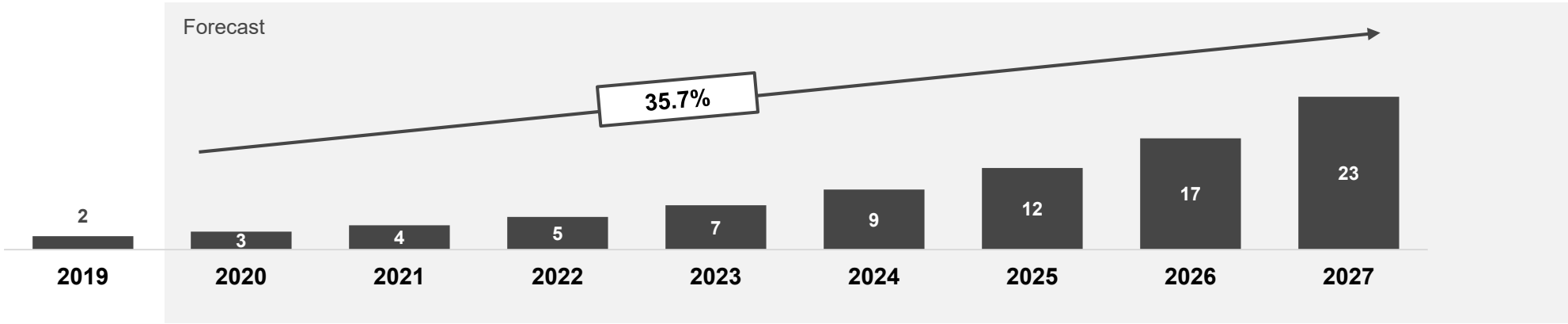
Technology trends

- Advent of **deep-learning based NLP** has improved the ability to understand and handle a wide range of languages and domains
- **Speech recognition** is the **preferred technology** among users but **only few chatbots support voice enabled features today**
- **Increasing importance** of domain specific offerings and **contextualization**
- The Chatbot market is crowded but **several players** lack clear strategic intent and provide **poor performing solutions**

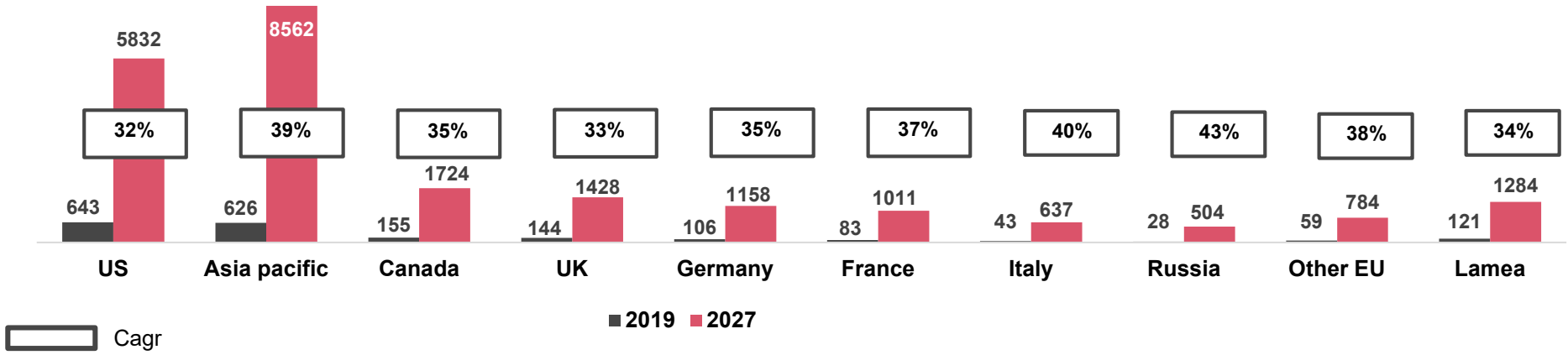
Source: PwC analysis and elaboration on Gartner, Markets & Markets, Allied Market research

Chatbot Market (2/2) – The Chatbot market is expected to reach US$ 23 bn in 2027. America and Asia Pacific represent the main markets (c. 63% of total) but stronger growth is expected from Italy and Russia

Global Chatbot Market
(US$ Bn,%)



Chatbot comparative market value by country
(US$ Mn)



Source: PwC analysis and elaboration on Allied Market research

Contact center market (1/2) – Cloud-based contact centers adoption is expected to increase significantly as the market shifts towards cloud solutions. Agility and flexibility are key elements driving the shift

Market definition

- Cloud based contact centers are defined as a network-based service in which the cloud services provider owns and operates the technology pertaining to contact centers
- Main market types are: **automatic call distribution**, **agent performance optimization**, **dialers**, **IVR**, **computer technology integration** and **Analytics and reporting**

Growth drivers

- Increasing convenience of cloud-based solutions
- Strong growth in **BFSI sector** linked to digitalization of banking industry
- Increasing number of industries moving towards cloud and **automation**
- **E-commerce** growth
- Increasing use of cloud computing by **retail** business in order to offer personalized services to customers and gain insights into their customer-base
- The increasing trend of moving towards **data driven solutions** is driving the demand for reporting and analytics

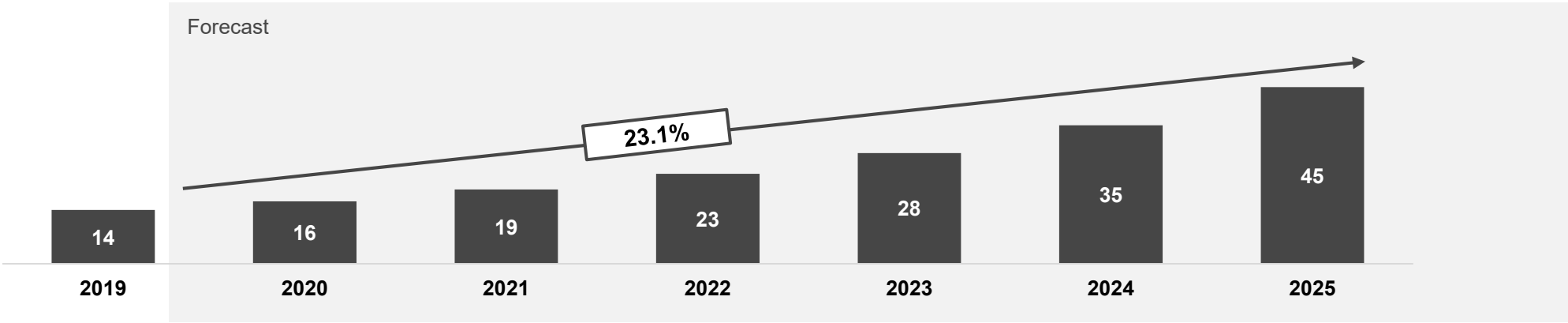
Technology trends

- CCaaS providers continue to mature in terms of **scale, VCA capabilities and carrier connectivity**, with leading providers adding marketplaces, communities and visible trust centers to bolster customer support
- **Three main technologies** comprise the foundation of contact centers: Queueing and routing technologies, workforce optimization technologies and customer relationship management customer service technologies
- Specialty vendors look to **connect voice and digital channels**
- Contact center technology is evolving toward tightly **integrated software suites**

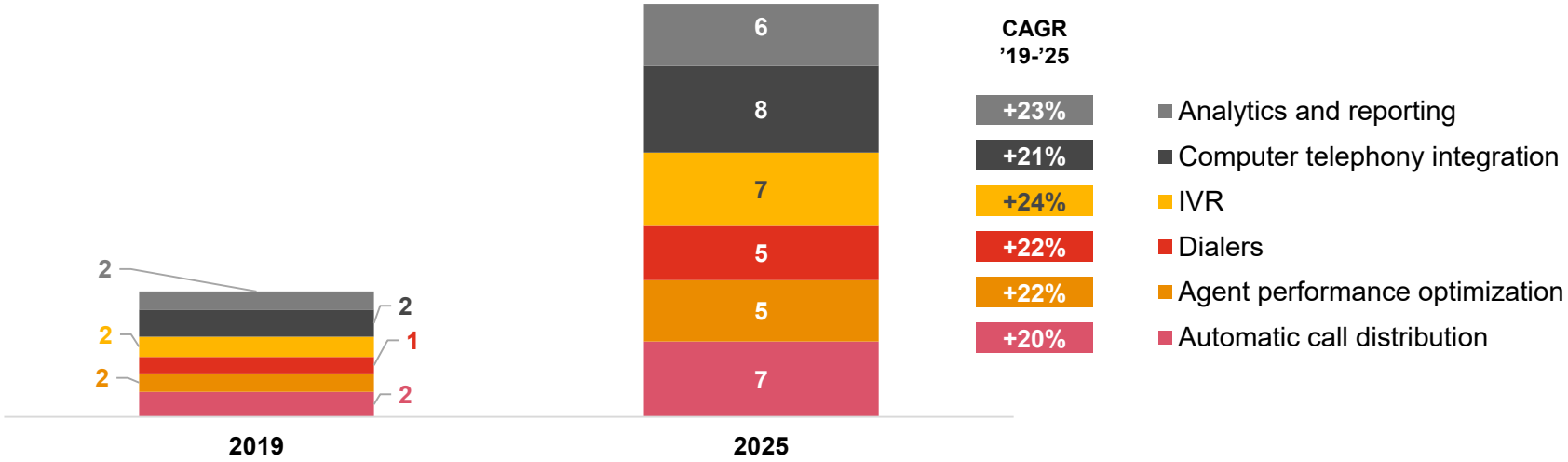
Source: PwC analysis and elaboration on Mordor, Gartner, Forrester

