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Market Guide for Conversational Artificial Intelligence in China

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China's rapid adoption of technology to innovate business requires conversational AI to cope with the volume of service queries. Enterprise architecture and technology innovation leaders seeking to change business practices to leverage conversational AI should focus on natural-language processing.

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Overview

Key Findings

- The complexity of the Chinese language — with over 20 dialects and accents — makes it a challenge to deliver voice virtual agents with an acceptable success rate, as most initial approaches are rule-based and use keywords, mapped to intent.
- Enterprises lacking their own data science teams can use vendors to build their own conversational artificial intelligence (CAI) applications, owing to the power of cloud platforms. However, the issue will be not having ownership of the trained models which means restarting the process from scratch when changing to a new vendor.
- According to Gartner's 2018 AI perception survey to IT leaders in China, the top three drivers responsible for adopting artificial intelligence (AI) are to improve operational efficiency, achieve cost reduction and improve customer experience. This is in line with the most popular CAI applications, virtual agents, human-machine interfaces (HMIs) and contextualization of content.

Recommendations

Enterprises' architecture and technology innovation leaders seeking to strategize and plan for CAI for business transformation should:

- Evaluate and select approaches using natural-language processing (NLP) such as semantic, syntactic parsing or long short-term memory (LSTM) recurrent neural networks that deliver compelling user experiences and meet task objectives.
- Prepare an exit strategy for changing vendors by keeping records of their training data, intent, business logic, response. Obtain agreement with the new vendor to collaborate in the interim until the full handover is complete.
- Evaluate the business value of the CAI applications, in order to make plans for scaling up, or changing the type of CAI application with supportive and proven measures.

Strategic Planning Assumption

By 2022, the adoption of Chinese NLP for conversational AI applications by enterprises in China will exceed 80% — up from 51% currently.

Market Definition

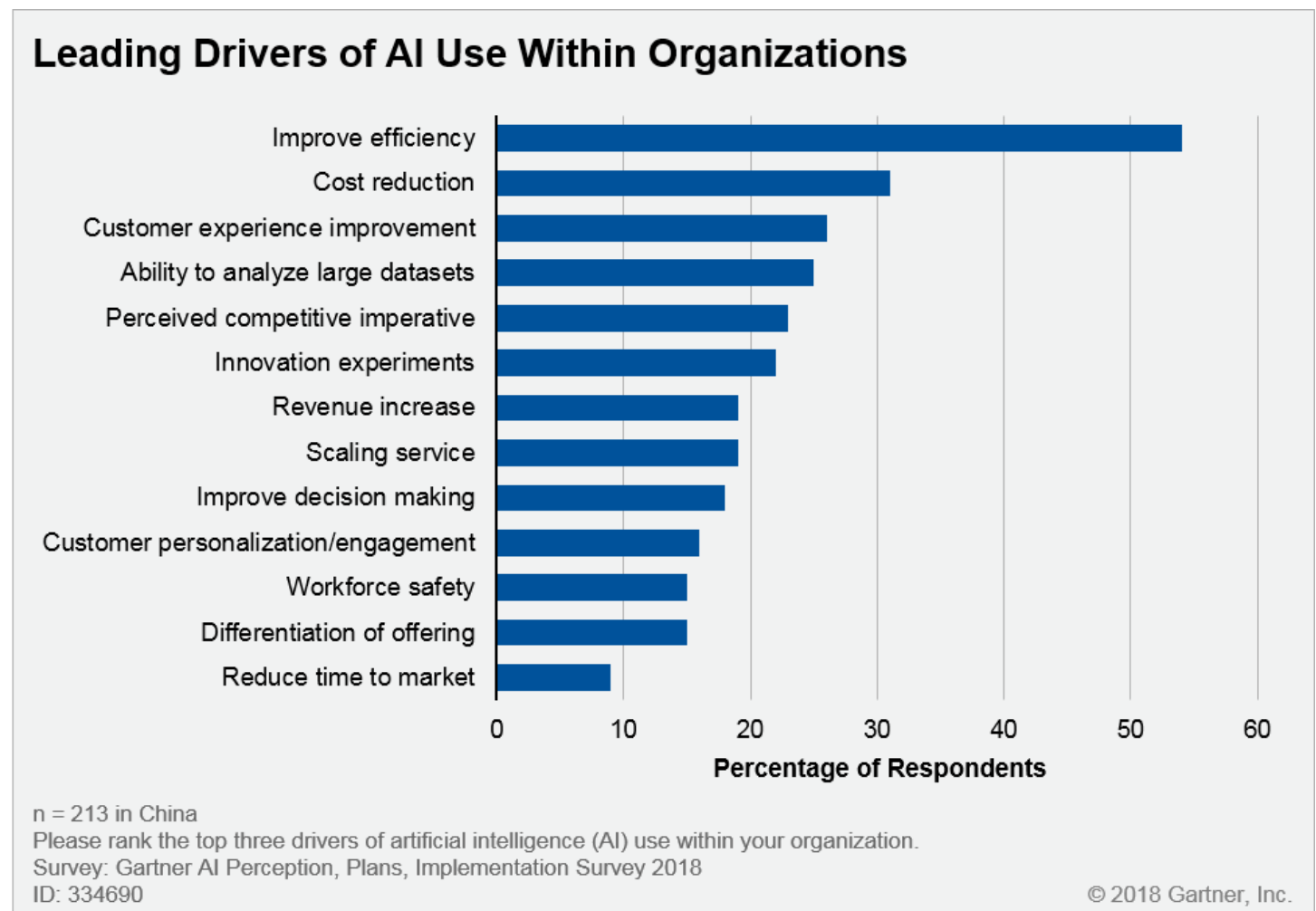
Conversational AI (CAI) consists of a range of technologies, often supporting three common types of applications:

