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Case Study of the Role of AI in Service Development

AI Capabilities in Service Development - Discourse Analysis on Annual Reports

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ABSTRACT:
This thesis aims to study the role of AI in service development by exploring the potential supportive impact of AI capabilities and AI applications on service development. The current research seems to focus on investigating AI capabilities and AI applications as separate concepts. The prior research studies AI capabilities in service development, yet it does not connect AI applications to this discussion. Therefore, in order to reach a comprehensive understanding of AI capabilities and the possible supportive impact on service development, it is important to research the possible benefits achieved through AI applications in service development.

The thesis is based on a multiple-case study of five multinational technology companies. The selected multiple case study was chosen as a methodology, because it is a recommended research strategy to study a modern phenomenon. It allows the researcher to compare the prior theory with the findings and to find novel insights, possibly. The selected case companies' core businesses focus on offering AI capabilities through AI applications, which allowed us to make a comparison between their AI offerings. The empirical data were collected from online material using the case companies' annual reports as primary data and other online data sources as secondary data. The empirical data were first analyzed using within-case analysis, followed by cross-case analysis, allowing a discourse between theory and data insights.

Although the potential supportive impact of AI capabilities, especially in relationalized service, and AI applications in service development is somewhat unclear in the literature, the empirical findings of this study offer a novel insight into the connection. Consequently, both the theory and empirical findings suggest that there are AI capabilities and AI applications that can support service development through productivity and customer experience improvements. Accordingly, AI's conversational and personalization capabilities seem to respond to relationalized service characteristics at some level, and support service process in the service interaction stage. Another research insight is that AI has capabilities for content creation, reasoning, decision-making, data analysis, and multimodal understanding, which all support the service process. Empirical findings are in line with the literature by suggesting that automation, data insights, predictions, and recommendations are part of supporting AI capabilities. Another novel finding is that software-based AI applications are used to support service development by offering assistance for productivity and customer experience improvement. Moreover, it seems that generative AI, machine learning, and predictive AI are the most popular AI types for AI applications to support service development. The empirical findings emphasize that agentic AI is slightly used in both productivity and customer experience improvement, and, however, the theory suggests that it is becoming more popular. Final insight is that it seems that AGI has not been implemented, and based on the literature, it is seen as the AI of the future.

KEYWORDS: service business, artificial intelligence, development strategies, service strategies, strategy work

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TIIVISTELMÄ:
Tämän Pro gradu -tutkielman tavoitteena on selvittää tekoälyn roolia palvelukehityksessä tutkimalla tekoälykyvykkyyksien ja tekoälysovellusten mahdollista tukevaa vaikutusta palvelukehityksessä. Nykyinen tutkimus vaikuttaa keskittyvän tekoälyn kyvykkyyksiin ja tekoälysovelluksiin erillisinä konsepteina. Aikaisempi tutkimus on selvittänyt tekoälykyvykkyyksien roolia palvelukehityksessä kuitenkaan ottamatta huomioon tekoälysovelluksia. Kokonaisvaltaisen käsityksen luomiseksi tekoälykyvykkyyksien ja tekoälysovellusten mahdollisesta tukevasta vaikutuksesta palvelukehityksessä, on tärkeää selvittää tekoälysovellusten rooli tekoälykyvykkyyksien mahdollistavana tekijänä palvelukehityksessä.

Tämä Pro gradu – tutkielma toteutettiin viiden monikansallisen teknologiayrityksen tapaustutkimuksena. Tutkimuksen metodologiaksi valikoitui tapaustutkimus, koska se on suositeltu tutkimusstrategia modernille ilmiölle. Tämä tutkimusmenetelmä mahdollistaa tutkijalle teorian ja löydöksien vertailun, ja mahdollisien oivalluksien löytämisen. Valittujen tapausyritysten liiketoiminta keskittyy tarjoamaan tekoälykyvykkyyksiä sisältäviä tekoälysovelluksia, joka mahdollisti yritysten tarjoamien tekoälyratkaisujen välisen vertailun. Empiirinen tutkimusaineisto kerättiin pääsääntöisesti yritysten vuosikertomuksista, mutta myös muita verkkomateriaaleja käytettiin aineiston tukena. Empiirinen aineisto analysoitiin ensin tapauskohtaisen analyysin avulla, jota seurasi tapausten välinen analyysi mahdollistaen teorian ja löydösten välisen diskurssin.

Vaikka tekoälykyvykkyyksien ja tekoälysovellusten mahdolliset tukevat vaikutukset, erityisesti rationaalisissa palveluissa, palvelukehityksessä ovat kirjallisuudessa hieman epäselvät, tämä tutkimus tarjoaa oivalluksia tästä yhteydestä. Sekä teoria, että empiiriset löydökset ehdottavat, että tekoälykyvykkyydet ja tekoälysovellukset tukevat palvelukehitystä tuottavuuden ja asiakaskokemuksen kehityksen kautta. Tekoälyn keskusteleva ja personoiva kyvykkyys vaikuttavat jollain tasolla vastaavan relationaalisen palvelun piirteisiin, ja tukevan palveluprosessia vuorovaikutusvaiheessa. Toinen tutkimushavainto on, että tekoälyn kyvykkyydet sisällöntuottamisessa, päättelyssä, päätöksenteossa, data-analyysissä ja multimodaalisessa ymmärtämisessä tukevat palveluprosessia. Empiiriset löydökset ovat linjassa teorian kanssa ehdottaen, että automaatio, dataoivallus, ennustus ja suositukset ovat osa tukevia tekoälykyvykkyyksiä. Lisäksi tutkimuksessa todettiin, että ohjelmistopohjaiset tekoälysovellukset tarjoavat tukea tehokkuuteen ja asiakaskokemuksen kehittämiseen. Generatiivinen tekoäly, koneoppiminen, ja ennustava tekoäly ovat kaikista suosituimpia tekoälysovelluksissa olevia tekoälytyyppejä palvelukehityksen tukemisessa. Empiiriset löydökset myös osoittavat, että agenttista tekoälyä käytetään vähäisesti tehokkuus ja asiakaskokemus hyödyn tuottamiseen, mutta teorian mukaan sen suosio on kasvussa. Viimeisenä todettiin, että AGI:tä ei ole otettu käyttöön, ja kirjallisuuden mukaan kyseessä on tulevaisuuden tekoäly.

AVAINSANAT: palveluliiketoiminta, tekoäly, kehitysstrategiat, palvelustrategiat, strategiatyö

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1 Introduction

1.1 Motivation for the study

Services are becoming a more important part of businesses as companies realize that they cannot compete, create, and capture value with only a product offering. Companies want to create stronger customer relationships and customer experiences through services (Berry et al., 2002; Bitner et al., 2008). For example, in the manufacturing industry, companies are increasingly shifting towards servitization, adding services to products to offer total solutions (Baines & Lightfoot, 2014; Kastalli et al., 2013). The focus is shifting to customer experience due to many reasons, for example, because communication and information sharing are nowadays easier than ever with multiple channels, making the customer journey complicated (Lemon & Verhoef, 2016). In order to create new service offerings, companies need to invest in service development, which includes actions such as service design. The idea of service design is to understand the customer fundamentally and to focus on customer experience (Bitner et al., 2008).

Previous studies have noticed that firms need to recognize customers' emotional and cognitive responses to the service in order to manage customer experience (McColl-Kennedy et al., 2019). However, it is believed to be a challenge for firms to capture customer emotions (Silva et al., 2021) since the emotions are individually experienced subjective cognition (Virabhakul & Huang, 2018). Previous studies have found that data analytics and big data techniques can be used to manage customer experience and service delivery (McColl-Kennedy et al., 2019; Silva et al., 2021) and that AI solutions, such as chatbots, can be used to solve customer problems (Bolton et al., 2018). Furthermore, technological innovations, such as computer-enabled facial recognition of emotions, can improve the customer experience (Furrer et al., 2020).

Anyhow, there seems to be little evidence of how AI can capture customer experience or how AI could support service development. In previous studies, researchers have not

agreed whether the customer experience is under the firm's control or not (Heinonen et al., 2010). This makes the topic interesting since the role of AI is getting stronger, and it will be one of the biggest employers in the near future (Whiting, 2023). Furthermore, Hoyer et al. (2020) have found that new AI-based technologies are changing customer experience increasingly in the future, and that AI will be increasingly used in the future, for example, at the pre-transaction stage in their purchase path. It is found that problems with the AI can arise, for example, if customer feel that they have lost the control in the decision making or they do not understand the system (Hoyer et al., 2020), or because of "the uncanny valley" phenomenon where the uncomfortable feeling originates from a mismatch between an individual's expectations and a robot's behavior (Bolton et al., 2018). These can cause a decline in customer experience (Hoyer et al., 2020).

There is plenty of academic research done about the topics of (new) service development and AI, but the research about AI capabilities is rather scarce. The concepts are largely studied as individual topics. Only a few studies are focusing on the supporting role of AI in the field of service development, and even fewer focus on AI capabilities in this regard. Hence, this needs further investigation. Furthermore, hardly any case studies are found about the potential supportive role of AI or AI capabilities in the context of multinational technology companies. On the basis of these reasons, there is a notable academic gap that this study aims to cover.

Moreover, this study answers the call of Silva et al. (2021) who state that "Considering recent advances in technology and associated new tools that offer significant opportunities to improve data collection and monitoring CX from the customer perspective (e.g. unstructured data analysis, voice and facial recognition of emotions, big data, business analytics), researchers should explore the benefits and limitations of these new tools (and the new metrics which derive from their use)." Same authors state that "studies should also include experiences that are partially or fully mediated by digital and smart technologies" (Silva et al., 2021).

Furthermore, Kurtmollaiev and Pedersen (2022) suggest researching “How can digital capabilities contribute to the success of NSD?” and “How can artificial intelligence-based technology be used in the design of dynamic service settings?” Kim et al. (2022) emphasize that “Future research can look into various AI capabilities—including the domains in which AI performs better than humans”. Larivière et al. (2024) highlight that “the importance of aligning AI capabilities with the specific service goals of different customer segments -- Further research on this issue is warranted”. Zolfagharian and Paswan (2008) state that “Future research could focus on identifying strategies to enhance the integration of AI into service businesses”, followed by Yang and Hu (2022) stating that “Future studies should highlight successful cases of AI integration in service businesses, identifying best practices that can guide businesses in optimizing human-AI collaboration.”

In addition, this study could answer the call of Antons and Breidbach (2018), who state that “Future researchers could explore how service firms address the challenges associated with emerging technologies.” Authors also state that “the link between the topics Business Models (#9) and Service Innovation in the Digital Age (#20) is not understood very well in service research”, but in this research, the focus would be on service innovation and the digital age. Finally, this study would support the proposal of Furrer et al. (2020), who state, “research should continue to take a strong customer perspective to study the role of technology and AI in service operations.”

The purpose of this study is to address this research opportunity by answering the research question “How does AI support service development?” Particularly, the research will focus on investigating how AI capabilities can support service development through AI applications. The research aims to answer the research question from the perspective of AI capabilities, which is the main focus area of the research. The research uses a qualitative research method to find an answer to this research question. The method used is qualitative because it gives an opportunity to understand more deeply the interconnection of selected factors in complex relationships, which is difficult to study in numerical terms (Creswell & Creswell, 2018, p. 31). The primary data is collected through the case

companies' annual reports found on their website. Press releases and other news are used as secondary data, and they would support the primary data. The data is analyzed through a data analysis process with multiple steps, including raw data transcript, data organization, data coding, thematic analysis, discovering interrelating themes, and interpreting the meaning of themes (Creswell & Creswell, 2018, p. 194).

Addressing the above research question creates three contributions to the literature. First, this study provides an overview of three key concepts: service development, AI capabilities, and AI capabilities in service development. Second, this study provides important future-oriented theoretical modeling about the interaction of the key concepts, which instructs industry professionals to effectively develop services with the use of AI. Third, the research gives suggestions for future research on this subject area.

This study is divided into five chapters. The idea of each chapter is to fulfill the objective of this thesis, which is to answer the research question. This introduction chapter represents the first part of the study, introducing the reader to the content of the study. The second chapter is a literature review of service development, AI capabilities, and the role of AI capabilities in service development. The same chapter two presents the theoretical framework based on the literature review. The literature review is followed by a methodology chapter covering the chosen methodological approach, research strategy, and reasons behind the selection. The fourth chapter explains the results of the study. Finally, the fifth and last chapter's discussion concludes the thesis.

2 Literature review

This literature review aims to model a theoretical framework for future research purposes. The literature review explores academic research about service development, AI capability, and the supportive role of AI capability in service development. The study focuses on finding possible positive connections between AI capability and service development, as the aim is to answer the research question: *"How does AI support service development?"*

The chapter is divided into three main sections based on the key concepts of the study: service development, AI capability, and AI capability in service development. The first section defines service development. Service development is a broadly researched field of study, and hence, it is important to explore the literature in terms of the research topic. The service development section starts by defining the concept of service and service quality. Service quality is explained because it is an essential area of service development, as the main goal of service development is to create services that aim for high service quality and service excellence (Edvardsson & Olsson, 1996). The section continues by defining service development and new service development (NSD). The service development is defined through new service development because the terms are used interchangeably in academic research literature. Case companies' AI capabilities are applied in different parts of service development, and therefore, it is important to get familiarized with the NSD process. Furthermore, service delivery systems, service innovation, and customer involvement seem to be areas where case companies' AI solutions are applied to, and those are contributing factors to service development, which is why this literature review takes a closer look at them at the end of the first section.

The second section goes through academic studies about AI capability, which is the other main concept of this thesis. The terms AI and AI capability are defined. The purpose of the third section is to answer the research question by reviewing academic literature regarding AI capability in service development. Finally, the chapter ends with a theoretical framework.

2.1 Service development

2.1.1 The concept of service

In order to understand what service development is, it is essential to clarify the concept of service. Gustafsson and Johnson (2003) and Edvardsson et al. (2005) define service at Edvardsson et al.'s (2006, p. 282) work as follows: "*services are in time and space linked activities and interactions provided as solutions to customers' problems*" (Edvardsson et al. 2006, p. 282). From the perspective of Edvardsson and Olsson (1996), customer involvement is at the core when defining the notion of service. They explain that a service can be characterized based on a customer outcome, a customer process, and service prerequisites. Accordingly, a customer outcome means the customer's perception of a service outcome - it is an indicator of the customer's perceived value and quality. A customer process refers to a service creation process where the customer is involved, and their individual preferences are considered. Service prerequisites mean the resources that are used in order to create the services, such as technical capabilities (Edvardsson & Olsson, 1996). Edvardsson and Olsson (1996) identify that customer knowledge and experience are part of resources, and they point out the strategic dilemma around it: "*how that customer's various resources should and can be utilized?"* (Edvardsson & Olsson, 1996, p. 147). This is explored in greater depth in the following sections, as it was found that AI plays a key role in solving that problem when developing services.

Service quality

Although service quality has new characteristics at the age of online services (Parasuraman et al., 2005), the core idea remains unchanged – in order to design high-quality services, service developers need to understand how customers feel about the service, whether it is provided online or face-to-face (Zeithaml et al., 2002). The next sections introduce four traditional service quality models and one modern way that can be used to evaluate the service quality.

According to Parasuraman et al. (1988), service quality can be determined with the SERVQUAL model, where perceived service quality stems from a combination of customers' expectations and perception of the service. Customer expectations are affected by customer needs and premonitions of the service that can be influenced by previous experiences or rumors. SERVQUAL model divides service quality into five segments: reliability, assurance, tangibles, responsiveness, and empathy. The model is designed to be used as a tool to improve the quality of services through discovering customers' expectations and perceptions of the service quality by evaluating previously mentioned factors (Parasuraman et al., 1988).