Contact center market (2/2) – The Cloud-based contact center market is expected to grow at a 23.1% Cagr from 2020 to 2025 reaching a total value of US$ 45 bn by 2025, remaining evenly distributed across the different typologies

Cloud-based contact centre market
(US$ Bn,%)



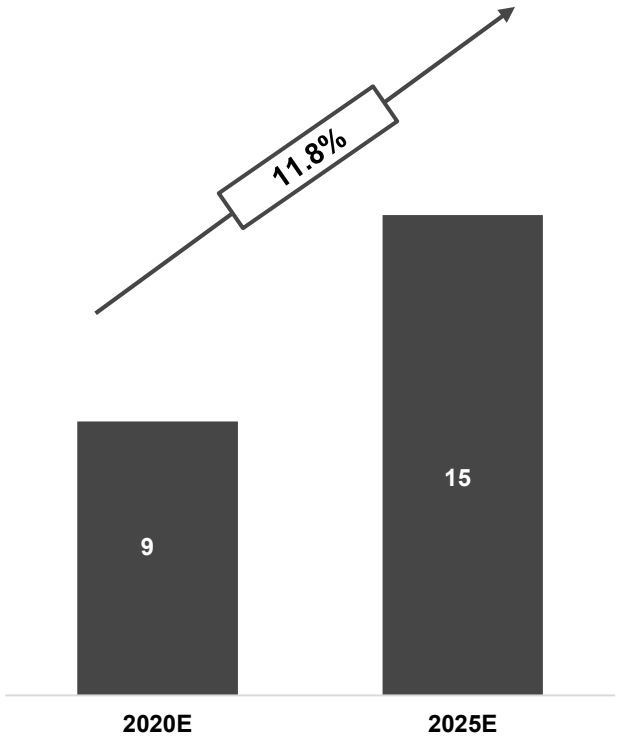
Cloud-based contact centre market by type
(US$ Bn)



Source: PwC analysis and elaboration on Mordor Intelligence

CX Management market – The Customer experience management is expected to grow at 11.8% Cagr from 2020 to 2025 reaching a market value of US$ 15 bn by 2025

CX management market
(US$ Bn,%)



Growth drivers

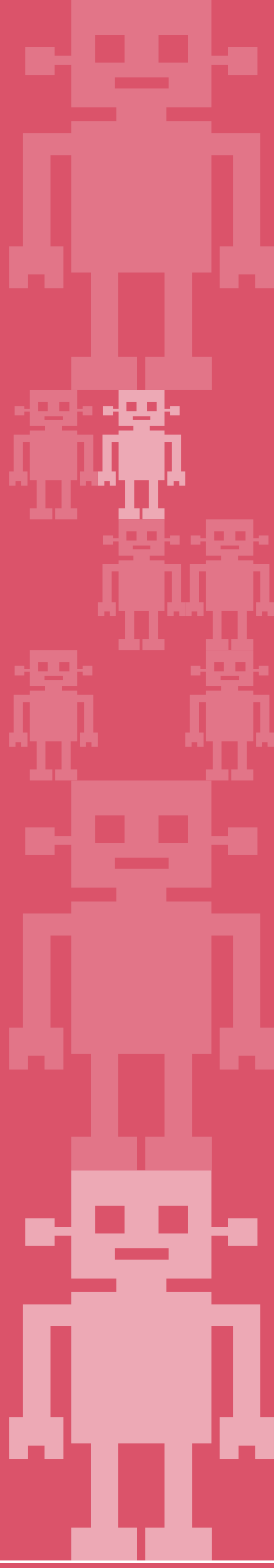
- Increasing adoption of customer experience solutions by **healthcare** and **public sector** following the COVID-19 outbreak
- Increasing attention by organizations to **customer churn rate reduction**
- Increasing number of organizations intending to use AI to assist with customer service moving from **reactive processes to proactive and predictive ones**

Technology drivers

- Need to improve **integration** of data from **different touchpoints**
- Need to ensure **high level of data security** to comply with regulation and maintain customer trust
- **Cloud segment** expected to grow at **highest CAGR** due to its cost-efficiency and hassle-free integration

Source: PwC analysis and elaboration on Markets & Markets

Italian market snapshot

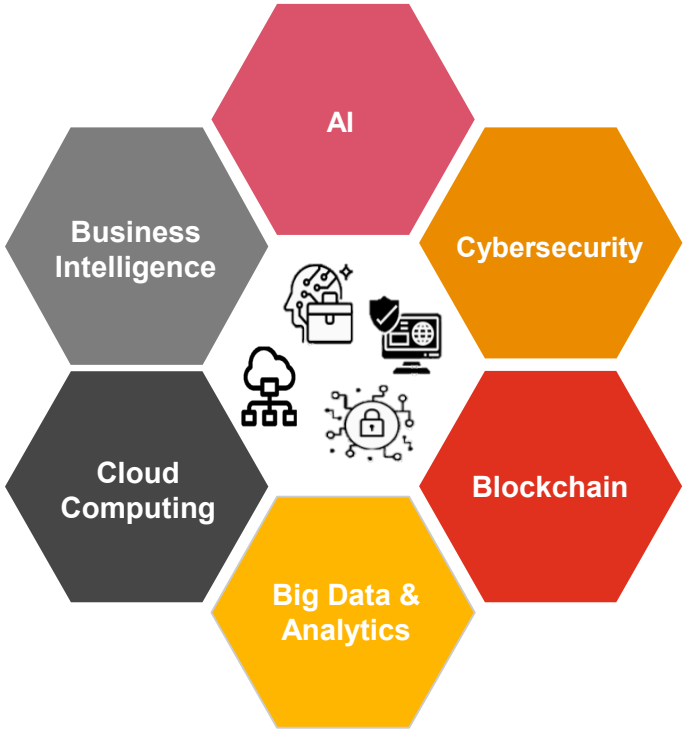


Italian Digital market (1/3) – In the first half of 2020 the Digital Market confirmed its growing trend in Italy, especially for some fast-growing segments like AI, Cybersecurity, Blockchain, Big Data, Cloud and BI

Key Trends

- In the 1H of 2020 the **Digital Market** confirmed its growing trend and its key positioning for the future growth of the country
- **Smart-working enablers**, **business continuity**, **flexibility** and **resilience** are top key priorities for companies and those will lead to an acceleration of **modernization projects** both in terms of **infrastructure and applications**
- The digital market will show differentiated trends with respect to the technology taken into consideration: **growth** for cloud, cybersecurity, collaboration enabling tools, telecommunication and investments **decline** for hardware, PC desktop and smartphone
- On one hand, **slowdown/postponement of "non-strategic"/"mission critical" projects** will have an impact on system integration and IT consulting services. On the other, companies face the need to **update their information systems**, front-end and client-oriented instruments and back-office