1. Virtual assistants — a chatbot or virtual assistant for customers, employees or personnel.
2. Human-machine interface (HMI) — sending voice commands and/or receiving audio feedback, when interacting with machines such as home appliances, smart speakers, in-vehicle systems, robots and so forth.
3. Contextualization for insights — extracting, data mining, comprehension or summarizing content to provide decision support/augmentation or decision automation.

Market Description

According to Gartner's AI Perception, Plans and Implementation Survey 2018, the top three motivating factors for using AI within the organization in China are to improve efficiency, cost reduction, and customer experience improvement (see Figure 1). The three major applications of CAI — virtual assistant, HMI and contextualization content — are in line to support these drivers with compelling customer experiences, or operation and cost-efficiency. Enterprise architecture and technology innovation leaders (EATIL) planning to use CAI to serve this market (with a population of over 1.3 billion in China) need to adopt localized Chinese CAI solutions.

Figure 1. Leading Drivers of AI Use Within Organizations

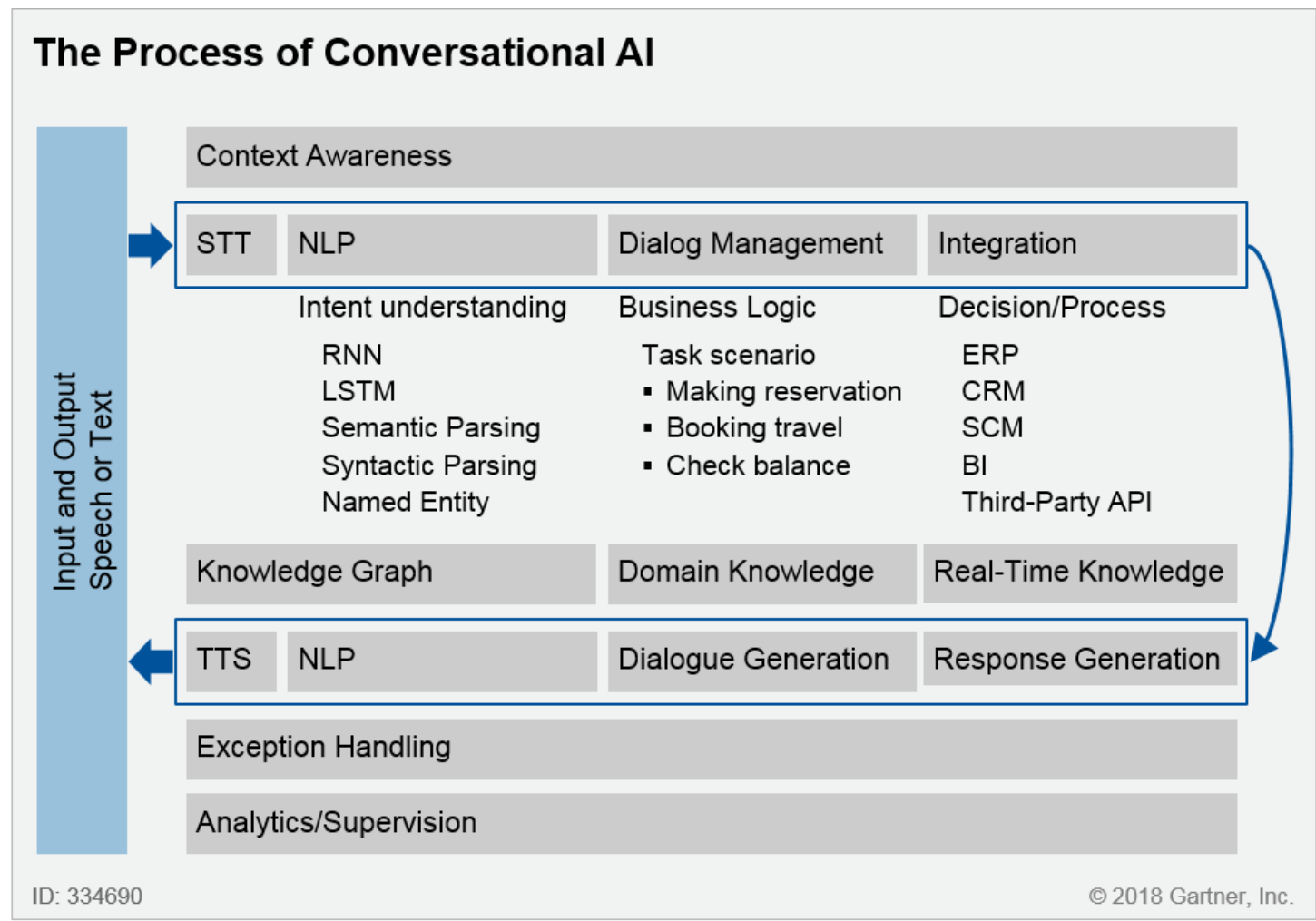


AI = artificial intelligence

Source: Gartner (June 2018)

CAI development in China continues to evolve, as the language itself is complex. A speech-to-text (STT) that can recognize up to 20 dialects and accents needs a large volume of localized content to train the model. In Chinese, there is no space or break between words and phrases. Different ways of segmenting words or phrases can result in very different meanings. Intense effort is required to develop conversational AI in Chinese.