In a more recent study, Parasuraman et al. (2005) explain that online service quality can be measured with two separate models: the E-S-QUAL model to measure usual service experience, and the E-RecSQUAL model to evaluate the service quality of an unusual service experience, including, for example, problem solving, which requires more complex further processing. E-S-QUAL covers four dimensions: efficiency, fulfillment, system availability, and privacy, whereas E-RecSQUAL covers three dimensions: responsiveness, compensation, and contact (Parasuraman et al., 2005). In contrast to Parasuraman et al.'s (2005) goal-oriented E-S-QUAL model, Bauer et al. (2006) have introduced the eTransQual model, where online service quality measurement is based on transactional service delivery process and customers' emotional perception or hedonic quality. The eTransQual model has five dimensions: responsiveness, reliability, process, functionality, and enjoyment (Bauer et al., 2006). Image 1 below summarizes the findings acknowledged above: service quality models, the object of measurement, and service quality dimensions. When interpreting the whole, it can be observed that responsiveness and reliability are repeating dimensions.

Service quality model and authors	Object of measurement	Service quality dimensions
eTransQual (Bauer et al., 2006)	Online service quality, transactional service delivery process and customers' emotional perception	Responsiveness, reliability, process, functionality and enjoyment
SERVQUAL (Parasuraman et al., 1988)	Customer expectations and perceptions of the service quality	Reliability, assurance, tangibles, responsiveness, empathy
E-S-QUAL (Parasuraman et al., 2005)	Usual online service experience	Efficiency, fulfillment, system availability and privacy
E-RecSQUAL (Parasuraman et al., 2005)	Unusual online service experience	Responsiveness, compensation and contact

Image 1. Service quality models, the object of measurement, and service quality dimensions. (Bauer et al., 2006, p. 871; Parasuraman et al., 1988, pp. 23-30; Parasuraman et al., 2005, p. 220).

Moreover, according to Matintupa (2020), the modern way is to utilize knowledge and data management to improve service quality, as they have become a crucial part of companies' management strategies. The key is to leverage AI's ability to gather a large amount of customer data, process it, and identify recurring phenomena that can reveal valuable information about customers' expectations or things that affect the expectations (Matintupa, 2020). These AI capabilities are discussed more in the upcoming sections.

2.1.2 Service development

Edvardsson et al. (2006, p. 2) define service development as follows: "*The term service development refers to further development of existing services in a company, new services for the company, or services that are 'new to the world.'* Edvardsson and Olsson (1996) state that service development refers to activities and resources that are needed in order to build operational services. Two concepts, service development and new service development, are discussed concurrently in the literature. However, the literature focuses on new service development; therefore, the following section discusses the concept of new service development.

New service development

According to Papastathopoulou and Hultink (2012), new service development (NSD) studies from 1982 until 2008 have been researching NSD through the NSD process, customer involvement, and NSD organization, with the NSD process and customer involvement being the most studied themes. Thus, the next sections focus on the NSD process and customer involvement in NSD as these two topics are heavily emphasized in the NSD literature.

New service development process

Many previous studies have examined new service development and named the NSD process stages in different ways and in different extensions. According to Zomerdijk and Voss (2011), the NSD process model varies depending on the type of service developed. Consequently, in their research, they find a contradicting vision of how predetermined the NSD process should be – occasionally, the process will benefit from a highly strict and pre-designed process, and sometimes, it will benefit from elastic and continuing development. For example, service development in experiential services benefits from a flexible and continuous development strategy (Zomerdijk & Voss, 2011). However, Froehle et al. (2000) posit that firms' service development should follow a settled process model strategy in order to beat the rivalry with speed and mimicry advantages.

Nevertheless, the literature emphasizes that the NSD process consists of different process activities that can be divided into phases. The most commonly used NSD process model that acts as a basis for several other studies is a periodical four-stage NSD process model by Johnson et al. (2000, pp. 17-18) (Melton & Hartline, 2010). Figure 1 represents this NSD process model, and it shows how it is divided into design, analysis, development, and full launch phases, as well as service delivery enablers (Johnson et al., 2000, pp. 17-18). The design phase includes ideation, strategizing, and testing a new service concept, and the analysis phase consists of business analysis and project authorization. These first steps represent the planning period, where required capabilities are decided. The

development phase has more activities as it includes service design, process and system design, marketing program design, training, and testing. Finally, the full launch phase forms from project release and evaluation activities (Johnson et al., 2000, pp. 17-18). These two last phases form an implementation period (Johnson et al., 2000, pp. 17-18). Finally, the NSD process is supported by service delivery enablers that are people, products, systems, and technology. These enablers affect the quality of the outcome of the service developed (Johnson et al., 2000, pp. 18-20). Therefore, service quality can be evaluated based on the success of the service delivered, which is formed from development activities and delivery enablers.

The previous studies (Johnson et al., 2000, pp. 17-18; Yu & Sangiorgi, 2018; Melton & Hartline, 2010; Wang et al., 2022) highlight that the service design is an essential part of the NSD process. Consequently, Yu and Sangiorgi (2018) explain that the main idea of the service design is to facilitate the NSD process by thoroughly understanding customer experience through ongoing observation and to build an organizational culture that aims for service development. Bitner et al. (2008) highlight that the purpose of the service design is to innovate and design distinctive services compared to rivals by possibly using different strategic tools, such as Service Blueprinting tool, that are used to visually present the service process by carefully examining customer journey and service delivery touchpoints especially from customers perspective as the idea is to realize what customers value in service (Bitner et al., 2008). This technique has been seen as especially useful when designing experience-oriented services (Bitner et al., 2008) or so-called hedonic-oriented services (Larivière et al., 2024).

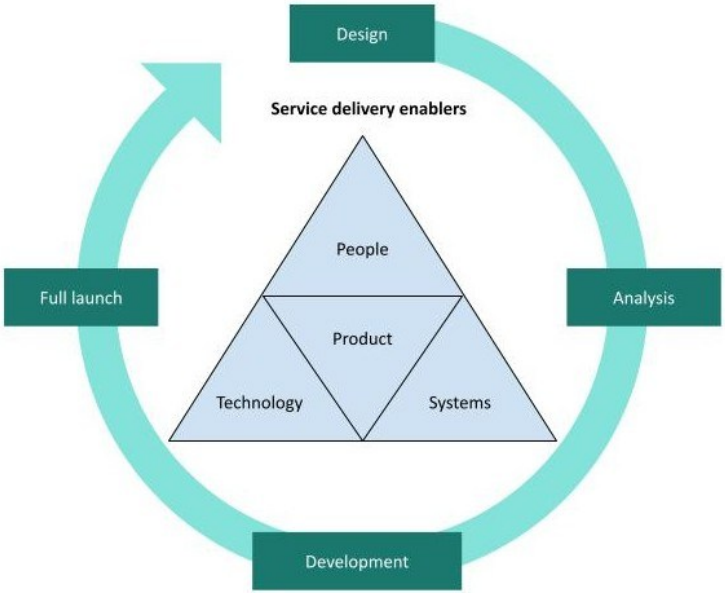

Figure 1. The NSD process model after Jonson et al. (2000, p. 18).

In subsequent studies, researchers have applied Johnson et al.'s (2000, p. 18) NSD process model by either extending or condensing it. For example, Yu and Sangiorgi (2018) present a multidimensional NSD model that acts as an extension to Johnson et al.'s (2000) NSD process model. Their multidimensional NSD process model highlights the importance of service design and user value creation in the process. Hence, the model has two more stages, exploration and evaluation stages, as well as user-involvement activities and user-centered innovation capabilities that aim to support all process stages. In turn, Melton and Hartline (2010) have taken a compressed approach and simplified Johnson et al.'s (2000) model into three phases: design, development, and launch, where the design covers both design and analysis phases. Melton and Hartline (2010) underline that customer involvement supports the design and development stages, and employee involvement supports the launch stage of the NSD process. Similarly, Wang et al. (2022) use a three-stage approach with slightly different process stage names, ideation, development, and deployment, which, however, cover the traditional process steps. According to their study, customer involvement has a positive effect on ideation and development stages, and business partner involvement supports the deployment stage.

Edvardsson and Olsson (1996) divide NSD into three divisions: development of a service concept, service system, and service process. The development of a service concept refers to planning and analysis tasks, the service system refers to resources, for example, employee training and physical and organizational capabilities, and the service process includes activities from different parties that enable service creation. The authors highlight that customer involvement is a strong factor throughout the whole NSD process and a critical part of a service prerequisite, as that is also part of the result of the process (Edvardsson & Olsson, 1996). Image 2 below gives a brief presentation of different NSD process models, their stages, and supporting factors named after different authors as discussed earlier.

Moreover, Froehle et al. (2000) have found that information technology (IT) facilitates the creation of suitable capabilities needed in NSD and increases the NSD process performance, making the process faster. Precisely, IT provides the possibility to exploit real-time data that could be used to create new services and boost innovation in NSD (Froehle et al., 2000), and hence, technology can be considered as an important supportive factor in the NSD process, as also noticed by Jonson et al. (2000, p. 18). Froehle et al. (2000) supplement that it is necessary to be prepared and train the organization and employees for new IT appliances in order to embed them into the processes.

NSD process models		
Authors	**NSD process stages**	**Supporting factors**
Edvardsson and Olsson (1996)	Service concept development (planning and analysis), service system (resources) and service process (other activities)	Customer involvement
Johnson et al. (2000, p. 18)	Design, analysis, development and full launch	People, product, system and technology
Melton and Hartline (2010)	Design, development and launch	Customer involvement in design and development stages, employee involvement in launch stage
Wang et al. (2022)	Ideation, development and deployment	Customer involvement in ideation and development stages, business partner involvement in deployment stage
Yu and Sangiorgi (2018)	Exploration, design, analysis, development, full launch and evaluation	User-involvement activities and user-centered innovation capabilities

Image 2. NSD process models (Edvardsson & Olsson, 1996, pp. 159-162; Johnson et al., 2000, p. 18; Melton & Hartline, 2010, pp. 413-420; Wang et al., 2022, p. 190-199; Yu & Sangiorgi, 2018, p. 52).

Service delivery system and service innovation in the NSD process

According to Johnson et al. (2000, p. 20), the enablers form a service delivery system as an important part of the NSD process that determines how the service is delivered and the level of customer contact with the service delivery. Accordingly, low customer contact refers to a service that is mostly delivered through technology, and thus, the role of people as an enabler is smaller, and service offering is highly standardized (Johnson et al., 2000, p. 20). In contrast, Johnson et al. (2000, p. 21) emphasize that a high level of customer contact refers to personalized service offerings that are delivered through human rather than technology. However, nowadays technology, especially AI and machine learning, enables service delivery as well as recommendations with personalization based on customers' historical data (Hou et al., 2024; Hoyer et al., 2020), which means that low customer contact service delivery can also be personalized.

Along with the literature, service innovation has not been defined as the same as service development (Gustafsson et al., 2020), but rather, as a part of the service development process (Johnson et al., 2000, pp. 17-18; Jong & Vermeulen, 2003; Melton & Hartline,

2010; Wang et al., 2022; Yu & Sangiorgi, 2018). According to Gustafsson et al. (2020), service innovation focuses on innovating new services, and therefore, it is a proven part of the new service development process. Furthermore, according to Johnson et al. (2000, pp. 22-24), service delivery configuration is connected to the level of service innovation, and the NSD process enablers change along with the innovation. This means that the level of service innovation can be low or profound, depending on how radical the change in service offering and service delivery is. For example, service innovation can be considered to be radical when a new service offering is delivered completely through technology, and the initial service offering was delivered through a human (Johnson et al., 2000, pp. 22-24).

In addition, different types of service innovations require a different set of enablers in order to create services that fit current trends. For instance, in the technological development era, services are delivered differently based on the technologies used. For example, self-service requires high technical qualities, whereas face-to-face service requires fewer technical features, but human resources are necessary (Johnson et al., 2000, p. 20). Jong and Vermeulen (2003) add the importance of building the right environment to support ongoing innovation in NSD. Furthermore, Jong and Vermeulen (2003) identify that technology has a lot of potential in service innovation since it can be used, for example, to search for important information about rivals.

Customer involvement in the NSD process

As already mentioned earlier in the NSD process description, the literature repeatedly highlights the importance of customer involvement in the service development process (Carbonell et al., 2009; Edvardsson & Olsson, 1996; Matthing et al., 2004; Sjödin et al., 2020; Yu & Sangiorgi, 2018). However, academic studies seem to possess somewhat divergent views on what part of the process the customer should be involved in.

Consequently, Matthing et al. (2004) argue that the reason behind customer involvement popularity is linked to the possibility of winning the competitive advantage by

learning customers' hidden needs and its positive influence on technological features and innovativeness. The study by Carbonell et al. (2009) supports the latter vision by discovering that customer involvement has a positive influence on sales and competitive outcomes by boosting technical features and the NSD process, and that there is an increasing need for customer involvement in the process when the new service contains modern technological features or if the environment is experiencing "technological turbulence". Furthermore, Carbonell et al. (2009) suggest that customers should be involved throughout the whole NSD process because its positive effects are not dependent on a certain process stage. Also, Edvardsson et al. (2006, pp. 1-2) support the idea that customers should be involved at different stages of the service development process for value creation.

However, Matthing et al. (2004) emphasize the value of customer cooperation at an early development stage. Similarly, Melton and Hartline (2010) underline the possibilities customer cooperation creates at the design and development stages. Specifically, they argue that customer involvement at an early development stage boosts the firm's readiness to launch a new service and positively affects sales and business competence. Wang et al.'s (2022) finding seems to support the stage-specific perspective, as they state that customer participation promotes the innovation and development stages. Zomerdijk and Voss (2011) support Matthing et al.'s (2004) view about the benefit of understanding customer wishes, as their research results indicate that customer insight is the most relevant preliminary information the NSD process requires in the design stage of the process.

Furthermore, Zomerdijk and Voss (2011) highlight that there are multiple ways to collect customer insight, for example, by surveying people or conducting research on different topics, such as market research or empathic research, depending on the information to be collected. Image 3 compiles the NSD process stages that could benefit from customer involvement by different authors. As Image 3 presents and as discussed earlier, customer

involvement is most popular in the early NSD process stages, especially in the design stage, but also useful throughout the entire process.

Customer involvement in the NSD process	
Authors	**NSD process stages that benefit from customer involvement**
Carbonell et al. (2009)	All process stages
Edvardsson et al. (2006, pp. 1-2)	All process stages
Matthing et al. (2004)	Early development stage
Melton and Hartline (2010)	Design and development stages
Wang et al. (2022)	Innovation and development stages
Zomerdijk and Voss (2011)	Design stage

Image 3. Customer involvement in the various stages of the NSD process (Carbonell et al., 2009, pp. 547-548; Edvardsson et al., 2006, pp. 1-2; Matthing et al., 2004, p. 492; Melton & Hartline, 2010, p. 420; Wang et al., 2022, p. 199; Zomerdijk & Voss, 2011, pp. 77-78).

2.2 AI capability

2.2.1 Definition of AI

In order to give a determination to AI capability, it is justified first to briefly explain what artificial intelligence (AI) is. According to Sheikh et al. (2023, pp. 28-39), AI was first researched back in 1956 when the first AI programs were developed, and AI was able to play checkers and solve simple mathematical problems. Later, in 1970, AI was developed to obey the rules and solve more complex mathematical problems, and in 1997, AI progressed to the point where it could beat humans in chess. The neural networks approach has begun dominating as well as machine learning and deep learning. Sheikh et al. (2023, pp. 28-39) stress that the development of AI and its subfields has been accelerated by the growing amount of data and computing power, and advanced research. Perhaps the most significant recent milestone in the field of AI is Pluribus, created by Tuomas Sandholm, an AI bot that beat the world's best human players in six-player Texas hold 'em poker in 2019 (Brown & Sandholm, 2019; Sijoituskästi, 2025, 11:36).