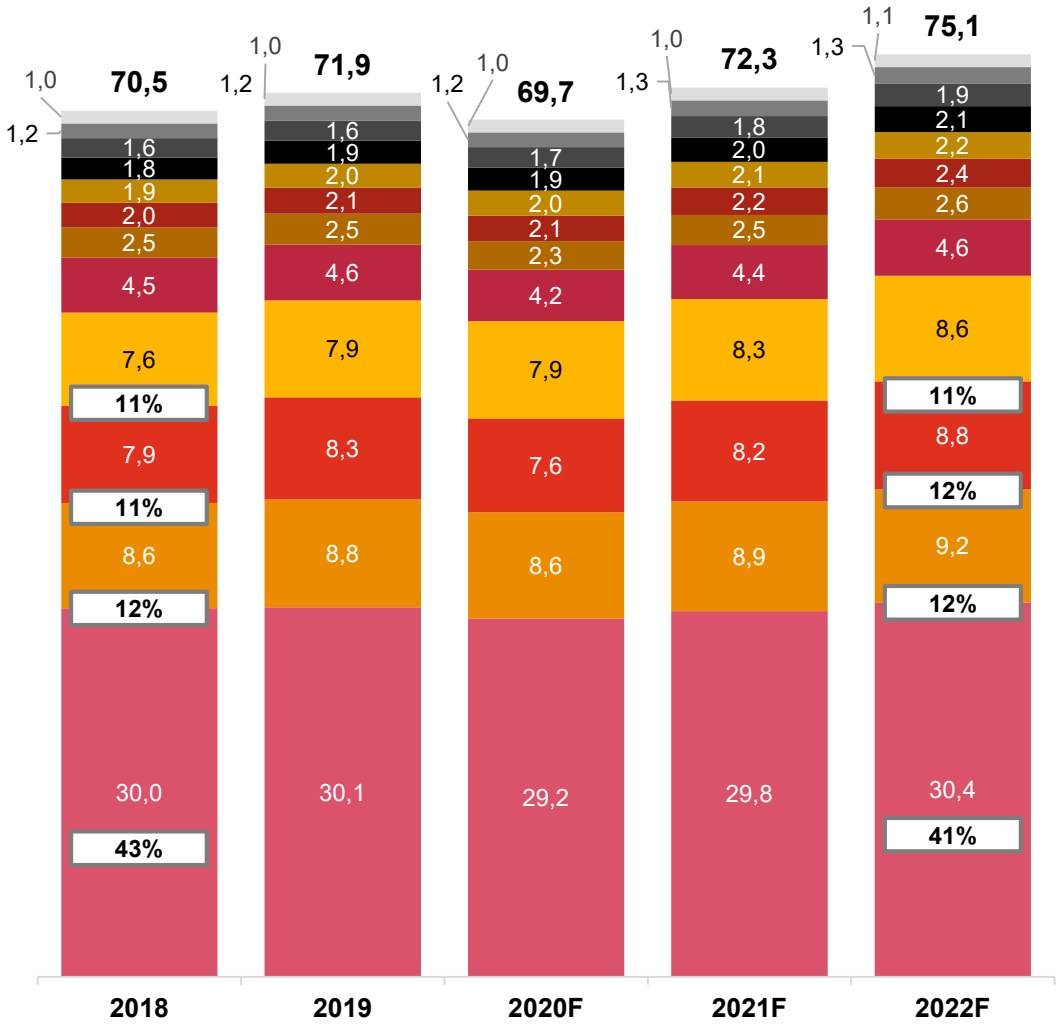
Fastest growing segments

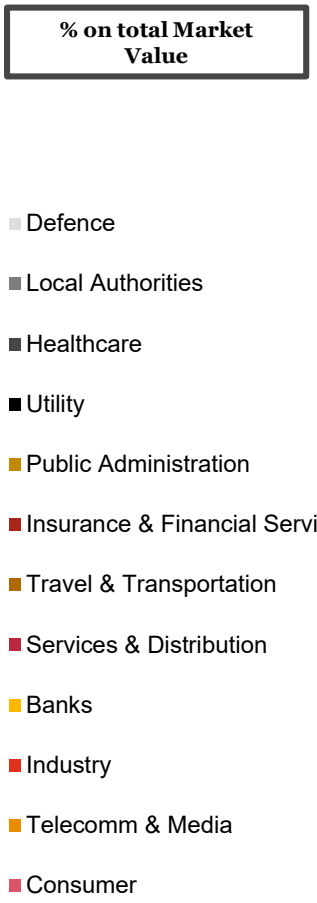


Source: PwC analysis and elaboration on Anitec - Assintel

Italian Digital market (2/3) – The Consumer industry is expected to remain the highest contributor in terms of market value whereas healthcare is the most attractive industry in terms of growth prospects

Italian Digital Market – Revenues by Industry
(€Bn, %)





POST-COVID-19 DATA

	CAGR '18-'20	CAGR '20-'22
	+2.1%	+1.4%
Defence	+1.0%	+0.4%
Local Authorities	+0.8%	+2.8%
Healthcare	+4.4%	+4.1%
Utility	+4.9%	+4.0%
Public Administration	+3.1%	+3.3%
Insurance & Financial Services	+5.3%	+3.6%
Travel & Transportation	+2.2%	+1.4%
Services & Distribution	+2.1%	+0.1%
Banks	+3.8%	+3.0%
Industry	+4.8%	+1.9%
Telecomm & Media	+2.6%	+1.7%
Consumer	+0.3%	+0.4%

Source: PwC analysis and elaboration on Anitec

Italian Digital market (3/3) – PA, Governmental Institutions and Digital & Technological Innovation Research Centres are playing and are expected to play a substantial role in the post-COVID-19 Italian relaunch plans

Italian "Innovation" National Plan

- Public Service App
- Digital Republic
- Governance for Digital Innovation
- AI ethical LAB-EL
- Digital Restructuring

- Digital domicile
- Digital identity
- Shared digital infrastructure (Cross-tech Hub)
- Digital Tax

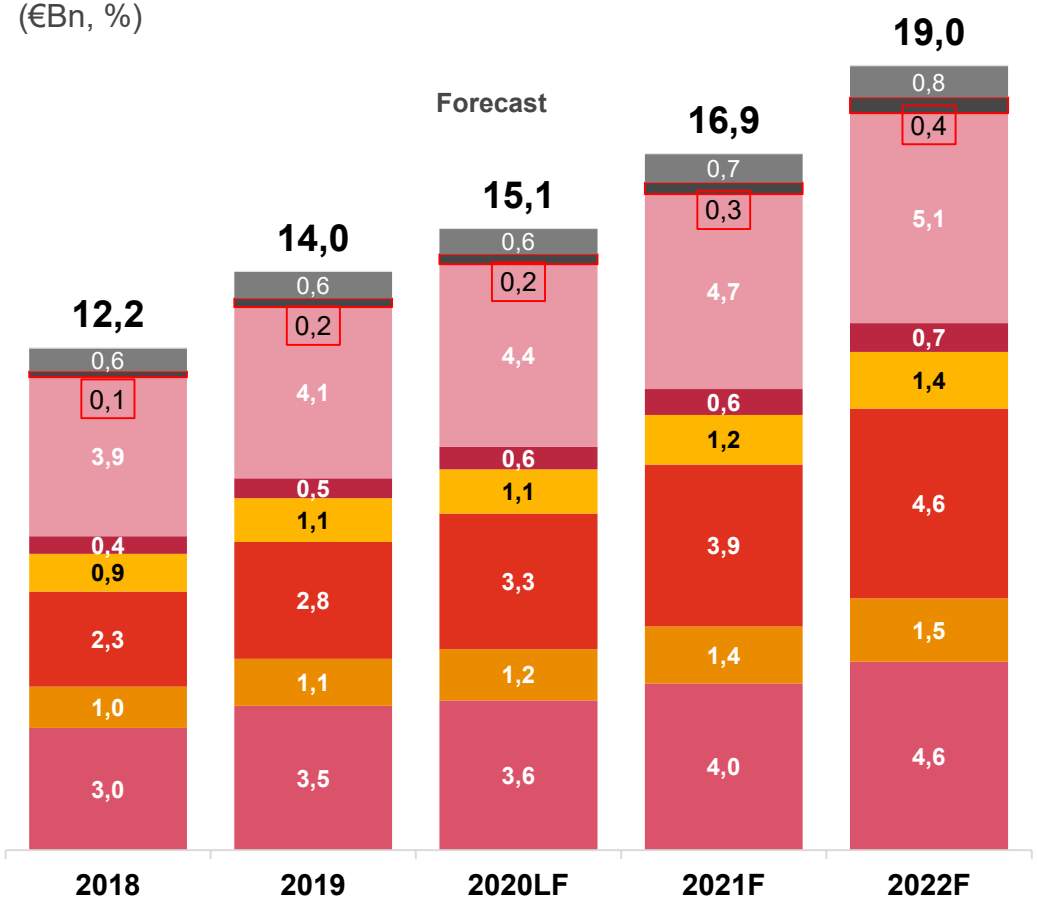
PA Strategic Guidelines

SIDI Implementation (Education Information System)	Digital Transformation	Data Management
NSIS Development (Health Ministry Information System)	Public Cloud (IAAS/PAAS)	Cloud

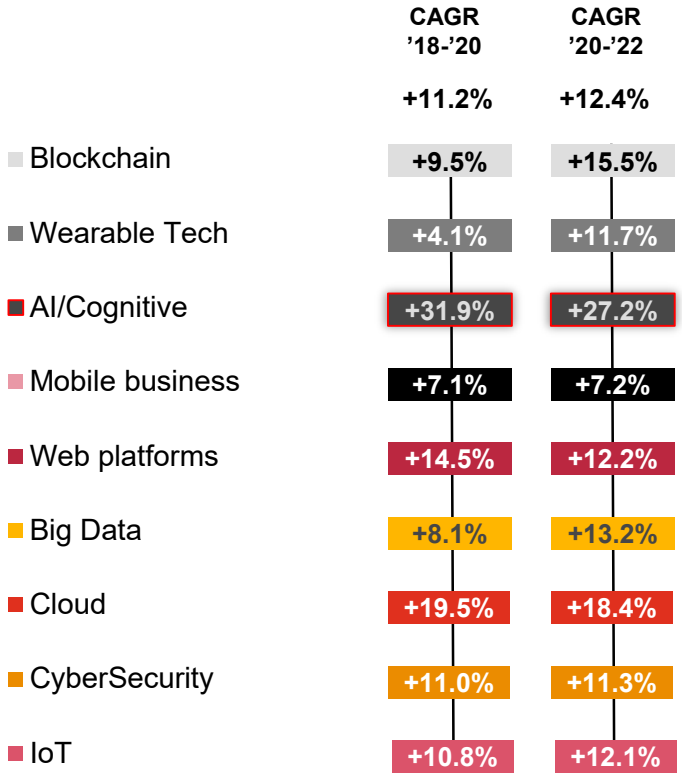
Source: PwC analysis and elaboration on Anitec, NetConsulting

Italian Digital Enablers – Artificial intelligence is the fastest growing segment within Italian digital market and is expected to reach a total value of €0.4 Bn by 2022, registering a Cagr of 27% between 2020 and 2022

Italian Digital Enablers – Revenues by Segment
(€Bn, %)