Figure 2. The Process of Conversational AI



AI = artificial intelligence; API = application programming interface; BI = business intelligence; CRM = customer relationship management; ERP = enterprise resource planning; LSTM = long short-term memory; NLP = natural-language processing; RNN = recurrent neural network; SCM = supply chain management; STT = speech-to-text; TTS = text-to-speech

Source: Gartner (June 2018)

Market Direction

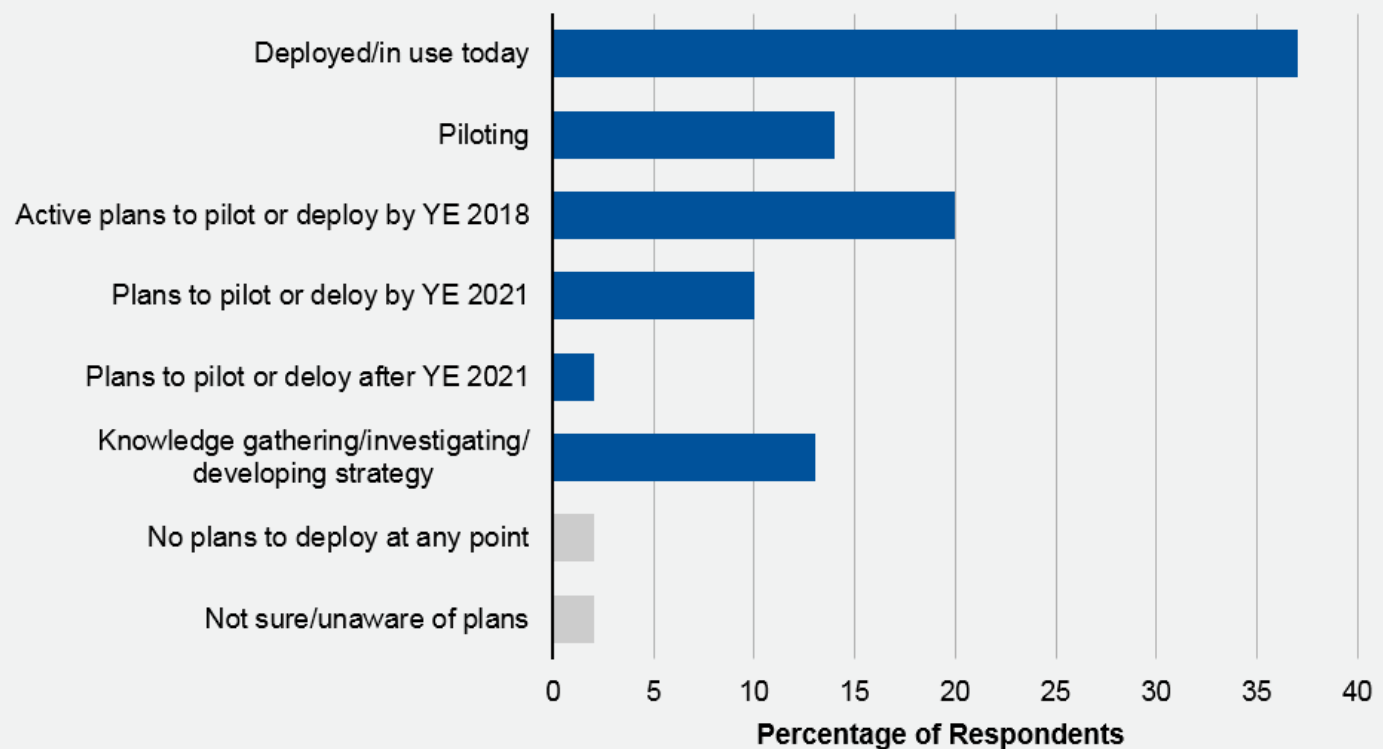
Shift From Keyword and Rule-Based to NLP

Adoption of CAI in China continues rapidly across three types of applications – virtual assistants, human-machine interfaces and content contextualization. The market initially used keyword and rule-based approaches to develop simple Q&A chatbots. Now, techniques are moving to NLP with deep neural network (DNN) approaches – such as recurrent neural network (RNN) or long short-term memory (LSTM). These can handle a more complex virtual assistant application to improve conversation success rates.

According to Gartner's AI Perception, Plans and Implementation Survey in 2018, 37% of surveyed businesses in China (see Note 1) are already deploying/using NLP; and 14% are piloting it, totaling 51%. Some 20% plan to run a pilot by 2018 with a further 10% by 2021. We expect that by 2022, over 80% of enterprises in China will have adopted NLP. See Figure 3.

Figure 3. Stages of Enterprise Adoption of NLP in China

Stages of Enterprise Adoption of NLP in China



n = 213

What is the current stage of adoption of the following solutions/technologies within your organization?