Wang (2019) highlights that AI is a complex term to define because the definition changes according to research perspective, as there are different kinds of AIs that function differently. However, several other authors have set a clear definition of AI as

presented in Image 4. Image 4 shows that all of the definitions refer to a machine, a system, or a program, but different authors refer to it from different perspectives. To summarize the definition of the term, AI is defined as a technical system that aims to achieve a certain goal or solve a problem (Chowdhury et al., 2023; Gao et al., 2025; Göcke & Rosenthal-von der Pütten, 2020, p. ix; High-Level Expert Group on Artificial Intelligence, 2019; Mikalef & Gupta, 2021; Osaba et al., 2021, p. 1). Huang and Rust (2018) and Madanaguli et al. (2024) add that AI can have anthropoid abilities. Nevertheless, there are minor differences in the definitions - Chowdhury et al. (2023), Gao et al. (2025), Madanaguli et al. (2024), and Mikalef and Gupta (2021) refer to AI systems' ability to learn from data. In contrast, Göcke and Rosenthal-von der Pütten (2020, p. ix), Huang and Rust (2018), McCarthy (2007), and Osaba et al. (2021, p. 1) do not mention or emphasize AI's learning skills in their definitions. On the other hand, the High-Level Expert Group on Artificial Intelligence (2019) and McCarthy (2007) refer to a system that can take actions. McCarthy (2007) adds that AI’s functionality is not limited in the same way as human biological functionality.

AI definitions	
Author(s)	**Definition of AI**
Chowdhury et al. (2023)	"the ability of a manmade system comprising of algorithms and software programs, to identify, interpret, generate insights, and learn from the data sources to achieve specific predetermined goals and tasks"
Gao et al. (2025)	"individuals utilizing AI systems to analyze and learn external data, and achieving established goals and tasks through continuous upgrades"
Göcke & Rosenthal-von der Pütten (2020, p. ix)	"a computer program developed by humans that can achieve complex goals"
High-Level Expert Group on Artificial Intelligence (2019)	"systems that display intelligent behaviour by analysing their environment and taking actions – with some degree of autonomy – to achieve specific goals"
Huang & Rust (2018)	"machines that exhibit aspects of human intelligence (HI)"
Madanaguli et al. (2024)	"the family of technologies that enable machines to simulate human-like cognitive functions such as learning, thinking, and making decisions based on current and past inputs and outputs"
McCarthy (2007)	"the science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable."
Mikalef & Gupta (2021)	"the ability of a system to identify, interpret, make inferences, and learn from data to achieve predetermined organizational and societal goals"
Osaba et al. (2021, p. 1)	"a wide field of knowledge dedicated to the design, modeling and implementation of intelligent systems so that they automatically give a response to complex problems arisen in the real-world"

Image 4. Definitions of AI (Chowdhury et al., 2023, p. 2; Gao et al., 2025, p. 3; Göcke & Rosenthal-von der Pütten, 2020, p. ix; High-Level Expert Group on Artificial Intelligence, 2019, p. 1; Huang & Rust, 2018, p. 155; Madanaguli et al., 2024, p. 2; McCarthy, 2007, p. 2; Mikalef & Gupta, 2021, p. 3; Osaba et al., 2021, p. 1).

Furthermore, Sheikh et al. (2023, pp. 15-20) see defining AI as problematic for two reasons: it can mean the technology to replicate not only one kind of, but different levels of intelligence, and the concept of AI is evolving; it has not remained the same or stable. Authors explain that AI is a broad and complex concept, and there is no single correct definition for it - the definition depends on what purpose it is used for. Even so, Sheikh et al. (2023, p. 19) like to follow the European Commission's High-Level Expert Group on Artificial Intelligence's (AI HLEG) (2019) definition of AI as it gives AI a broader definition by not naming a certain level of intelligence or actions to the system. Wang (2019) has a similar approach to defining AI as Sheikh et al. (2023, p. 19), as the author criticizes that there should not be one universal definition of the term AI because it can mean different things or different capabilities in different contexts, or then the capabilities should be clarified. This is because, for example, not all AIs are designed to be capable of learning

from data (Huang & Rust, 2021). Therefore, Wang (2019) underlines that it is more crucial to define the term "intelligence" and, hence, the author explains that intelligence is the system's ability to function with the given or vague conditions. McCarthy (2007) emphasizes that intelligence refers to different levels of competence to accomplish a target. In turn, the High-Level Expert Group on Artificial Intelligence (2019) states that intelligence is an unclear concept. Since there are several definitions to AI and it is a complex concept without a settled definition, it seems to make most sense to agree with High-Level Expert Group on Artificial Intelligence's (2019) open definition of AI: *"Artificial intelligence (AI) refers to systems that display intelligent behaviour by analysing their environment and taking actions – with some degree of autonomy – to achieve specific goals*" (High-Level Expert Group on Artificial Intelligence's, 2019, p. 1).

Sheikh et al. (2023, p. 49) highlight that AI appears in different applications with different capabilities depending on its purpose. An AI application can be represented physically in hardware, such as a drone, or virtually, backed up with software, such as a search engine (High-Level Expert Group on Artificial Intelligence, 2019). However, an AI application can be based on both software and hardware, for example, in modern robotics (Jansen & Kelkar, 2025). According to Sheikh et al. (2023, p. 49), AI can be divided into five categories based on its practical usage: machine learning for predictive analysis, computer vision for image processing, natural language processing for language ability, speech recognition for speech ability, and robotics for physical activity. Different AI applications can use these abilities or a combination of these to assist humans and improve efficiency in different industries and purposes (Sheikh et al. 2023, p. 59). Thus, the above-mentioned practical skills of AI are an obvious sign of AI's capabilities. The concept of AI capability is discussed in greater detail in the upcoming sections.

How does an AI system work in practice?

As discussed earlier, AI is a complex concept with many subfields, but in order to realize how AI can support service development from the perspective of AI capabilities, it is beneficial to understand the basic logic behind the operability of an AI system.

Consequently, the High-Level Expert Group on Artificial Intelligence (2019) has found that an AI system has three main functions it uses in order to reach its goal: sensors, reasoning and decision-making, and actuators. First, sensors, for example, a website's mission is to collect the data, process the data by interpreting and reasoning, and decide which action to take based on the data and the given goal. Finally, at the actuation step, the program acts based on given rules. If the system is a so-called "learning system", it can learn from the environment and fix its reasoning and decision-making capabilities, but this is not necessary and is not set to all AI systems (High-Level Expert Group on Artificial Intelligence, 2019).

2.2.2 Definition of AI capability

AI capability is the central concept in this work, and hence, it is essential to examine the relevant literature about the topic to draw a definition for it. Although Sjödin et al. (2021) and Mikalef and Gupta (2021) acknowledge in their studies that there is no clear definition of AI capability, a few were found. However, a noteworthy observation is that there are only a few determinations of AI capability because AI capability is a somewhat novel and unsettled concept (Mikalef et al., 2022). It seems that the definition of AI capability depends on the context, purpose, or perspective from which the capability is viewed. Accordingly, the literature emphasizes that there are few definitions, two of which are commonly used AI capability frameworks: the resource-based AI capability framework created by Mikalef and Gupta (2021) and the AI capability framework based on AI's intelligence levels by Huang et al. (2019). Several authors, such as Ameen et al. (2024), Chowdhury et al. (2023), and Mikalef et al. (2022), have applied Mikalef's and Gupta's (2021) theory of AI capabilities in their research. Likewise, the AI capability framework by Huang et al. (2019) has been used in academic research many times, for example, by Huang and Rust (2021) and Kipnis et al. (2022).

In addition to the previously mentioned frameworks, the EU's High-Level Expert Group on Artificial Intelligence (2019) briefly presents a more general definition for AI capabilities compared to Mikalef and Gupta (2021) and Huang et al. (2019) by focusing on an AI

system's operational capability. In turn, Sheikh et al. (2023, pp. 49-50) present five types of AI based on their practical abilities, yet the authors do not name them as "AI capabilities". Consequently, AI capability is a complex and nascent concept, and hence, it is difficult to define as there does not exist a clear and settled definition yet. However, based on the scarce literature found, the next paragraphs present the definitions of AI capability that can currently be found in academic literature.

Resource-based model

According to Mikalef and Gupta (2021), AI capability is determined by the resources needed to build the AI capability. Although the literature stresses that AI is a technical system (Chowdhury et al., 2023; Gao et al., 2025; Göcke & Rosenthal-von der Pütten, 2020, p. ix; Huang & Rust, 2018; McCarthy, 2007; Mikalef & Gupta, 2021; Osaba et al., 2021, p. 1), Mikalef and Gupta (2021) explain that AI capability is a broader entity than just a technical system - it forms from supportive or administrative features in addition to technical ones. Precisely, Mikalef and Gupta (2021) base their view of AI capability on resource-based theory (RBT), whereby AI capability is composed of specific firms' resources - the resources that a firm needs in order to build a functional AI system that delivers value and that is difficult for rivals to copy.

Figure 2 presents a division of AI capability by Mikalef and Gupta (2021). Accordingly, they divide AI capability into three domain resources: tangible, human, and intangible. Tangible resources consist of data, technology, and other primary resources. In contrast, human resources include technical and administrative expertise, whereas intangible resources cover firms' ability to be organizationally agile, which includes, for example, firms' departmental organization and readiness for change and risk-taking capability (Mikalef & Gupta, 2021). Mikalef and Gupta (2021) highlight that a firm can gain creativity and performance benefits if it possesses the right set of resources in order to achieve AI capability.

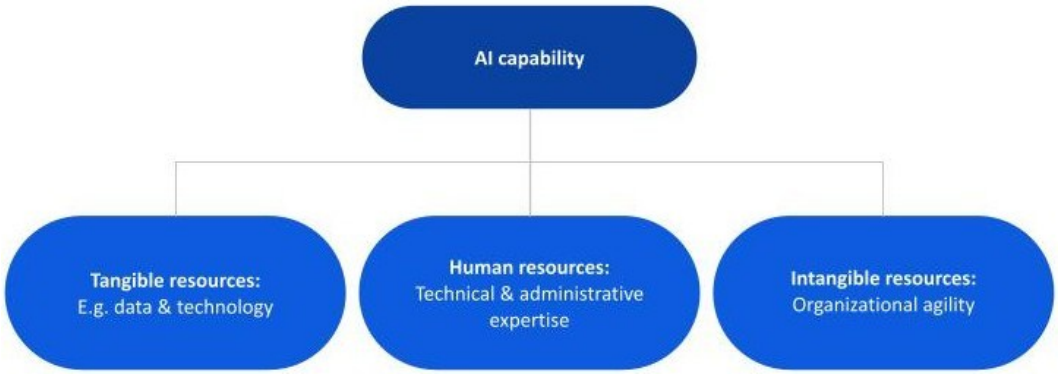

Figure 2. AI capability and resources (adapted from Mikalef and Gupta (2021, p. 4)).

Intelligence-based model

Huang and Rust (2018 & 2021) and Huang et al. (2019) have introduced quite different approaches to AI capability compared to the resource-based model by Mikalef and Gupta (2021). Huang et al. (2019) present an intelligence-based model where AI can be divided into three dimensions according to AI's level of intelligence. Their AI intelligence framework stems from an earlier study by Huang and Rust (2018), where the authors identify four intelligence levels for AI: mechanical, analytical, intuitive, and empathetic. Later on, Huang et al. (2019) summarized the intelligence levels into three AI: mechanical AI, thinking AI, and feeling AI. In their research, authors explore how AI and its different intelligence levels can take over tasks in the service industry (Huang & Rust, 2018 & 2021; Huang et al., 2019). This AI division is presented in Figure 3, illustrating how the level of intelligence increases when the AI develops from mechanical AI to thinking AI and to feeling AI (Huang et al., 2019; Huang & Rust, 2021). The three intelligence levels of AI are named as different levels of AI capabilities in this work in order to make sense of AI capabilities in service development, but also because Huang et al. (2019) use the term "AI capability" when explaining AI's different intelligence levels.

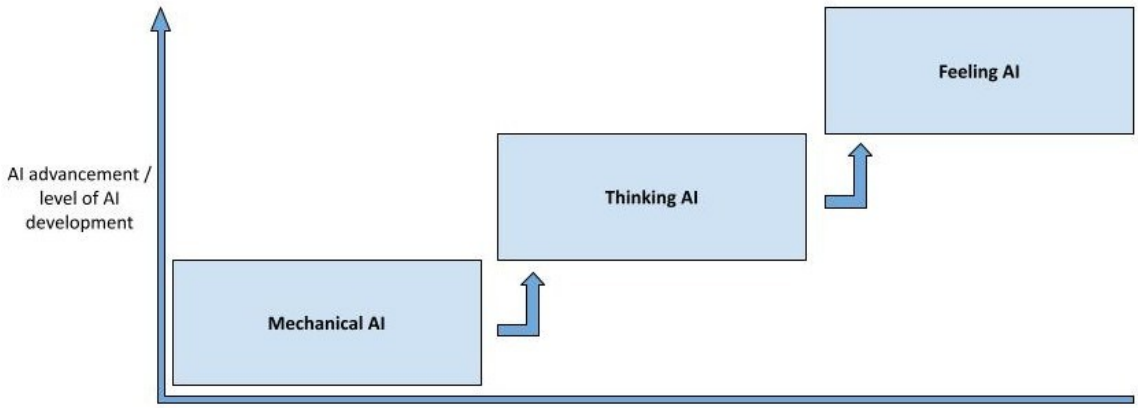

Figure 3. AI capabilities at different development levels (Huang et al., 2019, pp. 45-46; Huang & Rust, 2021, p. 32).

Mechanical AI

Huang et al. (2019) have found that mechanical AI has the lowest intelligence level, and it is used in simple routine work with narrow learning capability. They emphasize that mechanical AI is the most used AI out of all three AIs, and automation is one example application of mechanical AI.

Thinking AI

Huang et al. (2019) underline that thinking AI's intelligence level is placed between mechanical and feeling AI, and it is becoming more popular as it advances. Thinking AI is capable of decision-making and learning from data, and it is used, for example, in self-driving cars (Huang et al., 2019). Huang and Rust (2018) point out that intelligent AI is going to help with data analysis tasks so that it can process the data, and what remains is for human intelligence to make the decisions based on AI's work.

Feeling AI

Finally, Huang et al. (2019) suggest that feeling AI is the most undeveloped of all AIs but is constantly developing. It has the highest intelligence level, as the goal for it is to mimic humanoid skills, such as empathy, by having responsive skills. More precisely, feeling AI learns from knowledge and is capable, for example, of having conversations through

Natural Language Processing (NLP) (Huang et al., 2019). However, Kim et al. (2022) highlight that AI is not yet as capable as humans of delivering emotionally intelligent outcomes.

AI's operational capabilities

AI HLEG (2019) roughly divides AI capabilities into two sections based on AI's operational capabilities: reasoning and learning. In brief, by reasoning, they mean an AI system's ability to reason data, which has first been modified into knowledge, and then the AI decides what the next step or the action to perform (High-Level Expert Group on Artificial Intelligence, 2019). AI's ability to reason and make decisions is based on symbolic rules that have been set by humans. The advantage of "symbolic AI" is that the outcome, or, for example, the recommendation as an outcome, can be more personalized compared to a machine learning approach because the dataset is not that broad and the decision is based on predetermined rules (AIBrilliance, 2024).