YoY AI Growth %	59%	9%	21%	33%

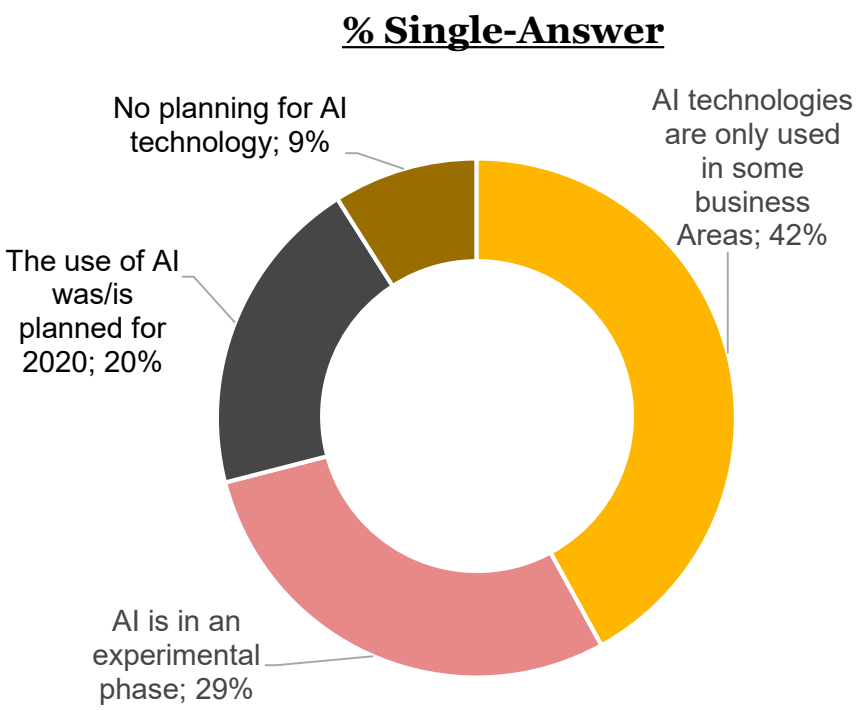


Source: PwC analysis and elaboration on Anitec - Assintel

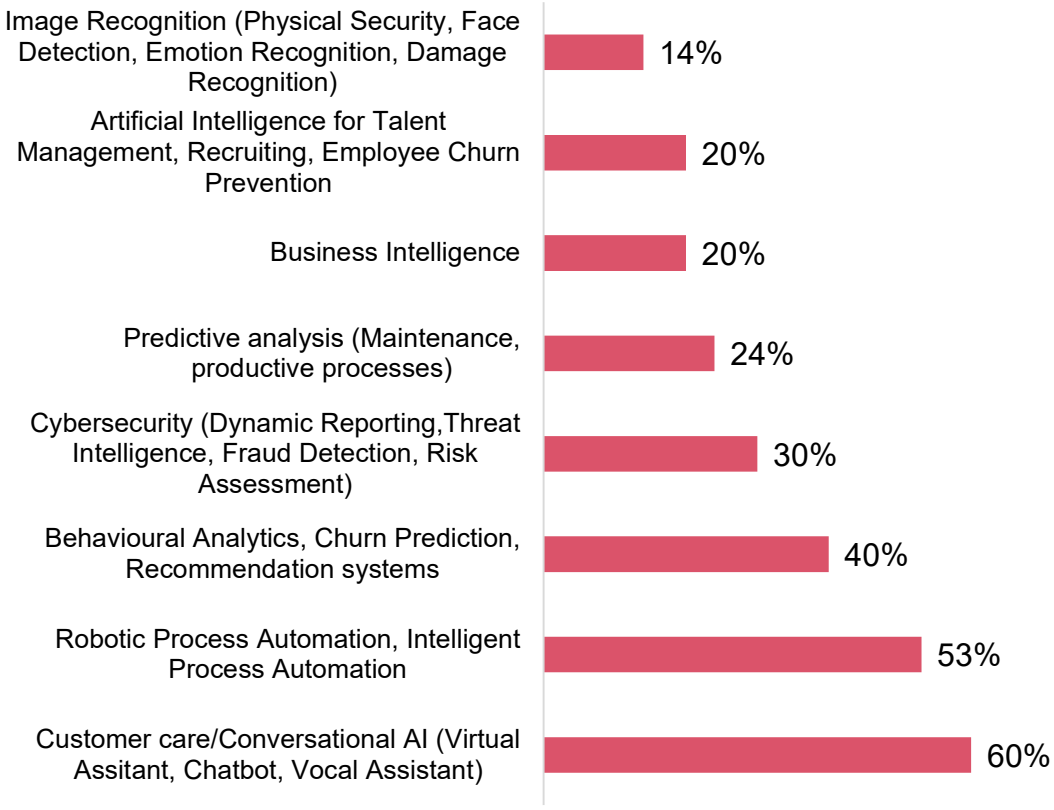
Diffusion & Application of AI technologies – Italian firms are attributing increasing importance to AI although AI use is still limited only to some business areas. The main applications include customer care, conversational AI and RPA

Diffusion and Application Areas of AI solutions in Italian firms
(NetConsulting cube, 2020 Survey)

Diffusion of AI solutions



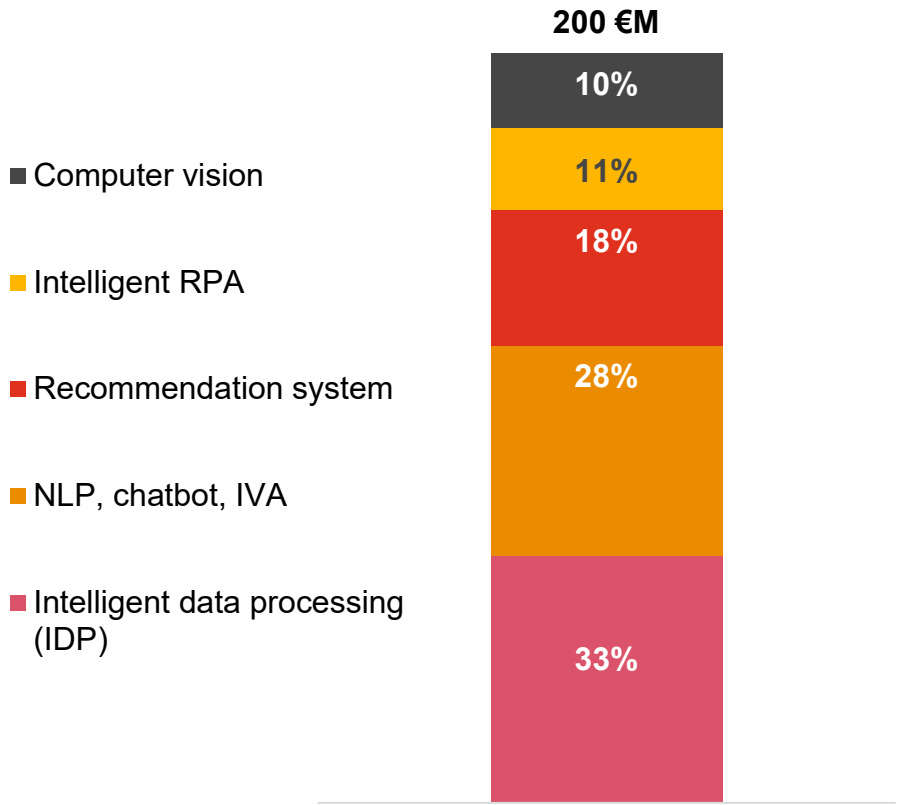
Application Areas



Source: PwC analysis and elaboration on Anitec – Assintel, NetConsulting

AI enterprise expenditure – Banking and finance is the sector that attracted most investments in Italy in 2019. Majority of AI projects focused on intelligent data processing, natural language understanding and conversational systems

2019 Italian AI expenditure by project



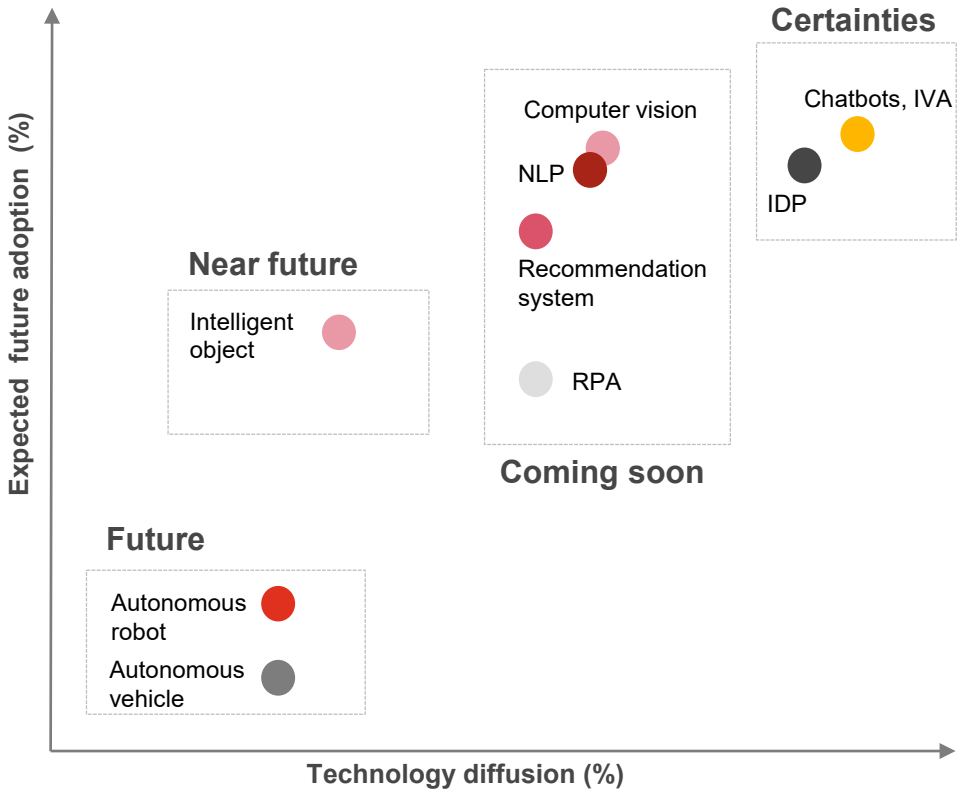
Key insights

- Italian companies invested c. €200m in Artificial intelligence projects
- Banking and finance accounted for c. 25% of total investments, followed by manufacturing (13%), Utilities (13%) and Insurance (12%)
- Main investments were directed to Intelligent data processing (c. 33% of total investments) and Natural language processing and conversational systems (c.28% of total investments)
- According to Gartner, companies that implemented AI solutions registered a revenue growth ranging from 4% to 14% between 2018 and 2019