Survey: Gartner AI Perception, Plans Implementation Survey 2018

ID: 334690

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NLP = natural-language processing; YE = year-end

Source: Gartner (June 2018)

Gartner sees virtual assistants as having the highest adoption rate among the three types of AI in China, as it supports operational/cost-efficiency and natural-language user experiences. Almost every consumer-facing vertical business — such as telecom services, retail, restaurants, banking, travel and government — use virtual assistants. Either as a chatbot or voice system, they operate as 24/7 customer service and sales channels. In China, WeChat is the major provider that enterprises choose for their virtual assistant presence.

However, the initial user experience for voice type interaction failed to deliver the expected service quality. High failure rates for conversations meant users were unable to complete a task over 70% of the time. The main reason is that most enterprises choose rule-based and keyword searches to match intent.

Often, enterprise architecture and technology innovation leaders (EATIL) in China believed that using STT was good enough to succeed for voice-enabled virtual assistants. However, results proved that this was not the case. While the technology is relatively mature compared to other types of CAI technologies, STT can struggle in capturing speech due to different users' accents, incomplete sentences and environmental background noise. Vendors' STT efforts perform better when NLP engines are trained using machine learning to improve overall accuracy.

Some vendors claim greater accuracy of up to 80% or higher, which is mostly like an interactive voice response (IVR) instructional call. Similar to a Q&A chatbot, users follow the instructions in a scripted process which does not provide a natural-language conversational experience.

The increasing demand for better user experiences and for handling more complex tasks sees CAI development focus more on NLP. Various techniques under NLP (such as semantic and syntactic parsing) are used to extract the entity, attributes and action data from users' input. These solutions mostly use a framework to structure the task scenario and minimize the manual efforts to maintain a rule-based query and answer flow.

Vendors providing NLP-type conversational AI includes Beijing Ultrapower Software, Emotibot Technologies, Microsoft Xiaoice and wul.ai as examples. Yet some enterprises choose to use STT via third parties, but build the NLP themselves, as there are few mature NLP solutions on the market that meet their requirements.

Vendors Remain Specified Vertical or Domain Focused

The most successful conversational AI vendors focus on selected vertical industries or business scenarios, because understanding the business operation is critical in solving issues. AISpeech leads on voice-enabled CAI on human-machine interfaces for in-vehicle, home appliances and robots. Emotibot Technologies focuses on the virtual customer assistant for finance, telecom and retail.

There are also vendors focusing on using NLP to contextualize content and extract insights for CRM or other purposes. (Examples include Beijing Ultrapower Software, Intumit or Pachira.) Baidu's DuerOS and Microsoft's Xiaoice conversational platforms are the exception — lacking a specific vertical focus. Microsoft's Xiaoice aims to improve users' conversational experience through multiple-turn conversation and general-purpose conversation. Baidu's DuerOS is an end-to-end conversational AI platform that supports voice-enabled conversational AI applications for hardware devices.

Shift From On-Premises to Cloud, Edge Computing and Hybrid

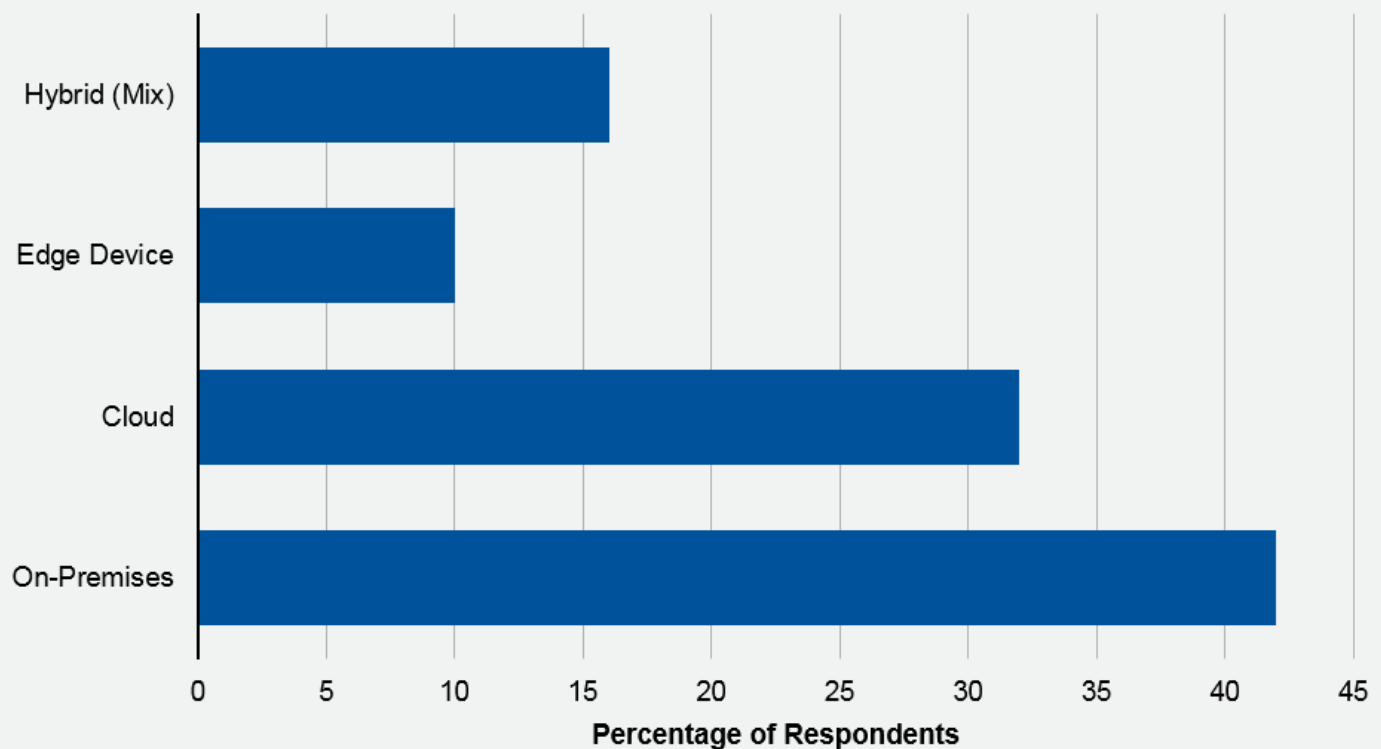
Currently, most virtual agent applications are deployed on-premises at customers' sites for operational efficiency, and the enterprise can maintain the application internally. According to Gartner's AI perception survey (in 2018), among all the enterprises using NLP, 42% of the use is on-premises. Cloud is 32%, followed by hybrid at 16% and edge device on 10%. Along with wider applications for virtual agents expanding from customer support type services to sales and marketing, it is expected that there will be more cloud-based inferencing to optimize users' experiences.