In turn, the second operational AI capability, learning, refers to AI's ability to observe and learn from data with different techniques, for example, by using machine learning. In this capability, AI learns from a big dataset and, hence, the decision is not limited or based on symbolic rules (AIBrilliance, 2024; High-Level Expert Group on Artificial Intelligence, 2019). Furthermore, the third approach is hybrid systems that combine both symbolic AI and learning capabilities (AIBrilliance, 2024). Hybrid systems are not limited to only one kind of capability, and thus, they are seen to have a lot of potential in the future and are already used, for example, in IBM Watson AI solution (AIBrilliance, 2024).

Five AI types

Sheikh et al. (2023, pp. 49-50) divide AI into five types: machine learning, computer vision, natural language processing, speech recognition, and robotics. This division is based on AI's subfields, and their respective AI capabilities are based on each AI type's practical abilities. Authors do not precisely name these AI types as AI capabilities, but they give comprehensive examples of what they are capable of, and hence, they can be

considered as capabilities. These five AI types and their AI capabilities are listed in Image 5 below and explained in the following paragraph.

According to Sheik et al. (2023, pp. 49-50), machine learning refers to AI's ability to comprehend and analyze data and make predictions from data, and it can be used in predictive analytics. For example, bank financial services can use this AI capability to help with credit competence evaluation based on customers' financial data when deciding whether or not to grant credit to the customer. In turn, Sheikh et al. (2023, pp. 49-59) underline that computer vision is AI's ability to analyze visual data and recognize images. Examples include self-driving cars and facial recognition. Sheikh et al. (2023, pp. 49-59) continue by explaining that natural language processing represents a third ability where AI is capable of comprehending, analyzing, and creating human language in different applications, such as search engines or chatbots. The authors further highlight that speech recognition is capable of observing and analyzing spoken human language, and it is capable of turning voice into text or the other way around. Several voice assistants and audiobooks are examples of applications that use speech recognition. Finally, robotics can combine several previously mentioned AI capabilities in an AI context (Sheikh et al. 2023, pp. 49-59). Robotics AI application aims to mimic humans in physical tasks or even do things better than humans (Sheikh et al. 2023, pp. 49-59). Robotics with AI is used, for example, in manufacturing tasks, but it is not used much in complex human tasks as they are not yet highly advanced enough to respond to unexpected events (Sheikh et al. 2023, pp. 49-59).

Type of AI	AI capability
Machine learning	Predictive analytics
	Understanding and analyzing data
	Making predictions from data
Computer vision	Image recognition
	Analyzing visual data
Natural language processing	Understanding, analyzing and creating human language
Speech recognition	Observing and analyzing spoken human language
	Turning speech into text and doing reverse
Robotics (in AI context)	Combining several AI capabilities
	Physical representation of machine aiming to mimic human by doing human tasks

Image 5. Five types of AI and their corresponding AI capabilities (Sheik et al., 2023, pp. 49-59).

Levels of AI

In addition to the previously mentioned definitions based on academic research, it is reasonable to examine the concept from the perspective of a secondary source, as academic literature is rather scarce. Consequently, Lepistö and Tuominen from Nordnet Suomi (2025a, 15:00) explain recent trends and the development of AI based on the current AI solutions from leading AI companies. It is important to explore AI from the perspective of its development because it helps to understand its capabilities from a development perspective. Accordingly, Lepistö and Tuominen (2025a, 15:00) roughly divide AI into four main segments and three levels based on the development of AI, starting from the most developed and popular AI, generative AI (GenAI), followed by agentic AI and physical AI, and finally introducing the least developed and most novel AI, AGI. Figure 4 gives a visual presentation of the AI levels based on their development. As seen from Figure 4, physical AI and agentic AI represent the same level on the development path since the physical AI utilizes the same AI features as agentic AI, and, hence, the biggest development leap can be noticed between GenAI, agentic, and physical AI and AGI (Nordnet Suomi, 2025a, 15:00).

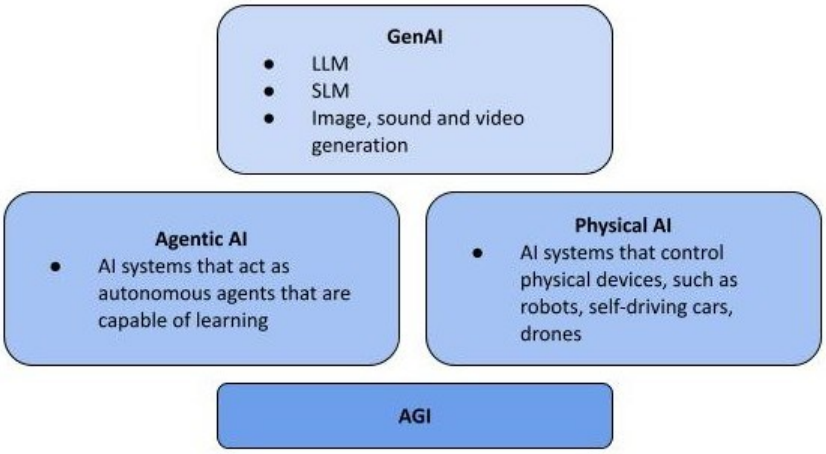

Figure 4. Levels of AI according to development (Nordnet Suomi, 2025a).

The most developed AI, GenAI, consists of LLM, small language model (SLM), and image, sound, and video generation. The second developed agentic AI is an autonomous agent system with learning ability, and physical AI represents AI that powers physical devices (Nordnet Suomi, 2025a, 15:00). Morris et al. (2025) define artificial general intelligence (AGI) as an AI system that is as capable or more capable than humans in tasks. However, Lepistö and Tuominen outline in their more recent discussion (Nordnet Suomi, 2025b, 08:20) that AGI is currently at the development phase, and it is seen as a future AI that needs a couple of technical breakthroughs before being ready for implementation. According to Lepistö and Tuominen (Nordnet Suomi, 2025b, 35:45), AGI combines two kinds of AI technologies: LLMs and symbolic AI, or so-called “Sandholm’s AI”, which can be described with system 1 and system 2 thinking. System 1 or LLMs represent a traditional AI system that uses pattern recognition and statistical prediction.

In turn, system 2 is a more strategic AI that uses search and optimization and is used, for example, in Computational Game Theory and Strategic Reasoning technologies developed by Tuomas Sandholm. The future goal is to combine understanding and intuitive LLM with reliable and logical symbolic AI (Nordnet Suomi, 2025b, 44:08). Based on this, it seems that the combination of different-level AI capabilities is indeed needed in the future, as noticed earlier in this literature review.

In summary, AI capabilities can be defined from different perspectives with different definitions, which makes the topic multidimensional and hence difficult to understand, as there does not exist a settled definition. However, when researching current literature and secondary sources, the overall picture of the concept begins to emerge. According to Huang et al. (2019), Huang and Rust (2021) and Sheik et al. (2023, pp. 49-50), and the secondary source from Nordnet Suomi (2025a & 2025b), a clear picture of the AI capabilities can be drawn – AI capabilities can be described based on AI's level of intelligence, or in other words, how developed the AI is. AI's development state gives an indication of what AI is capable of. Hence, this study relies on the mixture of definitions of AI capabilities and tries to explore its relation to service development from the perspective of current research on AI capabilities and their development.

Nevertheless, as this thesis is academic work, there are a few reasons why this thesis's framework relies more on a couple of existing academic studies. Accordingly, the AI capability framework by Huang et al. (2019) is more relevant for this study compared to the framework by Mikalef and Gupta (2021) for a couple of reasons. First, Huang et al.'s (2019) framework applies to the data collected for this study, and hence, makes it possible to answer the research question. This is because their framework is about how capable or intelligent AI actually is and what it is capable of, and it makes it suitable for the objective of this study, as the aim is to explore how AI capabilities support service development. There is clear evidence that AI capabilities can be set at the stages of the service development process in order to support the service development. Second, Mikalef and Gupta's (2021) framework does not quite fit the data collected, and the AI capability perspective of this study is different because their framework focuses on a firm's resources, where technology is part of it. Otherwise, it is about firms' other organizational resources, and this study focuses on technological capability rather than firms' capability or resources that are needed to adopt AI. The next subchapter continues the literature review by explaining how these previously mentioned AI capabilities could support service development.

2.3 AI capability in service development

The objective of this thesis is to examine how AI capability supports service development, and hence, it is important to research the connection between AI capability and service development. There can be found a few studies that investigate the role of AI in the service sector (Huang & Rust, 2018; 2021; Huang et al., 2019). However, it is not straightforward to make connections between service development and AI capability, as the existing literature about this relationship is insufficient, and, for example, AI capability itself does not have a settled definition. Regardless, the next sections look at how academic research connects these two topics and aims to answer the research question.

AI capability matching the nature of the service

The existing literature highlights that customer experience matters when deciding which AI capability to apply for different types of services – customers' service objective guides the service developer to choose how advanced AI, with which qualities to apply for each service purpose (Huang & Rust, 2018; 2021; Larivière et al., 2024; Schepers et al., 2022). Obviously, as all services with their service objectives, as well as all AI features, are unique by nature, the decision of which AI to use in each service needs careful case-by-case consideration to avoid failing investments. Consequently, Figure 5 acts as a representation of the use of the AI capabilities based on the nature of the services adapted from studies conducted by Huang and Rust (2018; 2021), Larivière et al. (2024), and Schepers et al. (2022). In the study of Huang and Rust (2021), the authors wisely link AI capabilities to the service context by also considering the service process.

However, it is worth noting that the service process is somehow different compared to the service development process. Accordingly, Huang and Rust (2021) divide the service process into service delivery, service creation, and service interaction, and the traditional service development process includes service design, analysis, development, launch, and service delivery system (Jonson et al., 2000, p. 18). However, it can be observed that the two processes, the NSD process and the service process, walk hand in hand as they

seem to mix quite well, and that the processes might use different process stage names but refer to the same stage. For example, by service creation, Huang and Rust (2021) refer to new service development, and this could then include traditional NSD process steps. In addition, Edvardsson and Olsson (1996) name the service process as part of the NSD process.

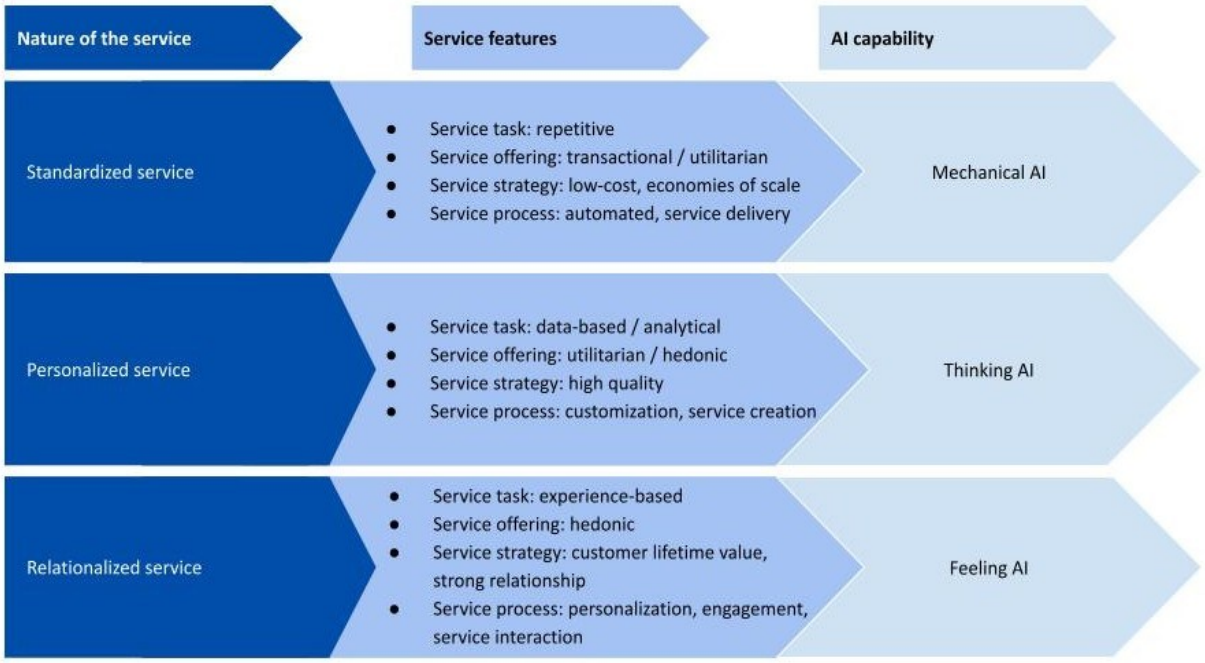

Figure 5. AI capabilities match the nature of the service and service features (Huang & Rust, 2018, p. 166 & 2021, pp. 36-38; Larivière et al., 2024, p. 18; Schepers et al., 2022, p. 578).

As Figure 5 illustrates, the nature of the service is divided into standardized, personalized, and relationalized services. Further, those are distributed into service features that constitute the nature of the service. The service features aim to depict service task, service offering, service strategy, and service process (Huang & Rust, 2021). According to Larivière et al. (2024), service offering should be designed according to customers' philosophical perspective in customer experience, and therefore, service offering can be divided into hedonic or utilitarian ethical theories. According to the hedonic ethics perspective, people appreciate experiences, but experiences do not have that much value in utilitarian ethical theory. Instead, performance is of higher priority in utilitarian theory, so these ethical theories are opposite to each other (Larivière et al., 2024). Finally, the

figure addresses which AI capability, mechanical AI, thinking AI, or feeling AI, is most suitable for each service type (Huang & Rust, 2021). Huang and Rust (2021) underline that some service process stages might require not only one type of but many different AI capabilities, and thus, Figure 5 acts only as an example scenario. The next sections give a detailed description of each service type and matching AI capabilities.

Standardized service

As Figure 5 presents, standardized service firms are most likely focusing on economies of scale or a low-cost service strategy that would benefit from mechanical AI, as customers value quick and straightforward service experience and do not expect personal service (Larivière et al., 2024; Schepers et al., 2022). In this case, the customer segment is likely to possess a utilitarian ethical perspective in customer experience as the service offering is transactional. The service process is likely to use automation, and mechanical AI is used in the service delivery stage of the process. Therefore, the service task is likely to be repetitive in nature and require minimal brainwork (Huang & Rust, 2018).

Personalized service

Thinking AI is between mechanical AI and feeling AI, and it matches with personalized service type (Huang & Rust, 2021). In this category, the service process focuses on customization and is likely to take place in the service creation stage of the process. Furthermore, service strategy aims for high quality, service task is data-based, and service offering is something between utilitarian and hedonic. According to Huang and Rust (2018), the nature of service that requires multiple kinds of knowledge and is not easily covered by AI, hence, it can benefit from human-technology cooperation. That makes personalized services, as well as the following relationalized services, potentially suitable for this kind of cooperation between AI and HI.

Relationalized service

In relationalized service, firms most likely have full services, and they need emotionally intelligent AI applications with feeling AI capabilities because customers are looking for

personal services that usually include complex, experience-focused services (Huang & Rust, 2021; Schepers et al., 2022). In this section, customer segment and, thus, service offering are most likely to follow hedonic ethics because customers value service experiences (Larivière et al., 2024). The AI required for this kind of experiential service needs to have highly advanced qualities as the service process focuses on personalization and engagement, and the service strategy concentrates on customer lifetime value and strong relationships. AI is deployed in the service interaction stage of the process. However, there is a big chance that AI is not capable of carrying out the relationalized service all by itself, because the technology is not advanced enough, and human intelligence might be needed to fully complete tasks requiring emotional intelligence (Huang & Rust, 2018; 2021).