Source: PwC analysis and elaboration on Politecnico di Milano

Technology maturity – Chatbots and IVAs are the most popular technology presenting both a high rate of diffusion and a promising base for future growth. NLP has a lower rate of diffusion but its adoption is expected to increase in the future

Technology maturity
(Ossevatorio artificial intelligence 2020, Politecnico di Milano)

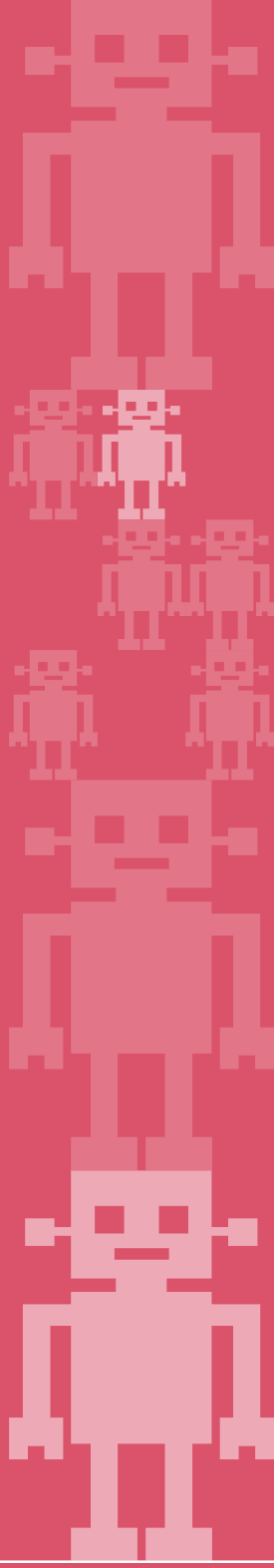


Key insights

- **Chatbots and intelligent virtual assistant** are the solutions with the **highest rate of diffusion** and with the **highest expected future adoption**
- The main applications of chatbots and IVAs are **customer care** and **internal assistance services** (e.g. help desk)
- **Intelligent data processing** also presents a **high diffusion rate** and expected growth. The main applications of IDP include forecasting, classification, and clustering
- Computer vision, **NLP**, recommendation systems and RPA are less adopted compared to “certainties” but present **good prospects of development for future years**

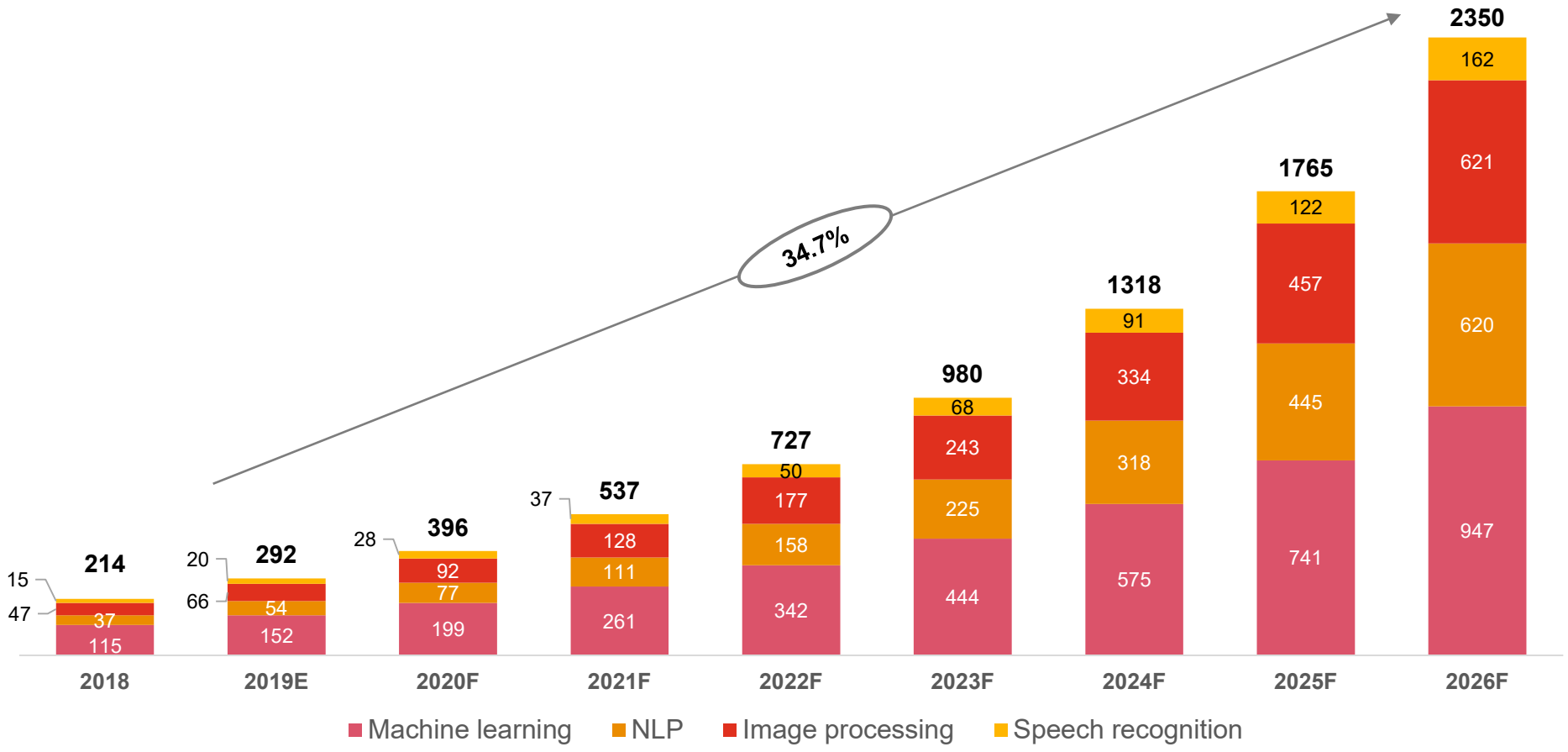
Source: PwC analysis and elaboration on Politecnico di Milano

LATAM market snapshot



AI Latin American market (1/2) – The Latin America artificial intelligence market is expected to reach US$ 2350 mn by 2026 (Cagr of 34.7%). NLP, speech recognition and image processing are expected to be the most attractive segments in terms of growth

AI Latin American market – by technology
(US$ Mn,%)



Source: PwC analysis and elaboration on Allied Market Research; Grand View Research; Gartner

AI Latin American Market (2/2) – A new wave of automation is expected to strike Latin American market driving AI investments across all industries. Financial services industry and Retail are expected to be most impacted industries

Key trends

- A **new wave of automation** is expected to drive AI adoption. Investments will be directed mainly at **eliminating process inefficiencies** but are foreseen to have a **broader impact affecting** the general ecosystem and the **way in which people interact**
- AI investments accounted for 18% of total IT investments in 2018 compared to a share of 3% in 2017. Increasing importance of AI initiatives is motivated by the fact that companies are considering **artificial intelligence** as a **crucial element to build and maintain competitive advantage**
- Although AI is foreseen to influence all industries, greatest increase in spending will be experienced in industries using large amount of multi-structured data. **Main benefits** expected from AI investments for enterprises include i) **product/service innovation**, ii) **operations optimization** and iii) **customer experience transformation**

Industry focus

- **Financial services** industry is expected to drive market growth representing **17% of total AI spending by 2022**. AI adoption is driven by the need to meet next generation customer needs and retrieve knowledge from large amounts of data. Main use cases are **chatbots** and **virtual assistance** for user experience optimization

- **Retail** is expected to account for c. **7% of total AI spending by 2022** and AI is expected to play an increasing role in customer loyalty development and customer support. Key use cases for retail industry are: i) **virtual agents** and **chatbots** to bring optimized solutions to customers and ii) **omnichannel operation control** for product localization

- AI will be increasingly used also in i) **insurance industry** to provide advisory services and claims processing automation and in ii) **securities and investment industry** for fraud analysis and investment recommendation

Challenges & opportunities

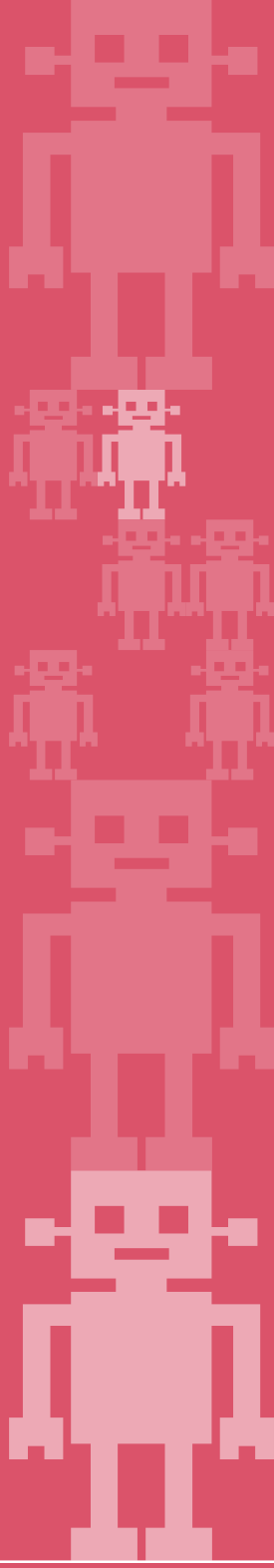
Main **challenges** to AI adoption in the short term are:

- **shortage of algorithm training data**
- **lack of analytical staff**
- Obsolete **legal frameworks**
- Low levels of **data literacy**