Along with more applications deployed on devices with voice as a human-machine interface, on edge deployment is mostly preferred for low latency operations. Example of devices include Internet of Things (IoT) endpoints such as smartglasses, wearables, in-vehicle, home appliances, or smart home or office speakers. Smart speakers are gaining market hype, aiming to provide a compelling user experience. Though there are many Chinese smart speakers in the market, user experiences require improvement. Latency is one issue. Having more frequent voice command inference running on edge is one way to improve the latency. The hybrid model will be more important for smart speakers to handle basic set up or command features and other CAI service on the cloud to optimize the user experiences.

Increasing the offline edge-deployed multilanguage translators (such as the one from Sogou AI Open Platform using Kneron edge AI chipset) so that it can run bidirectional multiple language translations in offline mode is important. There is growing adoption of NLP on edge for automotive, especially in the after-market — like navigator recorders and front-seat mirrors that use conversational AI hands-free operation.

Figure 4. NLP Usage in China

NLP Usage in China



Base: Technology is piloting/deployed; excludes "not sure," n = 213.

Specifically, where does the inferencing take place?

(In the cloud, on your premises, on an edge device or using a combination of deployment methods?)

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NLP = natural-language processing

Source: Gartner (June 2018)

AI Pricing Model

The pricing model for conversational AI in China varies by the type of applications and technologies offered. For cloud-based hosted services such as STT or chatbots, it is charged either by the volume of messages or usage per month, or by monthly active users (MAU). Baidu and iFLYTEK offer STT with free access for a limited amount of usage. Most virtual customer assistant apps are charged on a one-time project plus maintenance fee (if it is deployed on-premises at the customer's site) so that enterprises can maintain the application internally.

Market Analysis

This market analysis is divided into two parts:

1. Technology features differentiation
2. Use cases and business value

Conversational AI Features Differentiation

Among the different types of conversational AI solutions, one major selection criteria must be based on the usefulness and differentiated value of the solution. There is no single vendor that provides all the necessary features. Each one has their own strength and focus areas. Enterprise architecture and technology innovation leaders should evaluate the features most necessary to achieve the business objectives for deploying conversational AI technologies in operations. The following sections describe the type of technologies and differentiated value available for consideration.

Speech-to-Text

Among the conversational technologies, STT is considered relatively more mature compared to NLP (despite there being over 20 Chinese dialects and numerous different accents). However, the solution capabilities vary by vendor. AISpeech, Baidu, iFLYTEK, Microsoft and Nuance are examples of vendors providing Chinese language STT. The differentiations available are as follows:

- **Dialect and accent by geography.** Not every vendor supports all Chinese dialects and accents by geography. For example, very few vendors support traditional Chinese in Taiwan. Google and OLAMI are the few that do.
- **Vertical industry domain knowledge graph.** The specific domain terminology can be learned, but it requires data to support the capabilities. iFLYTEK is strong in the education vertical. Baidu is strong across more general usage, based on its dataset of web keywords and searches.
- **Sentence segmentation.** Features to analyze the spoken words and phrases, and segment them into sentences correctly vary by vendor. Most use NLP to optimize recognition.
- **Environmental noise interference.** Different environmental noise can affect the quality of audio received of the person speaking. Integrated software and hardware audio modules can help with noise cancellation. Without an optimized audio solution, using NLP to train and predict words based on previous and sequential sentences works as a second approach. AISpeech is one of the major vendors providing an optimized audio solution to capture STT for in-vehicle use.

Natural-Language Processing

Having semantic and syntactic parsing to extract the entity, action and attributes are one of many possibilities for NLP. There are other approaches to optimize NLP depending on the task objectives.