Image 6 represents an example scenario of which AI capabilities, mechanical, thinking, or feeling AI, a service robot could use to carry out different tasks in the case of healthcare service. Accordingly, mechanical AI capabilities could help to perform housework or lifting tasks, thinking AI capabilities could evaluate customers' physical state, and feeling AI could provide therapeutic support (Kipnis et al., 2022).

Example task	AI capability
Housework, lifting	Mechanical AI
Evaluating physical state	Thinking AI
Therapeutic interaction	Feeling AI

Image 6. Example tasks that different AI capabilities could carry out (Kipnis et al., 2022, p. 679).

AI capability advancement and the related need for HI at different service levels

It is commonly argued that AI covers human employees in their jobs, which is somewhat true as AI is now capable of managing some human jobs or tasks (Huang & Rust, 2021). However, research says it is still a future scenario that AI is advanced enough to cover all or most complex human jobs that require empathetic skills (Huang & Rust, 2021). Consequently, as pointed out previously, at this point, AI manages or serves as an assistant to humans and is capable of doing lower intelligence tasks such as mechanical and

analytical tasks (Huang & Rust, 2018; Huang et al, 2019). Thus, it is important to know which service level AI can be helpful in order to draw a picture of how AI can support service development.

Figure 6 illustrates the ratio of AI advancement and the need for human intelligence (HI) versus AI at different service levels, adapted from the study of Huang and Rust (2021). It shows how AI at its different intelligence levels and HI are used in different types of services at the moment, and what the future scenario looks like. Accordingly, Huang and Rust (2021) highlight that the level of AI advancement and sophistication increases from mechanical AI, to thinking AI, and to feeling AI, feeling AI being the most advanced AI. Based on the future scenario, AI is used at all service levels as it becomes more developed than HI. Hence, the need for HI decreases, and AI is able to replace humans also at the empathetic task level (Huang and Rust, 2021). However, the scenario is only a vision of the future and not implemented at the moment as AI is not advanced enough and it is manly capable of managing analytical tasks at mechanical service level (Huang & Rust, 2021; Nordnet Suomi, 2025a, 15:00). Thus, at the moment HI is needed more to support complex services such as feeling and thinking services that require empathetic capabilities. Hence, feeling services are mostly carried out by HI because AI's feeling capabilities are not yet advanced enough (Huang & Rust, 2018 & 2021). Both Huang and Rust (2018) and Tuomas Sandholm (Sijoituskästi, 2025, 11:36) underline that AI will first replace human workers in analytical tasks, and thus, thinking AI has a strong position already now and in the near future.

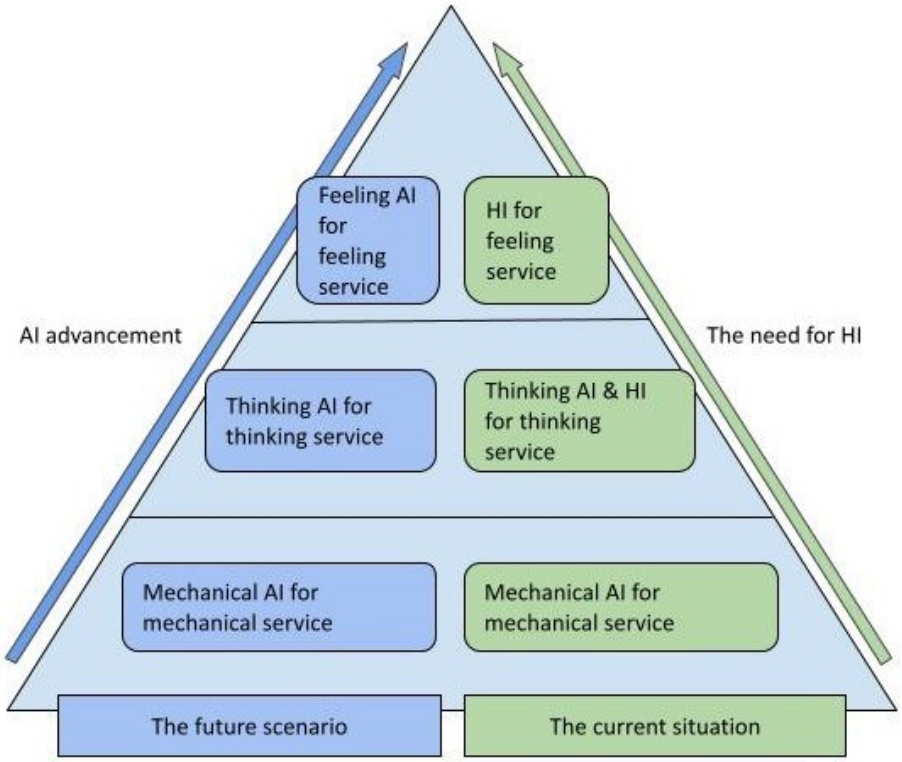

Figure 6. Future scenario and current state of advancing AI and the need for HI at different service levels (Huang & Rust, 2021, p. 34).

2.3.1 AI capabilities in the NSD process

The present research suggests that AI can support service development at different stages of the NSD process. The literature highlights that AI has the potential to support service development, particularly in service design, service delivery, and service interaction. Although service interaction is not named in the NSD process, it is clearly part of the process, because the service delivery as well as service interaction are thoroughly researched when designing services (Bitner et al, 2008). Furthermore, while AI's ability to support service development in service interaction is emphasized in literature, there is strong debate about whether or not AI can carry out emotional capabilities in service interaction. The following paragraphs examine how AI can support service development in its different stages.

AI capabilities in service design

Creativity

Ameen et al. (2024) highlight that AI can boost service development performance and creativity in service development that can lead to a competitive advantage when AI capabilities are combined with organizational agility. However, Ameen et al. (2024) emphasize that in order to get creativity gains, a company needs to possess specific AI capabilities or resources for them. Authors refer to tangible, human, and intangible resources defined by Mikalef and Gupta (2021), which were explained in detail in the AI capability chapter of this work. Furthermore, Ameen et al. (2024) note that government institutional support is an important facilitator to build AI capabilities to support service development and creativity.

Data insights

Kim et al. (2022) highlight that compared to humans, AI is invincible with its endless scope of memory, and it can be utilized in service development to improve services if customers are willing to provide data. However, customers might experience fear of revealing private data, which might limit the data availability and the type of data provided (Ameen et al., 2021; Kim et al., 2022). Nevertheless, AI's capability to store and process data can be used in service design to get customer insight that is used to learn customer needs and personalize services in order to improve customer experience (Ameen et al., 2021). Furthermore, Edelman and Abraham (2022) support this by judging that firms should build "intelligent experience engines" in order to be one step ahead of customers to exceed customer expectations and create a positive business outcome. The idea is to utilize AI and customer data to make the customer experience personalized from beginning to end (Edelman & Abraham, 2022).

AI capabilities in service delivery

Personalization and recommendations

Ameen et al. (2021) highlight the role of trust as a key factor in AI-based services in order to create a positive customer experience. They have found that an AI-based service

should be of high quality with tailor-made and easy-to-use features in order to build trust. Specifically, AI service should be personalized from its visible service delivery points, such as in customer touch points where the customer and service provider communicate, so that the technology is able to answer customers' individual needs (Ameen et al., 2021).

Furthermore, according to Aw et al. (2022), customers value that AI voice agents are capable of giving recommendations based on customers' historical data and hence help in decision-making. Similarly, according to Hou et al. (2024), AI can be helpful, for example, in the healthcare industry, as an AI assistant is capable of giving customized recommendations to customers with a specific problem. Therefore, the healthcare professional can get the relevant information more quickly, and service can be delivered more seamlessly and effectively. The AI technology behind recommendation capability is likely to be machine learning algorithms (Hou et al., 2024). According to Melton and Hartline (2010), service agents could also be beneficial at the launch stage of the NSD process, as they can act as promoters and influence customer perceptions. These judgments support the suggestion that AI's recommendation capability can be especially effective in service delivery, whether it directly helps with customer problems or assists service providers in problem-solving.

Efficiency

According to Rizomyliotis et al. (2022), firms can benefit from AI-powered chatbots as they can improve customer experience with their practical capabilities, such as helpfulness with analytical skills and tailored services that are available promptly around the clock. Thus, AI can be used to deliver service effectively, and when a firm gets efficiency benefits, it is able to economize by decreasing human working hours and putting AI to work. However, this will only happen when the AI capabilities are advanced enough to answer customers' needs at the same or greater level than a human representative (Rizomyliotis et al., 2022).

AI capabilities in service interaction

Empathy and anthropomorphic

Literature presents both benefits and limitations of AI's empathetic and anthropomorphic capabilities in a service context, and hence, it is important to explore both sides to find a fit in how these capabilities could possibly support service development. Accordingly, Juquelier et al. (2025) discovered in their research that AI technologies, such as chatbots that utilize affective computing, are advancing towards adapting empathetic skills. Their study shows that empathy in technology positively influences customer experience as customers feel more noticed and confidence grows (Juquelier et al., 2025). However, the same authors have noticed that chatbots' empathy may not always have positive effects on customers, for example, it has been noticed to decrease customer satisfaction rates in case of time pressure. Furthermore, Kim et al. (2022) express that the level of AI's empathy increases when AI has humanoid qualities, which, however, increases customers' perceived fear of societal evaluation. Hence, Kim et al. (2022) argue that customers prefer humans over AI when they want highly empathetic interaction and when they are looking for societal evaluation. This might be because humans do not trust technology as much as they trust other human beings. After all, people think that technology does not possess societal evaluation skills (Kim et al., 2022).

However, AI's limited societal evaluation skills can be used to advantage in service situations where social criticism is undesirable. In addition, understandably, AI is not currently perceived as being as trustworthy as humans, and sometimes, it is probably perceived as a threat, for example, to jobs. However, it should be noted that it is a matter of relatively new technology, or a technology that is visible to humans in new ways, and rapidly developing technology that is here to stay, and hence, people's perceptions and trust will presumably change and strengthen when people gain experience and learn that technology is part of everyday life. Consequently, Aw et al. (2022) underline that there is already evidence that AI can be considered trustworthy.

Furthermore, to support previous judgments about AI's limited capabilities in empathy, Kipnis et al.'s (2022) research findings reveal that AI cannot fully deliver emotional capabilities in the context of an AI service robot. Accordingly, their research emphasizes that where an AI-based service robot is able to deliver cognitive and behavioral empathy, boosting receivers' independence, AI is constrained to deliver deeper affective and moral empathy. Hence, authors suggest that HI is needed to support AI in delivering highly empathetic service occasions as AI capabilities are somehow limited in the category of feeling AI (Kipnis et al., 2022).

However, Schepers et al. (2022) highlight that thinking AI and feeling AI create the greatest positive impact on customer satisfaction in the case of a robot appliance in a service setting – customers are more willing to engage and consume more. Larivière et al. (2024) somehow support this as they argue that, in the case of a service robot, feeling AI is the most promising AI to create positive customer experiences if customers possess a hedonic or experience-oriented service goal, whereas thinking AI and mechanical AI are not likely to create a positive outcome in this case. Therefore, both authors, Larivière et al. (2024) and Schepers et al. (2022), judge that feeling AI in service robots can deliver positive service outcomes, which, however, according to Larivière et al. (2024), depends on whether customer value experiences or efficiency as a service goal.

Moreover, Chiang et al. (2022) have studied how service robots' anthropomorphic features affect customers' perception of the service. Their findings affirm that humanness advances the service attributes, but only when technology does not have too many human characteristics externally. Hence, authors argue that the service robots' humanity should not be shown in the design of the robot, but rather in the inner capabilities, at the level of intelligence and understanding, which increases humans' affection in the human-robot relationship. Likewise, Larivière et al. (2024) and Schepers et al. (2022) support this as they found that empathy in technology creates positive outcomes. Chiang et al. (2022) add that the level of service robots' anthropoid should be decided depending on the service type – whether the service requires emotional capabilities, it could

benefit from anthropoid features, and if the service focuses on operations, it might not benefit from anthropoid features. Hlee et al. (2023) discovered in their study that customers are more willing to use a service robot when technology has emotional as well as functional characteristics.

However, service robots' humanoid features are still at the early development stage, and service robots are not yet skilled enough to help service employees in complex tasks requiring higher emotionally complex intelligence levels (Hlee et al., 2023). However, AI is developing rapidly; for example, Aw et al. (2022) point out the positive effects of AI's human-like features as customers observe an AI agent's voice capabilities as trustworthy and that it will boost one-sided relationships.

According to Larivière et al. (2024), thinking AI might generate negative outcomes as customers might have a fear that a service robot is not capable of delivering the service promise, and the service is not delivered seamlessly enough. In turn, Aw et al. (2022) argue that AI's high level of intelligence does not guarantee a positive service outcome. For example, Schepers et al. (2022) acknowledge that overly judgmental AI robots' ability to dominate the service situation can generate negative customer feelings. Furthermore, Aw et al. (2022) state that a too-smart AI agent can hamper a one-sided customer-AI agent relationship. Similarly, Frank et al.'s (2023) findings highlight that too high AI self-government might weaken customer trust as it might not be in balance with firms' existing contribution. Ameen et al. (2021) support previous arguments by explaining that AI-based services can create negative effects on customer experience if customers feel they are missing the authority, privacy, or the feeling of getting a personal service. In addition, Kim et al.'s (2022) research results reveal that customers are more willing to concede sensitive data to AI that do not have authority and humanoid features to a large extent.

Based on these arguments, it seems important for the service provider to consider whether to use AI and to what extent in each service case individually, because there is a proven risk that AI cannot fully deliver emotional capabilities by itself, as the capability

seems to be somehow limited in terms of empathy. However, at the same time, based on studies, AIs' empathetic capabilities do exist at least at some level, and they are developing, and hence, they can support service development, especially in service delivery.

Practical user interface

Although the previous sections covered the positive effects of AI's empathetic capabilities, Rizomyliotis et al. (2022) underline that customers value AI chatbots' practical capabilities over pleasure qualities, meaning that it is more meaningful how seamlessly the software functions in practice and how well it solves customer problems, compared to its emotional capabilities. This is supported by Ameen et al. (2021) as they highlight that ease of use increases confidence customers have with new technology, and then, customers are more willing to use the technology.

Furthermore, Carter et al. (2020) emphasize that developers should focus on creating information technologies with features that make people feel they have control over the technology, because then people are more willing to use it. In practice, this could be done by building technology with an easy user interface with appropriate security features (Aw et al., 2022). This is further supported by Kipnis et al. (2022), highlighting that AI services should be built in a way that customers have the power to decide to what extent to use the AI, especially in the case of an AI robot. This could be especially useful and necessary in an early AI era when the AI is not advanced enough and cannot accomplish empathetic tasks all by itself, and human support is needed (Kipnis et al., 2022). Ameen et al. (2021) support this by suggesting that AI services should be backed up with additional help when necessary. Indeed, it would be irresponsible and unethical to cover human employees completely with technology if AI is unable to perform the task by itself, because then the company's service promise may not necessarily be fulfilled, as service quality may collapse.

Moreover, Rizomyliotis et al. (2022) note that developers should consider how to manage the transition phase when moving from a human agent to an AI agent in services, because technology functions very differently compared to humans. Thus, customer perception should be considered, and customers should be trained to use and receive service with a new service delivery system when AI delivers the service.