- By **2022 75% of IT operations will be replaced by AI or analysis-based automation**
- Development opportunities will come from **telecommunication**, **healthcare** and **manufacturing industries**
- Increasing use of **predictive analysis** to detect anomalies, make predictions and prescribe potential actions

Source: PwC analysis and elaboration on Allied Market Research; Grand View Research; Gartner

Emerging trends



Key technology trends (1/2) – STT and conversational platforms are mature markets and will focus on value added services and highly specialized functions. Tech giants and innovative start-ups are paving the way for further market development in text analytics

Technology	Trends
 **Text Analytics**	• **Gig techs** (e.g. Google) are expected to play a **crucial role in market development and their services could be used by new entrants and system integrators to develop vertical solutions easily and at lower cost**. One advantage of gig techs' text analytics platform is the use of crowdsourced knowledge graph, which competitors will struggle to keep up with • Document capture options and mining text from **images and cursive writing in multiple languages are key differentiators** for document-focused enterprise text analytics platforms, which focus on analysing relatively long documents, such as contracts, insurance claims, invoices, and purchase orders
 **Speech to text**	• STT providers have enlarged their offerings beyond simple transcription, to offer a raft of voice-related services, from **authentication to real-time alerts, compliance and emotion detection** • Niche solutions will continue to play a role as best-of-breed offers, supporting **less common languages** (e.g., Malayan, Manglish or Sinhalese) or applications targeting specific niche requirements. Meanwhile, broad suites from the very large artificial intelligence cloud providers will increasingly dominate the NL technology ecosystems • Increase in the partner services specifically around **voice experience design**. Simply having access to the baseline STT technologies does not make for a good voice experience design. Design agencies, who have evolved through web, social and mobile platforms will partner with practitioners in STT to deliver richer cognitive design services • Creation of go-to-market strategy for rapid deployment by packaging all supporting STT features into a consolidated and **productized API** with low to no coding requirements

Source: PwC analysis and elaboration on Gartner, IDC, Forrester, Mordor

Key technology trends (2/2) – STT and conversational platforms are mature markets and will focus on value added services and highly specialized functions. Tech giants and innovative start-ups are paving the way for further market development in text analytics

Technology	Trends
 **Conversational platforms**	• **Dialog management capabilities** will be crucial to develop more natural conversational agents. Evolutions include advanced dialog editor, integrating decision trees with BPM, a partial autonomy of the virtual agent and a dynamic interaction between virtual and human agents • **Recognizing the facial expressions** and classifying the related emotions can improve communication between humans and bots by better interpreting the conversation and the sentiment of the person • STT **language and acoustic assets**, such as taxonomies and lexicons, are **not yet very transferable** or interoperable with other natural language technology (NLT) platforms. On the other hand, text analytics has been witnessing a **revolution** caused by Google's last tech advancements (Bert) that **accelerates training on languages** and knowledge domains • Increase of **strategic alliances** between tech heavyweights and focused providers is expected as the conversational market consolidates
 **Open-source**	• Following **BERT** release in 2018 several **open sources technologies have emerged** on the market (e.g. BigBird, GPT-3) • These technologies give access to the market to **System Integrators, Consulting Firms, enabling them to develop** their **own products/solutions** quickly and with very modest investments • Furthermore **open-source tech gives a large group of small start-ups and universities spin-offs** with distinctive vertical competencies the **means to effectively compete** on the market

Source: PwC analysis and elaboration on Gartner, IDC, Forrester, Mordor

Tech enablers – Hybrid multicloud is gaining momentum and represents the next generation of IT architecture. Trustworthiness has become a crucial requirement by both users and regulators but challenges are still undermining its implementation

Tech Enabler	Description
 **Infrastructure**	• **Hybrid multicloud** represents the next generation of IT architecture. The cloud and mobile revolutions have accelerated the pace of data creation, both structured and unstructured. Hybrid multicloud platforms are the future of data architecture and address the data proliferation challenge across multiple silos, databases, and clouds. They knock down data silos to bring AI to their data
 **Skills & Competences**	• **Trustworthy AI** is quickly becoming a business imperative. Fairness, explainability, robustness, data lineage, and transparency, including disclosures, are critical requirements that need to be addressed now. While rapid advancements are being made on all fronts from the suppliers including ensuring data privacy and safety of AI systems, there are still gaps and challenges ahead • As organizations move from investigation to pilot to production, users are starting to see issues with getting the **necessary skills**, especially data scientists. Many vendors are addressing these needs by offering **suites of tools and APIs** that help enterprise developers to create AI-enabled applications more easily than ever before. Some offer **prepackaged services** to create applications that recommend products, optimize pricing, perform predictive maintenance, provide financial advice, and address a whole host of other use cases. **Low-code/no-code development** is on the rise, and all platforms vendors should pay heed while linking to the wide range of open-source machine learning (ML) frameworks and tools that are already available
 **Vertical Focus**	• *"Operationalising AI is currently the industry's toughest challenge, and few companies have been successful at taking proofs-of-concept out of the lab, imbedding them strategically in their operations, and delivering actual business impact"* – ***Jean-François Gagné CEO Element AI*** • Large players such as IBM remain focused on technologies with marginal interest so far in specific applications and vertical solutions. Nonetheless, the rapid market growth is likely to attract some players toward specific markets which today are regarded as niches, but not in the near future (e.g. healthcare) • A business solution oriented model could become a relevant part of large players' value proposition in the short term

Source: PwC analysis and elaboration on Gartner, IDC, Forrester, Mordor

Key trends by vertical industry (1/2) – Healthcare is the market with the highest potential for AI applications; VAs and conversational bots will be used more and more across all the industries also considering COVID-19 impact

Vertical industry	Trends
 **Healthcare**	• Chatbots have become a natural choice for **disseminating health information** in an interactive manner, gaining popularity against traditional online search methods. **COVID-19 is expected to accelerate the trend** considering the necessity to reduce the burden on hospital call centers. Features such as **interactive symptom checking** through question and answer can allow continuous monitoring of symptoms, potentially lowering the volume of cases in urgent care and emergency care by focusing on prevention • AI has **countless applications** in healthcare — whether it's being used to discover links between genetic codes, streamline radiology and pathology diagnosis to power surgical robots, or even maximize hospital efficiency. Top use cases are: ■ Diagnosis and treatment systems ■ **Automated customer service agents** ■ Sales process recommendation and automation ■ **Intelligent process automation** ■ **Digital assistants for enterprise knowledge workers** • Aidoc's AI-assisted radiology solution is an example of successful adoption, but rapid adoption of AI in clinical practice will be an **incremental process** driven by the rate of benefits uncovered and operationalized. The field of **imaging** is perhaps the most advanced in the adoption of AI solutions.
 **Education**	• AI is transforming every step of the **education journey** helping to make learning more accessible and inclusive. For instance, AI powered **translation tools** can be used to transcribe classroom lectures in real time for hundreds of enrolled students who are deaf and hard of hearing. Closed captions can be projected onto lecture hall screens via translator

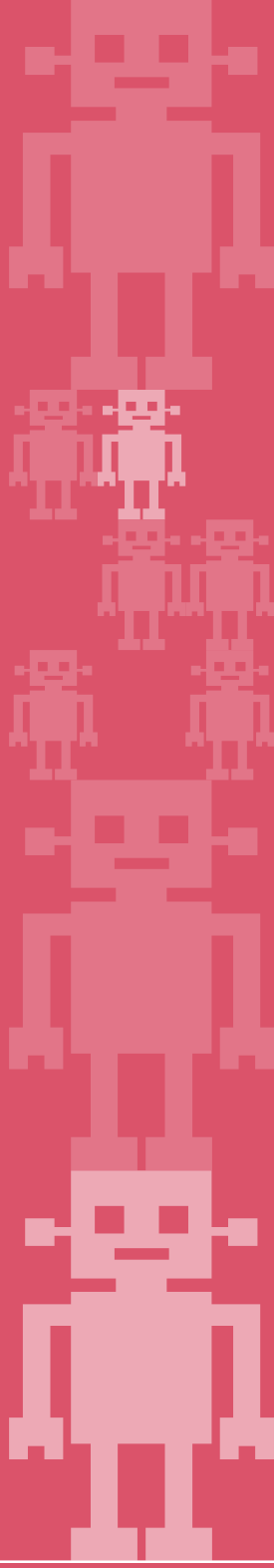
Source: PwC analysis and elaboration on Gartner, IDC, Forrester, Mordor

Key trends by vertical industry (2/2) – Healthcare is the market with the highest potential for AI applications; VAs and conversational bots will be used more and more across all the industries also considering COVID-19 impact

Vertical industry	Trends
 **Banking, FS & Insurance**	• Top use cases are : automated threat intelligence and prevention systems; **regulatory intelligence**; fraud analysis and investigation; program advisors and recommendation systems • In the insurance industry, in particular, AI is transforming areas such as underwriting, customer service, claims, marketing and fraud detection. For example, to improve customer experience many insurers are investing in **virtual assistants** such as chatbots. Insurtech start-ups are also utilizing AI to develop solutions to streamline operations and create better underwriting models
 **Retail**	• **Social distancing** practices have changed consumer priorities. Since brick-and-mortar locations have shut down, the demand for **online retail services** has skyrocketed. Concerned shoppers need easy access to medicine, groceries, and household goods. AI powered **chatbots** can help deliver high-quality, consistent customer experience (CX) for most valued shoppers. A simple, AI-powered tool like an **FAQ widget** can help track customer concerns during this uncertain time

Source: PwC analysis and elaboration on Gartner, IDC, Forrester, Mordor

Competitive landscape



Ecosystem overview – Diversified ecosystem with different categories of vendors that differ for business focus, portfolio coverage and specialization level