- **Semantic and synaptic parsing.** Used to extract words and sentences by segmenting long sentences into entity, action, or attribute, then mapping them to business logic for a response. This is more efficient than the rule-based and keyword method when handling complex customer service support. This will also minimize the requirement for substantial resources to build and maintain the database. The difference is, if a user asks "how's the weather in Taipei?" both rule-based and NLP will answer "the temperature in Taipei is 60-degrees Fahrenheit." Yet if they instead stated, "I don't care about the weather in Taipei," the rule-based by keyword approach will give the same response, while the NLP-based approach might answer differently with a default response for verification request such as "Hmm ... not sure what the question is," when the semantic and synaptic capture it not as a question but as a statement and there is no predefined corresponding answer to that statement.
- **Memorize conversation history.** In NLP, it is possible for LSTM to improve the intent understanding. In addition, the capabilities to link to users' previous conversational records as part of the business logic process loop can improve users' experiences (since they would not need to repeat the same thing during a conversation). For example, Laiye memorizes customers' orders for coffee and automatically confirms the flavor, size of coffee, where to order, where to deliver and which card to use for payment.
- **Multiple-turn conversation.** It is important to verify and reconfirm a client's questions, to help complete more complex tasks for multiple requests. It can also help provide close to real human conversation experiences. Microsoft Xiaoice and Emobtibot are example vendors. Microsoft Xiaoice provides consumer-facing solutions for social chatting or for business. One example is China Southern Airlines using Xiaoice for booking tickets which helped increase ticket sales by 300%.
- **Knowledge graph for general or specific domain/vertical industry.** Another key element to providing a compelling conversational experience is if there is an existing knowledge graph, either for general or specific domain/vertical industry to support NLP. There is often specific terminology for business scenarios that vary by industry. For example, Beijing Ultrapower Software built the knowledge graph specific for public security. Some basic scenarios, such as checking orders can be made easier by adding some specific terminology. There are also open-source solutions for certain knowledge graphs.
- **Maintain dialogue management on exception request.** A sentence analyzed by semantic and syntax is unable to complete the task, due to the lack of a business logic response. It is necessary to monitor the conversation, and if it is not completed, a framework used to log in the exception record allows the enterprise to review and expand corresponding responses or refine the business logic.

Use Cases and Business Value

When EATIL plans for a CAI project, they should first identify what their business objectives are. Under the business objective, EATIL should work with line-of-business units to discuss, identify and prioritize the most critical or strategic use cases of CAI. Also question what business value the case can support to achieve the business objectives. Quantify the business value, such as time saving (from

days to hours) or reduction on the required number of employees, growth of sales transactions, or customer satisfaction — all helps measure a project's success. It could further lead to impacts it might have on the organization.

In Figure 5, we list examples of use cases of each type of CAI applications — virtual assistants, HMI and contextualization. All the use cases need to tie into business value. Gartner categorized all the use cases into three types of business value:

1. Improve operation efficiency and quality
2. Improve customer experiences
3. Create new revenue/business model

Improve Operational Efficiency and Quality

Virtual Assistants

Virtual enterprise assistants are gaining traction in China, as it is an effective way to improve internal operations for new employees, in order to get access to answers they may require in a new environment. Adoption is more typical from vertical industries with business value that relies more on expert systems, which are expensive and difficult to deploy. Industries will discern more value from implementing virtual enterprise assistants to improve decision making through accessing business insights in a more efficient and customized way.

HMI

Smartglasses used in manufacturing industries for machine maintenance can receive an inspector's speech input, transform it into text and log it into the system allowing hands-free inspections to take place.

Contextualization

Use NLP to streamline insurance claim processes by contextualizing insurance claims from doctors' diagnostic records, hospitalized billing, for insurance coverage to build an automated process.

Examples of using NLP to extract insights from text-based content are wide ranging. This can include police report records, accounting terms, legal contracts, customers' service calls, insurance and medical records, among others.

Improve Customer Experiences

Virtual Assistants

Many consumer-facing enterprises launch virtual assistants such as chatbots or voice-enabled virtual assistants to provide customers with a 24/7 service and sales environment. Users can use a natural conversation to chat or talk to virtual assistants that can help complete a purchase or the booking of a table at a restaurant, greatly optimizing users' experiences.

HMI

Audio feedback is a useful tool to help improve customer experience as it confirms the success of device pairing and installation. For example, Bose Bluetooth speakers will send an audio feedback response saying "connected to specified named iPhone" so the user will know it has connected.

Contextualization

Compared to virtual agents, there is an increasing demand from enterprises using NLP to contextualize content, such as recording customers calls or capturing conversational logs in a chatbot to enhance CRM with more detailed user profiles.

Create New Business Models/Revenue

Virtual Assistants

Many consumer-facing enterprises (such as online stores) use virtual assistants for cross-selling products during the conversation. This can effectively increase the sales during the moment when a chatbot identifies users' needs to provide personalized recommended products.