As AI capabilities advance and AI replaces some human labor, it has notable effects on different areas in the NSD process. First of all, in the NSD process, service delivery will change from human to AI, or it can be a mixture of both. Furthermore, when technology takes over human jobs, it changes which human skills are considered valuable that AI cannot master as well as humans (Huang & Rust, 2018). It seems that human empathy has become an important skill that is difficult for AI to mimic. Also, human services can be considered as a luxury service when AI becomes more popular in the service industry, and human employees become rarer. This is a potential scenario because in many service industries, for example, in the hotel business, human labor is one of the biggest expense items, and it is likely also to be the first expense that firms want to save on. Thus, the whole customer experience is about to change – AI is going to simplify the customer journey, for example, with AI agents that do the hotel booking and reservation as well as the check-in process for customers (E. Bogsnes & K. A. Fiskvik, Strawberry Hotels Winter Conference, January 11, 2026).

When looking at the near future, it is estimated that agentic AI is going to fundamentally change business processes. Accordingly, agentic AI is going to change how services are purchased, and thus, how services are found (K. Bär, Haaga-Helia Tulevaisuusfoorumi, March 31, 2026). Agentic AI is seen to carry out processes (K. Kettukari, Haaga-Helia Tulevaisuusfoorumi, March 31, 2026). For example, agentic AI will change the hotel booking process by carrying out the process from the beginning to the end (E. Bogsnes & K. A. Fiskvik, Strawberry Hotels Winter Conference, January 11, 2026). Therefore, from the service development perspective, new strategies for customer acquisition and service design are needed as services are going to be designed for AI agents. The future

question is how to make a service visible and how to optimize search engine findability when the AI agent is the buyer of the service.

2.4 Theoretical framework

The theoretical framework presented in Figure 7 illustrates the AI capabilities' supportive effect on the service development process based on the existing literature. According to the current research, there seems to be solid evidence that AI capabilities can support service development in its different phases. However, the phenomenon is not unambiguous. Although there is a connection found in how AI capabilities support services according to their unique nature by helping to engage with customers (Huang & Rust, 2018; 2021), the division of the AI capabilities is not entirely straightforward because there does not exist a settled definition for AI capability (Mikalef & Gupta, 2021; Sjödin et al., 2021).

Two frameworks were created because the literature does not give strong evidence on how AI capabilities could support service development, and hence, the aim is to fill this gap with the case company's data. The first framework (Figure 7) illustrates an example scenario of the framework based on the literature. The second framework (Figure 8) at the end of the chapter leaves the AI application section empty because the idea is to fill the gap with case company data. The frameworks are explained in detail below.

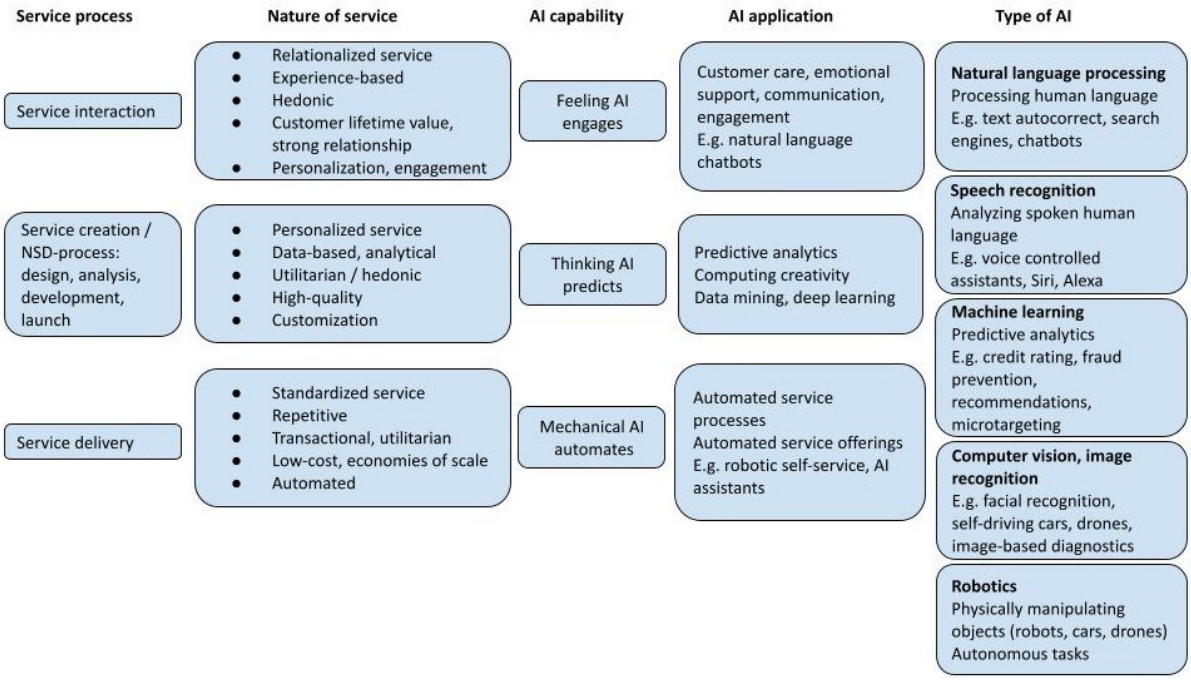

Figure 7. Theoretical framework example scenario: AI capabilities' supportive effects on service development (Huang & Rust, 2021, pp. 33-38; Jonson et al., 2000, p. 18; Sheik et al., 2023, pp. 49-59).

The framework aims to explain how different AI capabilities and their applications could support service development in different service settings and connect each AI type to this configuration. The framework is divided into five main sections: service process, nature of service, AI capability, AI application, and AI type. The first section is the service process, including service interaction, service creation or NSD process, and service delivery. Although Jonson et al. (2000, p. 18) divides traditional NSD process into four stages as discussed earlier in this work, this framework divides service development process after Huang and Rust (2021) three service process stages because the literature supports this approach when trying to find connection between AI's supportive factors towards service development – as discussed earlier, literature emphasize that AI has potential to support service development in service delivery, service creation and service interaction. However, the traditional NSD process model (Jonson et al., 2000, p. 18) has been added alongside the service creation section, because both seem to include similar tasks, but also because NSD is part of service creation (Huang & Rust, 2021).

The service process is followed by the nature of the service that clarifies the description of different service types, and which is then connected with the AI capability, because different AIs match different kinds of services with their unique service goals (Huang & Rust, 2018 & 2021; Huang et al., 2019). Starting from the bottom, the nature of the service is standardized, and the service is likely to have repetitive elements that can be automated. This kind of service is likely to be carried out by mechanical AI, especially in service delivery. This is followed by a service type that is personalized by its nature, and this is done through data-based methods and customization that can be done in service creation by utilizing AI capabilities. The last service type is a relationalized service that is likely to focus on experiences and strong personalization. Feeling AI can support this service at least at some level, but HI is probably needed to support AI in order to interact with customers at various service touchpoints (Huang and Rust, 2021). A more detailed description of the nature of service was given earlier in the section AI capability in service development. The last sections of the framework focus on AI: AI capability, AI applications, and AI type. AI capability is defined by Huang and Rust (2021), and AI types are named after Sheik et al. (2023, pp. 49-59). The next sections briefly explain AI types and give an example of how the framework's AI applications could be defined.

According to Huang and Rust (2021), mechanical AI is used to automate, for example, service processes and service offerings, where possible AI applications are payment and delivery automation, robotic self-service, and AI assistants. According to Sheik et al. (2023, pp. 57-58), robotics can combine capabilities from all AI types, and it can physically manipulate objects; hence, its capabilities can have a wide range of applications. However, Sheik et al. (2023, pp. 57-58) underline that robotics is mostly used in autonomous tasks such as automated logistics, and hence, robotics is a suitable AI type at least for mechanical AI. Furthermore, Sheik et al. (2023, pp. 52-54) highlight that computer vision is capable of recognizing images and can be used, for example, in facial recognition, self-driving vehicles, such as cars or drones, or image-based diagnostics.

Furthermore, Huang and Rust (2021) highlight that thinking AI is mainly for predictive tasks. It can be used for predictive analytics, computing creativity, data mining, and deep learning, especially for new service development and service personalization based on a huge amount of data (Huang & Rust, 2021). According to Sheik et al. (2023, pp. 49-52), machine learning is the AI behind predictive analytics, and functional applications include, for example, banks' credit control, fraud prevention, recommendation systems, and microtargeting.

Finally, Huang and Rust (2021) emphasize that feeling AI is the least advanced AI as it is used for customer engagement and customer care tasks that usually require emotional capabilities and communication that can be challenging for AI. According to the authors, feeling AI applications include, for example, natural language chatbots and speech recognition applications. Likewise, Sheik et al. (2023, pp. 55-57) highlight that speech recognition can be used to analyze spoken human language through different applications, such as voice-controlled smart AI assistants, such as Siri or Alexa, transcription, or audiobooks. According to Sheik et al. (2023, pp. 54-55), natural language processing is used to process human language, for example, in text auto-correction, translation, search engines, page rankings, or chatbots. It seems that transcription and audiobook cannot be considered as part of empathetic feeling AI capabilities, but perhaps an AI assistant can be considered to have some level of empathy.

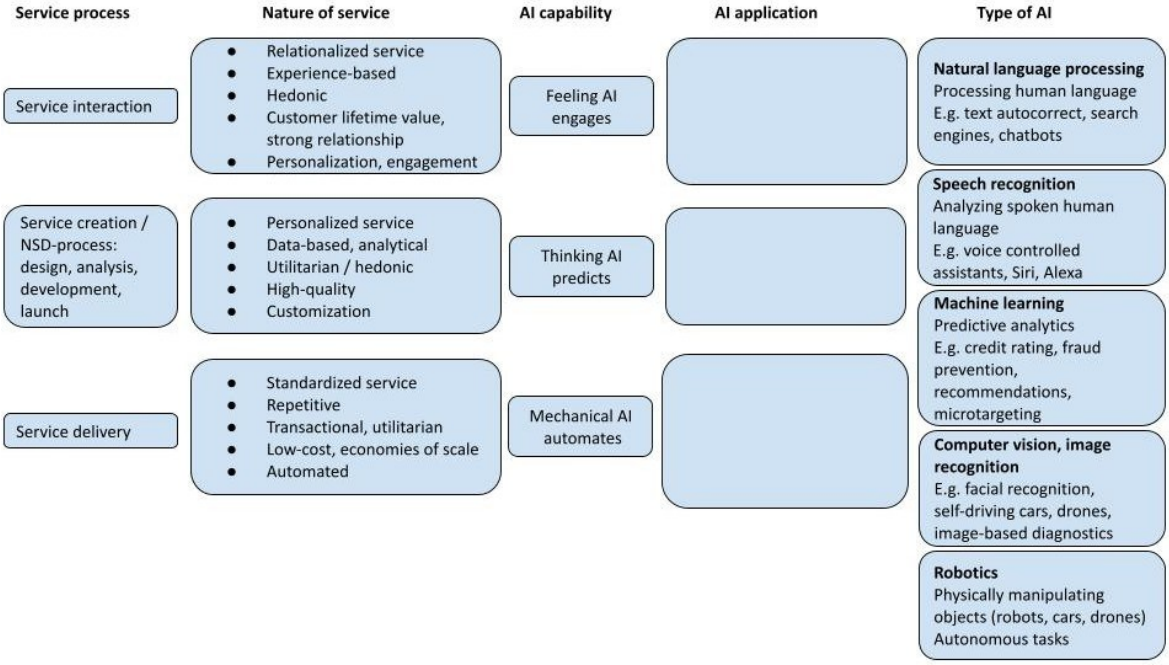

Figure 8. Theoretical framework: AI capabilities supportive effect on service development.

3 Methodology

This chapter aims to introduce the methodology used to carry out this thesis by explaining the research strategy and methods, case company selection, and data collection and analysis processes. The section presents the reasons why this specific research approach has been selected for this study.

3.1 Research strategy

Case study has been a popular research approach for a long time, especially in business research, because of its practical qualities (Eriksson & Kovalainen, 2016, p. 131). Eriksson and Kovalainen (2016, p. 131), as well as Eisenhardt (1989), use the term "research strategy" rather than "research method" from a case study because data analysis is flexible in terms of the methods used (Eriksson & Kovalainen, 2016, p. 131).

A case study is likely to be used as a research strategy when the subject of the study is a modern phenomenon and when various sources are used (Eriksson & Kovalainen, 2016, p. 131). The nature of the case study is likely to be qualitative (Eriksson & Kovalainen, 2016, p. 132), and the idea is to draw conclusions based on a comparison of theory and the empirical findings (Piekkari et al., 2009). One popular strategy is to form a theory from one or more cases by identifying patterns in or between cases (Eisenhardt & Graebner, 2007). In addition to studying the theory of service development and AI capabilities, this thesis tries to understand how AI capabilities and AI applications could potentially support service development. Thus, this research meets the criteria of the case study as the purpose is to find connections between theory and empirical research. Furthermore, since the present study examines a novel and theoretically complex phenomenon with no settled definition and selected case companies representing examples of the phenomenon, AI capability in service development, the selected research method is particularly suitable for this study through its rather novel nature.

A case study can focus on a single or multiple cases, depending on the research purpose (Fletcher et al., 2018) and a research question (Eriksson & Kovalainen, 2016, p. 136). A small sample size refers to a single case study, and the usual number of cases in a multiple case study is between four and ten, although there is no exact number of cases. Over ten cases are considered to generate too much data, and it can make data processing complicated, and less than four cases are seen as too little data because it can hamper theory building (Eisenhardt, 1989). Nonetheless, where a single case study focuses on getting acquainted with a deep understanding of a single event (Fletcher et al., 2018) and then creating complex theories (Eisenhardt & Graebner, 2007), a multiple case study relies on replication strategy where the theory is developed throughout analytical case comparison (Fletcher et al., 2018), and a finding can get stronger validation by repeating it between cases (Piekkari et al., 2009). Consequently, in the replication strategy, multiple cases are used to either verify or supplement the theory (Eisenhardt, 1989). Hence, the number of five cases selected to present research complies with the criteria of a multiple case study with a justified number of cases, and the study represents a qualitative multiple case study.

Eriksson and Kovalainen (2016, p. 133) highlight that the design of a case study can be either intensive or extensive, depending on the desired outcome. In an intensive case study design, a researcher explores one or a few cases in detail in a holistic way so that the aim is to understand the research subject profoundly throughout the cases (Eriksson & Kovalainen, 2016, pp. 133-135). In contrast, an extensive case study design focuses on exploring a specific event, and the objective is to create a theory that can be tested and generalized (Eriksson & Kovalainen, 2016, pp. 135-137). It seems that intensive case study design is more popular in single case studies, and extensive case study design is used more in multiple case studies. As stated, this research is premised on a multiple-case study of five multinational technology companies. Although this study has a slight characteristic of an intensive case study design through involving a qualitative approach and trying to understand the features of each case, this thesis emphasized more on an extensive design. This research aims to explore five cases and find patterns between

them. Furthermore, empirical findings are compared with the literature in order to confirm or potentially extend the current theory. The above-mentioned are indeed classic characteristics of an extensive case study design.

Moreover, a case study can follow an inductive or deductive case study logic (Eisenhardt & Graebner, 2007). The logics are different from each other, as the idea in inductive logic is to build the theory, and in deductive logic, the theory is tested (Eisenhardt & Graebner, 2007). As this research aims to possibly extend the theory of AI capabilities in service development, this study is more inductive than deductive in nature.