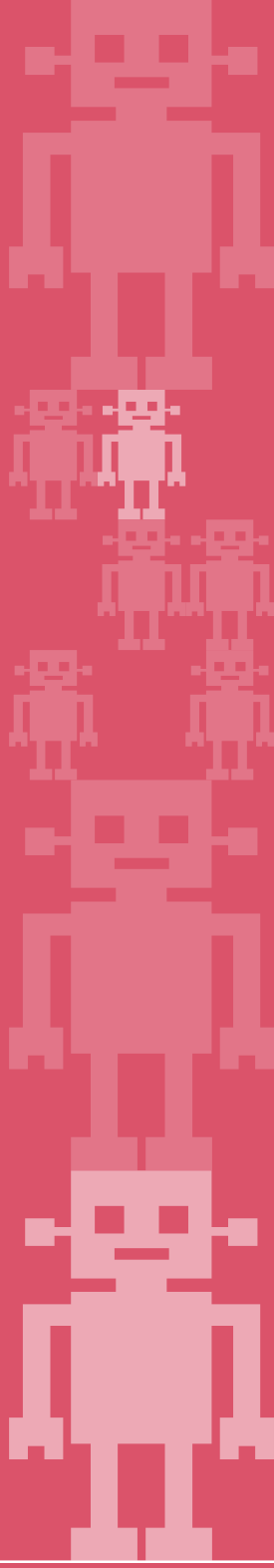
Ecosystem overview

Cloud technology providers	Global AI potential incumbents	Technology solution providers	System integrators consulting
• Focus on technology and product development • Strong brand and relationships with key partners / integrators • Lower interest in the development of customizable use cases solutions	• International players with generalist mindset • Strong multichannel strategy • Established presence on specific fields such as conversational technologies and contact centres	• Address specific business issues in which STT, text analytics, sentiment analysis and unstructured data analytical capabilities are solution's features rather than defining functionalities • Include start-ups and university spin-offs with market niche focus	• Focus on system integration and solutions development / sale / resale starting from non-proprietary products • Vertical know-how requirements and domain specific technologies
Illustrative			
• **Amazon Web Services** • **Google** • **IBM** • **Microsoft** • **Salesforce** • **ServiceNow**	• **Avaya** • **Genesys** • **NICE** • **Nuance** • **Verint**	• **Almawave** • **Artificial Solutions** • **BigHand** • **Clarabridge** • **Clarifai** • **Element AI** • **Expert System** • **Omilia** • **Sinqia** • **Spitch**	• **Accenture** • **Capgemini** • **Kainos** • **Reply**

Analysis focus

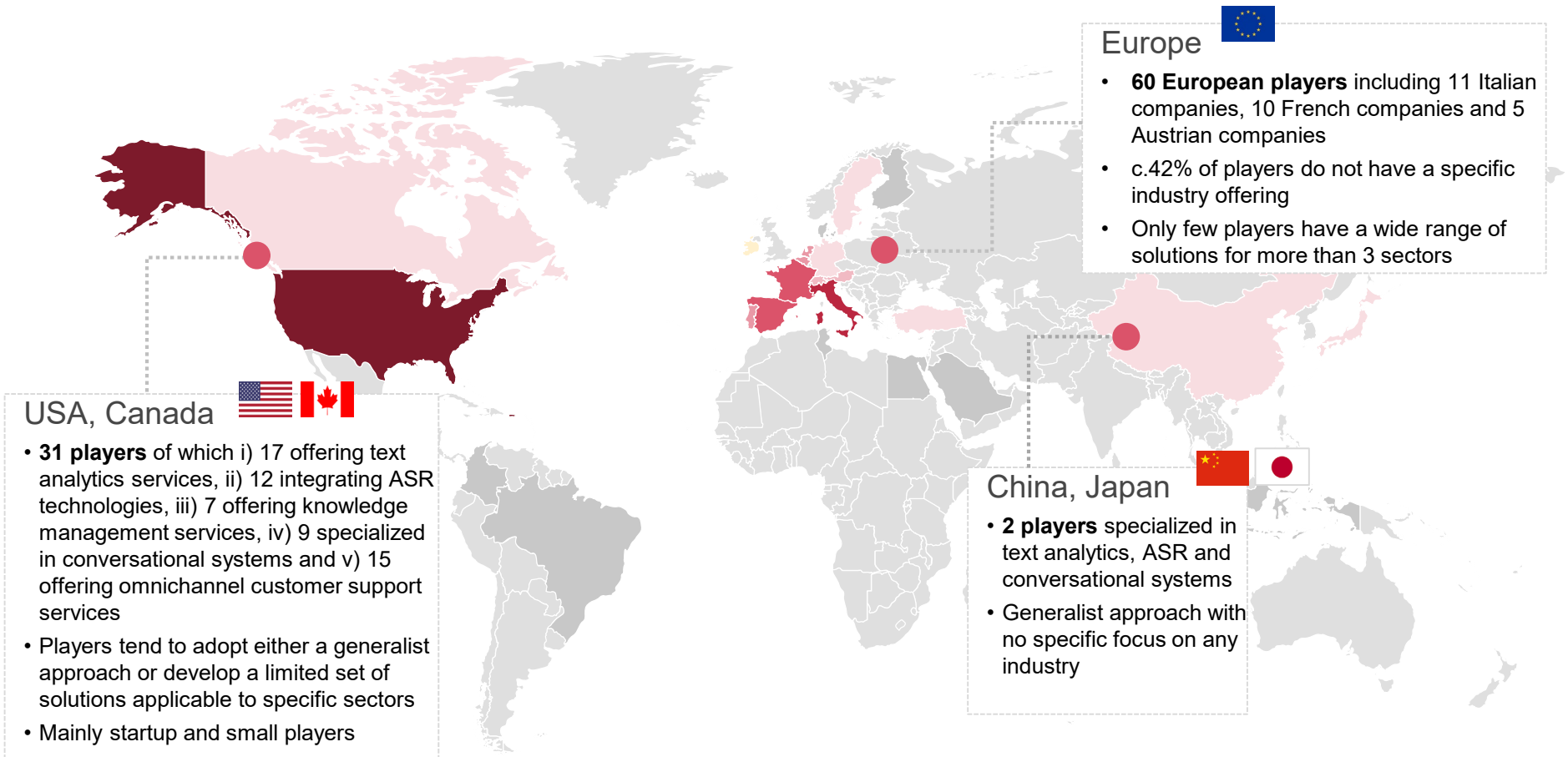
Source: PwC analysis

Solution Focused players



Global perspective – Among identified players, only few have an extensive coverage of applications and industries. With regards to industry focus, most players tend to have either a generalist approach or limited industry coverage

Global competitive landscape – Selected players



Europe

- **60 European players** including 11 Italian companies, 10 French companies and 5 Austrian companies
- c.42% of players do not have a specific industry offering
- Only few players have a wide range of solutions for more than 3 sectors

USA, Canada

- **31 players** of which i) 17 offering text analytics services, ii) 12 integrating ASR technologies, iii) 7 offering knowledge management services, iv) 9 specialized in conversational systems and v) 15 offering omnichannel customer support services
- Players tend to adopt either a generalist approach or develop a limited set of solutions applicable to specific sectors
- Mainly startup and small players