HMI

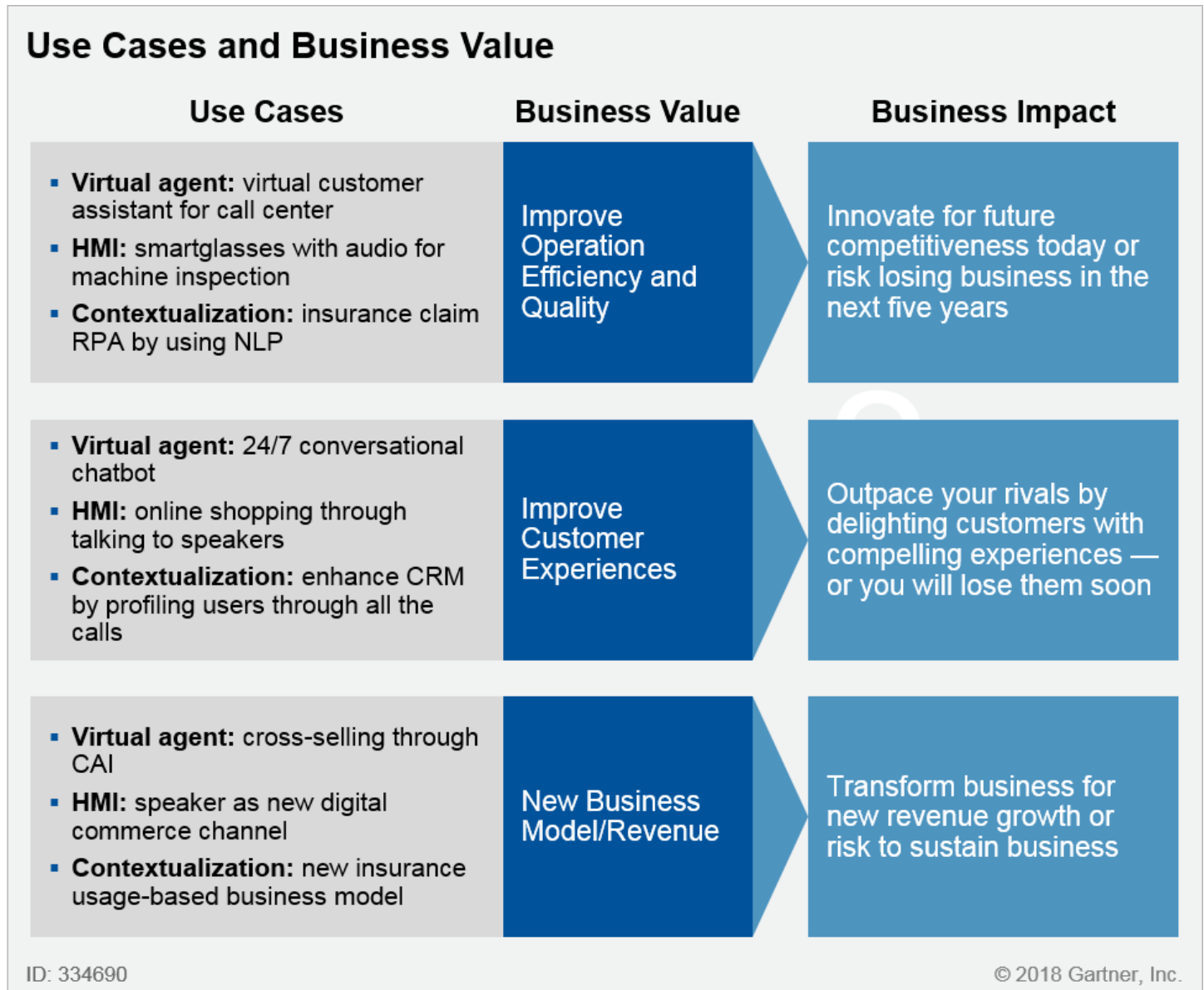
Smart speakers from online internet service providers, like Alibaba's Tmall.com, JD.com, are examples of using voice-enabled products to expand sales of frequently repurchased items. However, the smart speaker is struggling to deliver additional value and fulfill users'

expectations. The other type of human-machine interface, such as in-vehicle and home appliances, are more promising, as these are task-specific with defined commands.

Contextualization

Compared to virtual agents, there is increasing demand from enterprises using NLP to contextualize content such as customers' recorded calls or conversational logs in a chatbot to enhance CRM with more detailed users' profiles.

Figure 5. Use Cases and Business Value



CAI = conversational artificial intelligence; CRM = customer relationship management; NLP = natural-language processing; RPA = robotic process automation

Source: Gartner (June 2018)

Representative Vendors

The vendors listed in this Market Guide do not imply an exhaustive list. This section is intended to provide more understanding of the market and its offerings.

Market Introduction

Table 1 lists representative providers of conversational AI technologies in applications' virtual assistants, HMI and contextualization (in China) and their product or service names.

Table 1: Representative Vendors in Conversational AI in China

Vendor ↓	Product, Service or Solution Name ↓	Services ↓
AISpeech	HMI and Virtual Assistant	STT, TTS, NLP
Alibaba	Tmall.com Genuine Smart Speaker	NLP
Baidu	DuerOS Platform and Speaker	STT, TTS, NLP
Beijing Orion Star Technology	HMI	STT, TTS, NLP
Beijing Ultrapower Software	Contextualization	NLP
Emotibot	Virtual Assistant	NLP
IBM	Virtual Assistant	NLP
iFLYTEK	HMI and Virtual Assistant	STT, TTS, NLP
Intumit	Contextualization	NLP
Laiye	wul.ai for Chatbot	NLP
Microsoft	Xiaoice Virtual Assistant	STT, TTS, NLP
Mobvoi	HMI	STT, TTS, NLP
Nuance	HMI and Virtual Assistant	STT, NLP
Olami	HMI and Virtual Assistant	STT, TTS, NLP
Pachira Information Technology	Contextualization	NLP
Sogou	HMI	STT, TTS
Tencent	Virtual Assistant	STT, TTS, NLP
Tricorn	Virtual Assistant	NLP
Unisound	HMI and Virtual Assistant	STT, TTS, NLP
Xiaoi	Virtual Assistant	NLP
Zhuiyi Shenzhen Chaoyi Technology	Virtual Assistant	NLP
AI = artificial intelligence; HMI = human-machine interface; NLP = natural-language processing; STT = speech-to-text; TTS = text-to-speech		