3.2 Case companies and the case selection

This multiple case study is based on five multinational technology companies. The case companies are Microsoft, Alphabet Inc. (Google), Amazon, IBM, and Alibaba Group. The case selection of this thesis relies on a theoretical sampling strategy. As the name "theoretical sampling" already implies, the logic behind the case selection is based on theory rather than statistics (Eisenhardt, 1989). This approach is opposite to a random sampling, as the cases are selected for a specific purpose; they are likely to replicate the existing theory because the aim is to fill the gaps in the theory or depict it (Eisenhardt, 1989). Consequently, these case companies have been carefully selected for this study to complement existing theory.

There are three main reasons behind the selection of the case companies. First, as the aim of this thesis is to study AI capabilities, all firms need to have a strong strategic focus on AI. Hence, some of the selected case companies are the world's leading companies in developing AI solutions with the most advanced AI capabilities, as they heavily invest in AI. Accordingly, AI Magazine has listed the top 10 companies based on their investment in AI, and consequently, at the top of the list is Microsoft, followed by AWS or Amazon.com, Alphabet, and IBM (Wheeler, 2025). Second, to make a comparison between the case companies, the selected companies' profiles differ from each other in terms of their age and, most importantly, in their AI solutions and the target use or industry. Third,

the selected companies are significant stock-listed companies with a lot of public data available, such as annual reports and press releases, which are essential in order to collect the data for the research. The two images below, Image 7 and Image 8, give a summary of the case companies and their AI offerings.

Company	Description	Country of origin	Founded in
Alibaba Group	A global technology company focscing on e-commerce and cloud computing	China	1999
Alphabet Inc. (Google)	A multinational technology conglomerate holding company offering products, platforms and services	USA	2015
Amazon.com, Inc.	A multinational technology company offering products and services, operating online platforms	USA	1994
IBM	A software-led platform company combining technology and expertise services	USA	1911
Microsoft	Multinational corporation and technology company creating AI solutions	USA	1975

Image 7. Overview of the case companies (Alibaba, 2025; Chen, 2023; EBSCO, 2025; GlobalData, 2025; IBM, n.d. -a; Microsoft, 2025a).

Company	AI focus area	AI products, services and solutions	Industry solutions
Alibaba Group	Cloud based AI and machine learning solutions	AI Open Services (Vision AI, Intelligent Speech, Natural Language Processing, Digital Marketing & Interactive AI), Data Intelligence & AI Platform (Data computing, data management, machine learning, data intelligence application and visualization)	Finance, education, transportation & new retail
Alphabet Inc. (Google)	AI and machine learning services	Generative AI, machine learning & MLOPs, speech, text & language APIs, image & video APIs, document & data APIs, AI assistance, conversational AI, AI infrastructure, consulting	For knowledge, creativity, productivity, students & experimenting
Amazon.com, Inc.	Generative AI services	Generative AI, agentic AI, machine learning, AI infrastructure, data foundation for AI	Customer service, employee productivity, creativity & content creation, process optimization
IBM	AI solutions for B2B	watsonx, assistants & agents, models, consulting, infrastructure, developers	Customer service, application modernization, human resources, marketing, finance, IT operations
Microsoft	AI-powered tools and platforms	Business AI products, consumer AI products	For organizations, personal use, industry, education, IT, developers

Image 8. Overview of case firms' AI offers (Alibaba Cloud, n.d. -a; Amazon, 2025; Amazon Web Services, 2025; Google, n.d. -b; Google Cloud, n.d.; IBM, n.d. -b; Microsoft, 2025b).

These five case companies are analyzed to find an answer to the research question of whether these case companies possibly show a demonstration of how AI and AI capabilities could support service development through AI applications. However, before moving on to the empirical part, the thesis continues with the data collection and analysis process explanation.

3.3 Data collection and analysis

3.3.1 Data collection

Case studies are acknowledged to be more valid and versatile if the research uses multiple different data sources (Eriksson & Kovalainen, 2016, p. 138). Empirical data for a case study can be collected, for example, through documents, archival records, media texts, personal diaries of organization members, digital material, or physical artifacts (Eriksson & Kovalainen, 2016, p. 139). The data for this study were collected from publicly available case companies' annual reports, press releases, and other online materials of case companies, such as company websites. As said, this thesis uses annual reports as documents, press releases as media texts, and company websites as digital material, and hence, this work fulfills the criteria of empirical data collected for the case study.

Furthermore, publicly available data sources add reliability to the research because the data is transparent - anyone can check the data validity (Beverland & Lindgreen, 2010). However, it is justifiable to consider the validation of the public data from the perspective of the initial purpose of the data publication (Eriksson and Kovalainen, 2016, p. 139), and also because the author of the annual report is usually a company, not an individual person. Consequently, it seems that a company publishes press releases to add visibility. In this case, when AI capabilities are under investigation, it is possible to check the validation of this information from secondary data sources. Hence, it is rather safe to evaluate that the information in annual reports is reliable and possesses high value. Thus, secondary data is purposefully included in this study.

As the aim of this research is to examine a complex phenomenon and try to figure out possible patterns across cases by using documents, one way to do so is to depict the event through quotes and summaries from documents, as demonstrated by Hyder and Eriksson (2005). This is an especially useful data collection method for a few cases (Beverland & Lindgreen, 2009). Consequently, this study uses quotes from annual reports of five case companies and evidence from other online material in order to understand the complicated event and find patterns between the cases. Accordingly, the data collection process consisted of searching and collecting all relevant quotes from each annual report relating to AI and AI capabilities in service development. The data from the annual reports has been collected from case companies' annual reports from 2018 to 2024, meaning that the research period is seven years.

This research follows Yin's (2009, p. 129) flexible data collection method consisting of four main stages. First, the data, in this case the relevant quotes, are collected and sorted, for example, into a table. Second, the main categories are recognized, and a matrix is created based on these main categories, and the data is sorted into the matrix. Accordingly, the quotes were sorted under relevant themes regarding AI capability. Appendix 1 presents this division of the quotes. Appendix 2 presents the supplementary research material that was used to define key themes from the data. Third, the main themes with their respective quotes were divided under the theoretical model of AI capabilities' possibility to support service development in chronological order, as recommended by Yin (2009, p. 129). At the fourth and final stage, the most content-rich and critical quotes were taken for further analysis.

The data collection process of this thesis was accelerated with the help of ChatGPT, an AI application (OpenAI, 2026), to screen the essential quotes from a large amount of text. This strategy was not used at the beginning of the data collection process because ChatGPT was not able to screen the quotes from the document. However, the AI application seemed to be developed during the process, as this was possible later. AI was utilized because it significantly sped up the data collection process, as the data was

collected from many annual reports. After the use of AI, the accuracy of the quotes was manually verified from the annual reports to prevent possible bias. This method also strengthened the creativity aspect suggested for the process (Yin, 2009, p. 129). Additionally, the researcher used Google Translate (Google, n.d. -a) and DeepL Translator (DeepL, n.d.) in the thesis writing process.

Moreover, Eisenhardt (1989) highlights the flexibility of data collection as a great advantage in case study research because the researcher has the opportunity, for example, to define the research question or modify the data collection target as the process progresses. However, flexibility and freedom come with responsibility. Accordingly, as the researcher herself carries out the data collection in this study, the researcher takes responsibility for which quotes are included in the study and how they are further analyzed. Thus, researchers need critical thinking and decision-making when interpreting empirical findings. Although the citations for the analysis were selected objectively and carefully, the trustworthiness of the data collection is still decreased due to the coincidental nature of the data collection. This means that some other author might end up with a different data set or quotes collected with the same data collection method — the data collection process followed by the data-analysis process, which is explained in the next section.

3.3.2 Data analysis

In order to strengthen the reliability of the study, it is essential that the researcher justify how the data analysis is carried out and what assumptions influence the analysis (Nowell et al., 2017). That is why the data analysis methods used in this study are explained in the next sections. The data analysis process of this research can be described as a close discourse of the insights from the theory and the data, which aims to clarify the benefits of AI in service development.

In a multiple case study, a researcher first uses a within-case analysis followed by a cross-case analysis to analyze the data (Eisenhardt, 1989; Eriksson & Kovalainen, 2016, p. 141).

The idea of a within-case analysis is to become thoroughly acquainted with cases by studying each case individually (Eriksson & Kovalainen, 2016, p. 141) and to find patterns within cases (Eisenhardt, 1989). The within-case analysis is an especially useful method for researchers when analyzing a large amount of data (Eisenhardt, 1989). The within-case analysis acts as preparation for a cross-case analysis - when the within-case analysis is done, it is followed by a cross-case analysis (Eisenhardt, 1989). As the name already signals, a cross-case analysis aims to carry out the analysis by comparing the data across cases with different techniques and to examine the data from multiple perspectives (Eisenhardt, 1989). The idea is to find possible differences and similarities by also contrasting the findings with the theory (Eriksson & Kovalainen, 2016, p. 141). There is a chance that with a cross-case analysis, a researcher makes some unexpected findings that allow building a theory (Eisenhardt, 1989). Accordingly, the present study uses this data analysis strategy by first analyzing data thoroughly within cases, followed by cross-case analysis.

Moreover, Yin (2009, p. 129) suggests taking a creative approach when analyzing data that is difficult to analyze by using a computerized tool. The data for this research represent the above-described data type because it is not numeric, and it is rather difficult for a computer to analyze this multidimensional phenomenon from text content. One option nowadays would be to use AI to analyze the data, but as it is a rather novel application and not completely reliable, this research relies on a manual data analysis process and uses a creative approach, as it seems that there are no perfect instructions or one way to analyze this kind of data. Eisenhardt (1989) supports this by stating that there is no one correct way to carry out a within-case analysis; the analysis strategy depends on the researcher.

A chronological order in analysis is suggested as an analysis approach when the research highlights events, actions, and processes, and in turn, a thematic order takes place when the research focuses on themes, problems, or theoretical classification (Eriksson & Kovalainen, 2016). The thematic order seems to be a more reasonable tactic to find

similarities and differences between cases. Consequently, Eriksson and Kovanen (2016) state that the thematic approach is useful when trying to find patterns between themes. The data analysis of this thesis aims to investigate specific themes rather than finding patterns over time or comparing the chronological development of the cases. The chronological order is not relevant for the desired outcome of the study, as this thesis does not investigate events. Hence, this study follows the thematic order in within-case analysis as well as in cross-case analysis.

4 Empirical findings

This chapter presents the findings of the primary research of five multinational technology companies while aiming to answer the research question of this study: *How does AI support service development?* The chapter is divided into two main subchapters: the first section presents a within-case analysis, analyzing each company individually. This is followed by a second section consisting of a cross-case analysis where case companies are compared with each other.

4.1 Within-case analyses and case descriptions

In order to give a comprehensive description of each case company individually, the most essential quotes are selected from annual reports and analyzed. The sections contain a detailed description of AI capabilities and their supportive possibilities toward service development. Along with the annual report quote analysis, the descriptions include findings from the secondary data, such as press releases, that support the primary data findings. The annual report, which is quoted with a categorization, can be found in the appendix of this thesis due to the large number of quotes. The order of the case companies follows the approximate level of AI investment of the company. The company with the highest approximate investment in AI is introduced first, and the presentation continues by introducing others in descending order.

4.1.1 Microsoft

Microsoft has helped companies to create AI-powered customer experiences with its AI tools since 2018, based on the company's annual reports. Their AI solutions help companies across industries and individuals. When exploring a company's AI capabilities and their possible supportive effect on service processes, five themes especially stand out in the reports: automation, productivity tools, cloud services, customer experience, creativity, collaboration, and innovation. The next sections explain how these AI-powered

tools or applications support service development and service process based on annual reports, press releases, and other secondary data sources.

Microsoft describes AI capabilities in its annual reports as follows: *"Artificial intelligence ('AI') capabilities are rapidly advancing, fueled by data and knowledge of the world"* (Microsoft, 2018, p. 9; 2019, p. 10; 2020, p. 10; 2021, p. 11; 2022, p. 11). The company highlights that AI capabilities power Microsoft Cloud, Azure, and the services they provide (Microsoft, 2023, pp. 10-11; 2024, p. 11) and generative AI capabilities (Microsoft, 2023, p. 10). The ones who utilize these services can benefit from technological development and enhance innovation (Microsoft, 2023, p. 10).

Productivity tools

According to Microsoft's annual reports, the company offers several AI-powered applications that aim to improve business productivity. The productivity tools are mainly divided into three main groups according to their user group: businesses, individuals, and developers. Applications include, for example, Dynamics 365 AI applications for achieving operational efficiency in business operations (Microsoft, 2024, p. 11), Microsoft 365 Copilot for reducing manual work, such as data entry or content creation for individuals (Microsoft, 2023, pp. 2-3), and Azure AI for improving developer productivity, for example, in AI application creation (Microsoft, 2024, p. 11).

Microsoft states on the company's official website that Microsoft 365 Copilot is an AI assistant for work to improve productivity in different departments, such as marketing, HR, sales, and IT. The company divides AI capabilities into Copilots based on different offerings, including Copilot Chat, Researcher, Analyst, Copilot Studio, and Copilot Dashboard. Microsoft 365 Copilot, combined with generative AI, improves productivity in daily routine tasks, such as writing and summarizing (Microsoft, 2024, p. 3). Microsoft 365 job-specific Copilots, such as Copilot for Service or Copilot for Sales, streamline business processes through insights and assistance (Microsoft, 2023, p. 2; 2024, p. 11). For

example, Microsoft Sales Copilot combines customer interactions and data, aiming to improve trading speed (Microsoft, 2023, p. 2).

Furthermore, Copilot or AI assistance has been embedded in Microsoft 365 applications, in Word, Excel, PowerPoint, OneDrive, Outlook, and SharePoint (Microsoft, 2026a). AI-powered Microsoft 365 offers AI capabilities for prediction, translation, and insights (Microsoft, 2019, p. 3). AI and data-powered Microsoft Graph and Microsoft 365 applications in Microsoft 365 Copilot help to improve productivity and creativity (Microsoft, 2023, p. 3).

Lamanna (2023) highlights that Microsoft Dynamics 365 Copilot consists of AI-powered applications that help to reduce repetitive work with AI capabilities. These applications are Dynamics 365 Sales and Viva Sales, Dynamics 365 Customer Service, Dynamics 365 Customer Insights, Dynamics 365 Marketing, Dynamics 365 Business Central, Microsoft Supply Chain Center, and Microsoft Dynamics 365 Supply Chain Management (Lamanna, 2023). The AI applications are connected to data, such as CRM, ERP, or other relevant data sources, such as company websites (Lamanna, 2023), in order to get insights (Microsoft, 2018, p. 2; 2024, p. 11). Applications are programmed to do manual work, such as writing meeting summaries, emails, responses to inquiries or chats, doing calculations, or helping with content creation, ideation, and predictions (Lamanna, 2023). Based on Microsoft's official website (Microsoft, 2026d), Dynamics 365 and its applications are used to improve customer engagement and automate business processes. The solution uses traditional AI for automation and predictive AI for forecasting (Microsoft, 2026c). Hence, Microsoft helps companies to perform more effectively by transforming their data into insights and by using generative AI capabilities through cloud services and tools (Althoff, 2023).