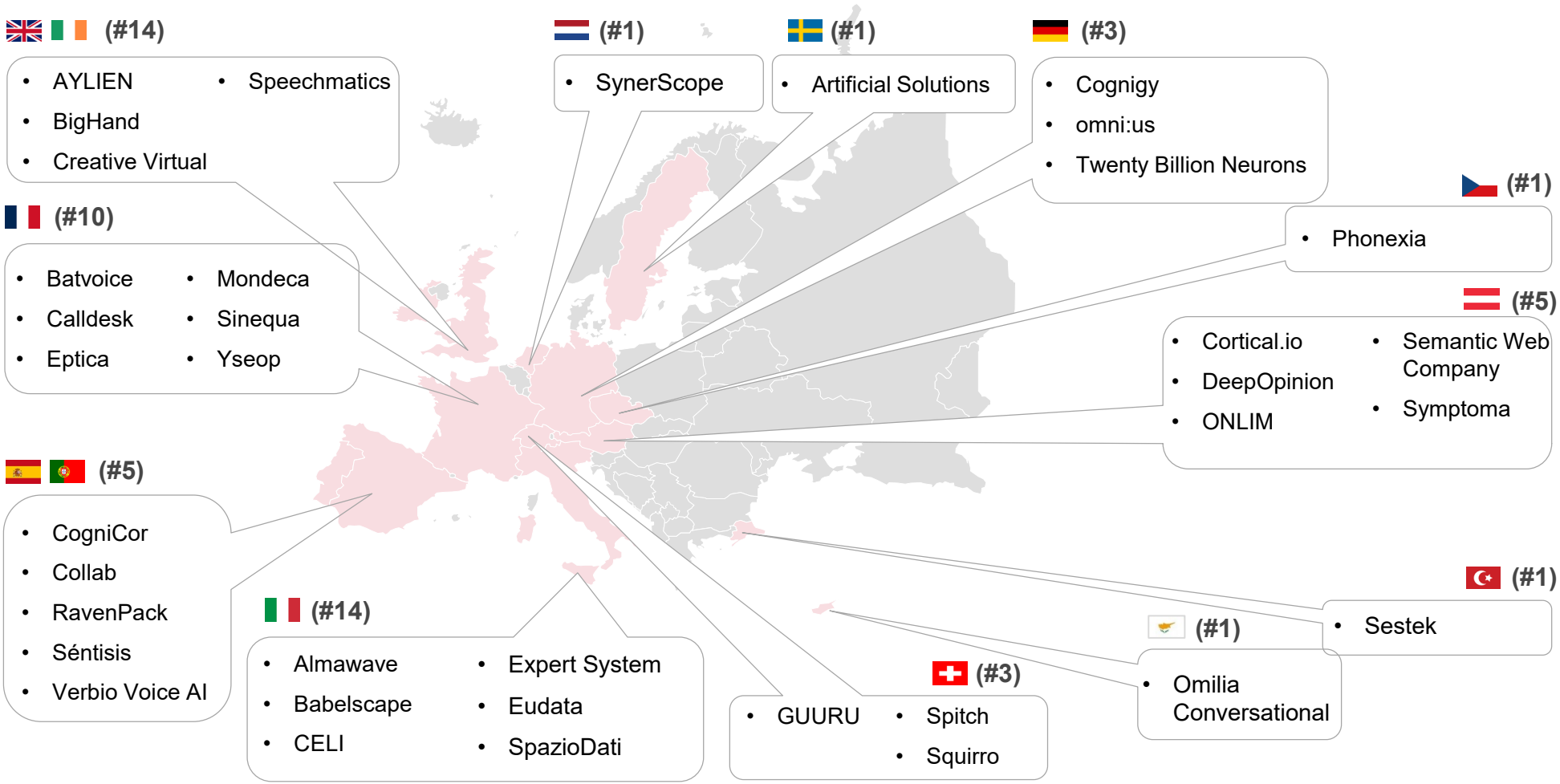
China, Japan

- **2 players** specialized in text analytics, ASR and conversational systems
- Generalist approach with no specific focus on any industry

Source: PwC analysis

European perspective – The European landscape is characterized by several small/medium enterprises, start-ups and scale-ups with mainly national focus despite multilanguage expertise

European competitive landscape – Selected players



Source: PwC analysis

Selected European solution focused players (1/2) – The European competitive landscape consists mainly of small sized players specialized on a limited number of technologies. Only a few players present an extensive coverage in terms of applications

✔ Focus
✓ Apparent marginal focus

	Country	Apparent Strategic focus*					Notes
		Text analytics	Automatic speech recognition	Knowledge management	Virtual assistants & chatbot	Omnichannel customer support	
Almawave		✔	✔	✔	✔	✔	Technology/solution player with strong vertical focus and AI & Data Science integration services. Unique positioning in vertical AI solution
Artificial Solutions		✔			✔		Provider of advanced conversational AI platform for enterprise clients
BigHand			✔				Software technology company specialized in digital dictation, document production and workflow process improvement
Cedat 85		✓	✔				Focused on Speech-to-Text proprietary products and solutions (Magnetofono 2.0)
Cognigy			✓		✔	✔	Enterprise software provider for conversational AI automation
Collab		✓	✓		✓	✔	Multimedia contact center provider belonging to Volaris Group
Cortical.io		✔		✔			NLU solutions provider specialized in contract intelligence, text analytics and semantic search
Expert System		✔		✔	✓		Technology/solution player with some relevant use-case history/know-how

Source: PwC analysis, Aida, Orbis, companies' websites; Note: (*) "Apparent Strategy Focus": offering and strategic focus inferred from available public information

Selected European solution focused players (2/2) – The European competitive landscape consists mainly of small sized players specialized on a limited number of technologies. Only a few players present an extensive coverage in terms of applications

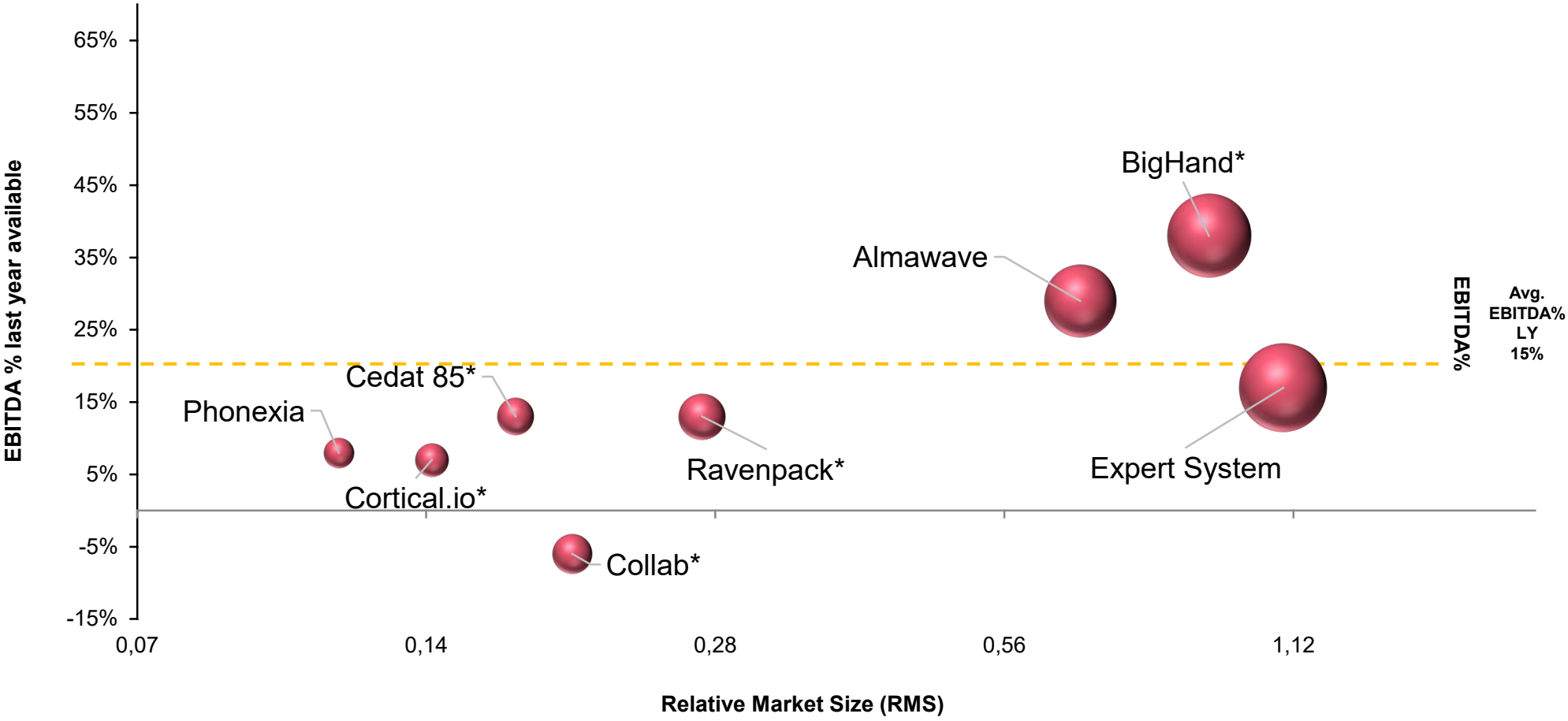
✔ Focus
✓ Apparent marginal focus

	Country	Apparent Strategic focus					Notes
		Text analytics	Automatic speech recognition	Knowledge management	Virtual assistants & chatbot	Omnichannel customer support	
Omilia Conversational		✔	✔		✔	✔	Startup providing NLU enabled IVR and natural dialogue interaction featuring voice biometrics and ASR technologies.
Phonexia		✓	✔				Speech recognition and voice biometrics technology developer
RavenPack		✔					Leading big data analytics provider for BFSI sector focused on NLP and insight extraction from unstructured data
Spitch		✓	✔		✔	✓	Provider of solutions based on ASR, voice biometrics, voice user interfaces and NLP
Squirro		✔		✔			Augmented intelligence player providing cognitive search and advanced analytics services
Verbio Voice AI		✔	✔		✔		Voice and cognitive technology company specialized in conversational systems and speech analytics
Yseop		✓		✓	✓	✓	Provider of natural language generation solutions supporting report writing, sales management and other business processes

Source: PwC analysis, Aida, Orbis, companies' websites; Note: (*) "Apparent Strategy Focus": offering and strategic focus inferred from available public information

Selected Competitors Performance – The selected players exhibited an average EBITDA% of 15%. Relatively larger players show higher profitability

Relative Market Size and EBITDA% of Selected European Competitors
(2019, €M)



Source: PwC analysis, Aida, Orbis; Note: (*) LY 2018

Thank you

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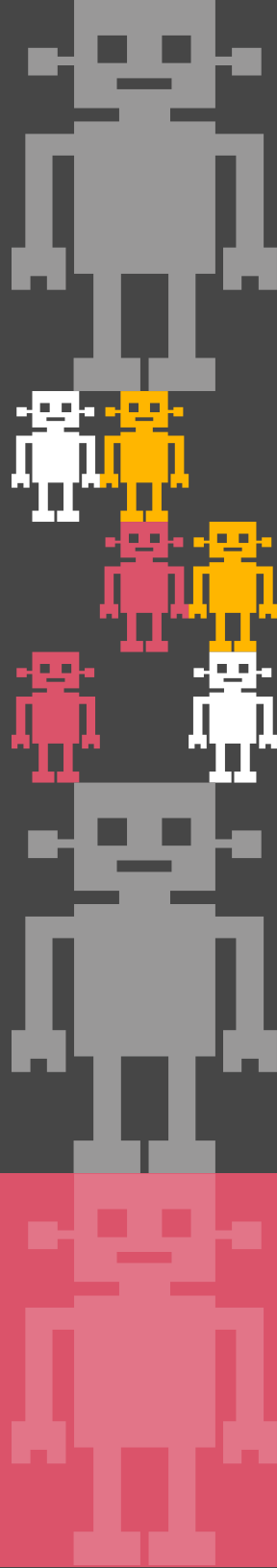

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