Source: Gartner (June 2018)

Market Recommendations

Enterprise architecture and technology innovation leaders planning to develop CAI applications should consider the following key elements when evaluating and selecting vendors:

- Identify business objectives and what type of business value CAI products can bring to support the business objectives.
- Discuss with line-of-business units about how to define the requirements of CAI products, features and experiences.
- Discuss requirements with vendors as part of the preliminary vendor qualification to see if they can offer the features the business needs, such as STT, text-to-speech (TTS), NLP and domain knowledge graphs. Establish how long it takes and how easy it is to use the tools. So far, STT and keyword/rule-based approaches do not provide conversational experiences.
- Request vendors provide an inferencing model for testing at least 30 days (or up to 90 days) run with your (or the enterprise's) own data at the company. The model usually needs to be trained and optimized with the new set of data.
- Be prepared to change or add new providers of CAI applications. Ensure the data is organized, and that the business logic can be kept and transferred to the next vendor.

Acronym Key and Glossary Terms

AI	artificial intelligence
API	application programming interface
BI	business intelligence
CAI	conversational artificial intelligence
CRM	customer relationship management
DNN	deep neural network
EATIL	enterprise architecture and technology innovation leader
ERP	enterprise resource planning
HMI	human-machine interface
IoT	Internet of Things
IVR	interactive voice response
LSTM	long short-term memory
MAU	monthly active users
NLP	natural-language processing
RPA	robotic process automation
RNN	recurrent neural network

ROI	return on investment
SCM	supply chain management
STT	speech-to-text
TTS	text-to-speech
YE	year-end

Evidence

The results presented are based on the 2018 Gartner Artificial Intelligence Enterprise Perceptions, Plans and Implementation Survey, conducted online in January 2018 through February 2018 among 848 respondents across U.S. and Canada (n = 208), U.K. (n = 217), China (n = 213) and India (n = 210). Results cited in this document have been collated **exclusively** among respondents in China.

All respondents were screened for active employment in organizations that are piloting or deployed/are using at least one of the following AI technologies:

- Natural-language processing (NLP)
- Computer vision
- Artificially intelligent physical robots
- Process augmentation
- Decision augmentation

Respondents were also required to be at a management level and to have knowledge of the artificial intelligence budget for 2018 to participate. They were also required to have knowledge about adoption plans for artificial intelligence solutions and — depending on the AI technology mentioned previously — to have knowledge of its strategy, business objectives, business requirements, technology requirements, selection and/or use of providers, effectiveness/ROI measurement, operations management and/or solutions design and implementation.

At the country level, soft quotas were established to guarantee a good distribution in terms of AI technology adoption, company size and industry.

The results of this study are representative of the respondent base — and not necessarily the market as a whole.

The survey was developed collaboratively by a team of Gartner analysts and was reviewed, tested and administered by Gartner's Research Data Analytics team.

Note 1

Representative Vendor Selection

The selection of the vendors are major ones based in China using conversational technology such as STT and NLP to develop any of these three types of applications — virtual assistants, HMI or contextualization.

Respondents were also required to be at a management level and to have knowledge of the artificial intelligence budget for 2018 in order to participate. They were also required to have knowledge about adoption plans for artificial intelligence solutions — and depending on the AI technology mentioned previously — to have knowledge of its strategy, business objectives, business requirements, technology requirements, selection and/or use of providers, effectiveness/ROI measurement, operations management and/or solutions design and implementation.

Note 2

Gartner's Initial Market Coverage

This Market Guide provides Gartner's initial coverage of the market and focuses on the market definition, rationale for the market and the market dynamics.

Document Revision History

[Market Guide for Conversational Artificial Intelligence in China - 31 May 2017 \(https://www.gartner.com/document/code/324212?ref=ddrec\)](https://www.gartner.com/document/code/324212?ref=ddrec)

Recommended by the Author

[Cool Vendors for Artificial Intelligence in Asia \(https://www.gartner.com/document/code/353337?ref=ggrec&refval=3879867\)](https://www.gartner.com/document/code/353337?ref=ggrec&refval=3879867)

[Cool Vendors for Artificial Intelligence, East Asia, 2017 \(https://www.gartner.com/document/code/326386?ref=ggrec&refval=3879867\)](https://www.gartner.com/document/code/326386?ref=ggrec&refval=3879867)

Recommended For You

[Maverick* Research: What Does Good Artificial Intelligence Look Like? Build an {a}IQ \(https://www.gartner.com/document/3819170?ref=ddrec&refval=3879867\)](https://www.gartner.com/document/3819170?ref=ddrec&refval=3879867)

[Market Guide for Computer Vision in China \(https://www.gartner.com/document/3874881?ref=ddrec&refval=3879867\)](https://www.gartner.com/document/3874881?ref=ddrec&refval=3879867)

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