Moreover, in 2018, Microsoft Outlook Mobile offered AI-powered experiences that improved productivity and security (Microsoft, 2018, p. 2). Later in 2023, Windows 11 and Windows Copilot improved developer productivity with AI assistance (Microsoft, 2023,

p. 12), and the AI-powered Microsoft Edge browser, Bing search engine, and Bing Chat helped people to get relevant search results, create content, and browse efficiently (Microsoft, 2023, p. 12). In 2024, Microsoft Fabric, an AI-powered analytics platform with data and analytics tools, allowed organizations to be more productive by easily getting insights from data (Microsoft, 2024, p. 2 & 12). In 2022, Azure OpenAI Service was powered with coding and language models for writing assistance, code creation, and reasoning (Microsoft, 2022, p. 5). Between 2018 and 2021, Microsoft supported developers with Azure Machine Learning Studio for building machine learning models, and with Azure Machine Learning Workbench for more challenging AI-modeling (Microsoft, 2018, p. 11; 2019, p. 12; 2020, p. 12; 2021, p. 13). Microsoft Azure OpenAI Service's generative AI assistant helps employees in Taiwanese hospitals in daily routine tasks, such as writing reports, summarizing, or finding information (Yee, 2024), and the AI-powered Supply Chain Platform is used for prediction, for example, to predict disruptions (Microsoft, 2023, p. 2).

Microsoft offers several AI-powered tools that developers can use to create, automate, and analyze (Microsoft, 2023, p. 2). Microsoft's AI-powered tools for automation include Power Platform for workflow automation (Microsoft, 2023, p. 2), Copilot for workflow and process automation (Microsoft, 2024, p. 3), Copilot Studio for building autonomous AI-agents (Microsoft, 2024, p. 3), and Microsoft 365 for automation in Microsoft Teams, PowerPoint, Streams, and Outlook (Microsoft, 2019, p. 3). Some applications, for example, Power Platform and Copilot, are powered with generative AI (Microsoft, 2024, p. 3). Automation can assist with routine-type tasks by releasing people's time, and therefore, people can focus on more meaningful tasks. Example use cases of Microsoft's AI-powered automation include DAX Copilot, which automates manual documentation in healthcare (Microsoft, 2023, p. 3), and Azure Sentinel, which automates threat detection (Microsoft, 2020, p. 4).

Microsoft's AI-powered applications demonstrate how they can enhance creativity, collaboration, and innovation. For example, Microsoft 365 and its AI-powered tools in Office

365, Windows, and Enterprise Mobility + Security, enhance creativity, collaboration, and innovation in people's work (Microsoft, 2018, p. 10; 2019, p. 11; 2020, p. 11; 2021, p. 12; 2022, p. 12). In 2024, AI-powered Pages improved ideation and creative work and enhanced collaboration (Microsoft, 2024, p. 3). Microsoft has applied AI capabilities or copilots also to its Edge browser and Bing search. Accordingly, AI-powered Bing gives more accurate search results and answers, interactive chat helps with more detailed information, and the search can help to innovate and create content. Microsoft Edge browser offers similar AI capabilities as Bing, for example, chat and content creation features (Mehdi, 2023).

Cloud services as productivity tools

Microsoft's annual reports emphasize that AI is used to power cloud services, which are used to create AI-powered services. Hence, cloud services are an essential part of service development as they can support service creation. As a basis for application creation, Microsoft offers companies Microsoft Intelligent Data Platform, a ready-to-use infrastructure for building AI applications, bringing together databases, analytics, and governance (Microsoft, 2023, p. 2; 2024, p. 12).

Furthermore, Microsoft Azure AI is a cloud-based AI platform for companies to create AI services (Microsoft, 2020, pp. 11-12; 2021, p. 12; 2022, p. 21; 2023, p. 18). Azure AI offers developer productivity through insights and AI capabilities (Microsoft, 2018, p. 10; 2019, p. 11; 2021, p. 13; 2022, p. 13; 2023, p. 11). Azure AI can be used for code and content creation with foundation models (FMs) (Microsoft, 2023, p. 2) and for application building with machine learning (ML) capabilities and large language models (LLMs) (Microsoft, 2023, p. 18). Furthermore, Azure Machine Learning allows companies to build models effectively (Microsoft, 2020, p. 2), and Azure AI Studio offers tools for renewing workflows and integrating models with data (Microsoft, 2024, p. 12). In 2018, Azure enabled firms to achieve a competitive advantage by unlocking data insight with several Azure AI solutions, such as Azure Cognitive Services, Azure Machine Learning, and data services (Microsoft, 2018, pp. 3-4). In the same year, Microsoft announced that they built the

world's first AI supercomputer in Azure (Microsoft, 2018, pp. 3-4). In 2019 and 2020, Microsoft announced that "*Azure Cognitive Services is the most comprehensive portfolio of AI tools available*" (Microsoft, 2019, p. 2; 2020, p. 2). In 2019, Microsoft added new AI capabilities to Azure Machine Learning, including speech-to-text, search, vision, and decision-making, to streamline the development of machine learning models (Microsoft, 2019, p. 2).

Improving customer experience

One clear focus area in Microsoft's AI solutions is the aim of improving customer experience. According to Hoffman (2023), companies in the retail industry can improve customer experiences with Microsoft's AI, machine learning, and data-powered Customer Experience Platform. Precisely, AI allows a company to make personalized recommendations by offering predictions based on customer insights (Hoffman, 2023). Thus, the used AI is predictive (Microsoft, 2026c). Microsoft Customer Experience Platform is a cluster of applications including, for example, Dynamics 365 Customer Insights, Dynamics 365 Marketing, Dynamics 365 Sales, Dynamics 365 Customer Service, Dynamics 365 Commerce, Microsoft Advertising, Microsoft PromoteIQ, Microsoft Clarity, Microsoft Azure Synapse Analytics, and Microsoft Purview (Hoffman, 2023). Microsoft articulates in annual reports that Dynamics 365 AI applications can be used for transforming service functions (Microsoft, 2024, p. 3) and improving customer experiences (Microsoft, 2024, p. 11).

Another example can be found in the travel industry, as American Airlines uses Microsoft's AI solutions to streamline operations and improve travel experience and processes at the airports (Shainock, 2022). The company uses Microsoft Cloud and Azure, powered by AI, machine learning, and data analytics, to get relevant insights based on accurate data that can be used, for example, to minimize aircraft turn time at the airport (Shainock, 2022).

Furthermore, Microsoft's Azure OpenAI Service enables a voice-assisted booking process powered with generative AI (Agrawal, 2023). MakeMyTrip travel company uses AI capabilities in Azure OpenAI Service to summarize content and have discussions with customers in different languages. The company underlines that AI voice capabilities allow services to be available to a wider audience, including people with disabilities (Agrawal, 2023). Similarly, Mercedes-Benz has its own virtual assistant to deliver conversational AI capabilities through Azure OpenAI Service (Althoff, 2023).

Moreover, Microsoft's AI solutions are extensively used to enhance contact center processes. For example, Genesys, a contact center software, uses Azure AI solutions to personalize customer experiences with AI capabilities, cloud, and machine learning (Stetkiewicz, 2020). Technology gathers data from different customer interaction points and makes data-based suggestions that a contact center agent can offer as a solution to customers' problems (Stetkiewicz, 2020). Microsoft has listed specific generative AI capabilities in Dynamics 365 Contact Center to improve self-service, contact center agent work, and operational efficiency in customer channels (Comstock, 2024). Accordingly, generative AI-powered Copilot can, for example, improve self-service by providing a personalized conversation. It can also improve contact center agent productivity by providing sentiment analysis, translation, summary, transcription, and other automated routine tasks (Comstock, 2024). Consequently, time-saving, data-driven, and hassle-free solutions can improve customer experience.

Microsoft emphasizes on the company's official website (Microsoft, 2026b) that agentic AI in Microsoft Dynamics 365 Customer Service helps service organizations to streamline service processes by managing manual tasks for service representatives and developing long-lasting customer relationships on customer channels. Likewise, the company highlights in its annual report (Microsoft, 2023, p. 2) that Dynamics 365 Customer Service assists Copilot for service employees, and hence, more time is left for more meaningful work when the cases are closed faster. The solution offers AI capabilities for service representatives: Copilot helps to answer customer problems and solve them faster,

providing insights, identifying and assigning the problem to the right person with AI-based routing. The solution powers self-service with AI by solving customer problems with GenAI chatbots, GenAI-powered conversational interactive voice response (IVR), and by automating repetitive tasks and transactions. AI also improves service functions by providing AI-based insights, such as channel analytics and KPI's, identifying trends and development targets, automating processes, and predicting staffing levels. Hence, AI makes it easier for service providers to create personalized recommendations for customers based on insights (Microsoft, 2026b).

The study conducted by Forrester Consulting Total Economic Impact (TEI) examined the economic impact of Microsoft Dynamics 365 Customer Service in five companies, finding that it created 315% return on investment. This result was achieved with AI tools improving service agent productivity by automating tasks and manual searches, increasing call resolution time, and decreasing misrouted calls with automated call routings. Also, sales improved, resulting from customer and lead information integration, and because of terminating old service operators that became irrelevant (Chang, 2024). Thus, Microsoft Dynamics 365 Customer Service has the potential to create a positive economic impact on service organizations through productivity gains.

Conclusion

Microsoft's AI tools can improve service development in several stages of the process. For example, creative AI capabilities can help early service development stages, such as in the ideation stage. As AI applications offer predictive capabilities, they seem to offer companies an opportunity to forecast changing customer needs. Several AI applications can be used to create data-based insights that can be used to offer personalized recommendations. Thus, companies can design their services with recommendation capabilities in order to provide more personalized and unique customer experiences. This is also supported by the AI-powered conversation capabilities that can be added to services to make them more accessible. The company also highlights that the tools improve productivity through automating repetitive tasks, and hence, businesses can improve their

operational efficiency and focus on more meaningful tasks. Furthermore, Microsoft's AI services and cloud services offer capabilities for building AI agents and applications, and hence, they support AI-service creation, for example, when creating self-service by offering coding support for developers.

4.1.2 Amazon

Amazon invests in AI to offer services that aim to optimize operations, improve developer productivity, customer experience, and advance innovation in service delivery based on the company's annual reports and secondary data sources. Amazon acknowledges in its annual report the possibility of achieving cost savings when technology improves productivity and optimizes operations, such as customer service, workflow, and daily routine tasks (Amazon, 2024, p. 6). The next sections present evidence supporting the above-mentioned key themes.

Productivity tools

According to Amazon's annual reports, the company offers a comprehensive set of AI services, including ready-made tools and AI capabilities, which developers use for creating AI services such as AI agents that optimize operations (Amazon, 2023, p. 7; 2024, pp. 2-7). In 2023, Amazon divided AI services into three layers: the bottom, the middle, and the top layer. The bottom layer includes Amazon SageMaker, a service consisting of all the tools developers need to efficiently create their own foundation models (Amazon, 2023, p. 7). The middle layer consists of Amazon Bedrock, a service for developers to create generative AI applications from ready-made FMs (Amazon, 2023, pp. 7-8). The top layer is the GenAI application layer, consisting of ready-to-use applications Amazon offers to consumer businesses, such as AI shopping assistant Rufus, Alexa, and productivity tools for marketing, customer, and seller services (Amazon, 2023, p. 8).

In addition, Amazon offers Amazon Q, a work assistant that is capable of assisting in several tasks, such as code creation, answering questions, having conversations, and summarizing information (Amazon, 2023, p. 8). Amazon emphasizes that all three layers

create a basis for transforming virtual customer experiences and for creating new customer experiences (Amazon, 2023, p. 8; 2024, p. 6). Furthermore, in 2024, Amazon advanced its AI services for developers by improving GenAI-based Amazon SageMaker and Amazon Bedrock services, and by launching custom chip Trainium2, and adding new FMs in Amazon Nova (Amazon, 2024, p. 2). Hence, these developer tools aim to optimize operations in service creation.

Amazon introduces all its AI services and tools on the company's official website. Accordingly, Amazon Web Services (2025) is Amazon's cloud that gathers AI and cloud capabilities and services under the same cloud for building and innovation (Amazon Web Services, 2026c). Amazon highlights that AWS AI solutions advance innovation through improved customer experience, optimized operations, and creating new CXs (Amazon Web Services, 2026b). The company has listed tools and infrastructure for creating AI agents and apps, ready-to-use AI agents and apps, AI services, and other resources related to the AI service implementation (Amazon Web Services, 2026a). Amazon divides AI tools into five categories: agentic AI solutions, generative AI, and machine learning services, AI infrastructure, and data management tools (Amazon Web Services, 2026b).

Several use cases demonstrate that companies use Amazon's services to build AI applications aiming to upgrade customer experiences, innovation, and productivity. For example, customer service platform Zendesk improves its customer support services by creating generative AI applications with Amazon Bedrock (Amazon, 2024a). Likewise, Zilch, an ad-subsidized payments network, uses Amazon's AI and ML services, Amazon Bedrock and Amazon SageMaker, to provide better services and credit decisions by utilizing customer data (Amazon, 2024b). Accordingly, the company uses Amazon's AI-powered services to personalize wealth limits, detect fraud, and predict customers' intents (Amazon, 2024b). The company highlights that the AI solutions improve developer productivity by decreasing the development time, and they allow developers to add an increased amount of data into models (Amazon, 2024b). Hence, this probably leads to more precise results and higher service quality by simultaneously optimizing operations.

Furthermore, companies across industries use Amazon's services to create tools for automation to improve productivity in daily tasks. For example, FM's and GenAI capabilities in Amazon Bedrock are used for document processing, getting prompt answers quickly, and summarizing text (Amazon, 2024c). In addition, Amazon Titan Text Embeddings V2 in Bedrock can be used for data searching, chatbots, and recommendations, and Amazon Titan Image Generator can be used for image creation or edition (Amazon, 2024c). Meta Llama 3 FMs in Bedrock uses LLMs for text summarization, sentiment analysis, translation, and code generation (Amazon, 2024c). In addition, NinjaTech AI uses Amazon's ML chips, Trainium and Inferentia2, and Amazon SageMaker, to create AI agents that manage autonomous tasks, such as researching or organizing events (Amazon, 2024d).

As noted earlier, Amazon Bedrock is a popular service when building AI tools that improve business productivity by managing routine tasks with generative AI. For example, Rocket Mortgage, a retail mortgage lender company, created its own AI tool using GenAI capability that allows the tool to transcribe and summarize calls, analyze sentiment, and identify customer preferences (Amazon, 2024e). The solution bases its intelligence on a large amount of customer data, allowing it to offer predictive capabilities based on insights (Amazon, 2024e). In addition, Amazon offers the AWS HealthScribe service for developers to build clinical AI applications, powered by speech recognition and GenAI capabilities that help automate clinical documentation work (Amazon, 2023b). Powered by Amazon Bedrock, the service allows developers to add generative AI capabilities into the applications with ready-available ML infrastructure, and industry-specific LLMs (Amazon, 2023b).

Improving customer experience

According to Amazon (Amazon, 2023, p. 7; 2024, p. 6), generative AI is the key to creating an exceptional AI-powered customer experience. Amazon highlights that AI is slowly being applied to all processes, and it is getting smarter as it advances (Amazon, 2024, p. 6). Hence, a company needs to adapt the technical innovation and apply generative AI

capabilities to its processes and to customer experiences to take advantage of data if it aims to achieve a competitive advantage (Amazon, 2024, p. 6).

Amazon extensively provides tools and applications for developers to apply generative AI to applications to virtually transform customer experiences (Amazon, 2023, p. 8). In 2022, Amazon powered its services with machine learning, aiming to improve customer experiences, for example, by offering personalized recommendations in e-commerce (Amazon, 2022, p. 7). In the same year, the company applied large language models with learning capabilities as a basis for GenAI to transform customer experiences (Amazon, 2022, p. 7). Amazon emphasizes that the company itself powers its services and experiences with generative AI, including, for example, shopping, advertising, content streaming, and devices (Amazon, 2024, p. 7).

Many companies use Amazon's AI services to improve customer experiences in various fields. Examples of use cases include Yellow.ai, an AI company that improves customer experiences with conversational AI chatbots powered by LLMs (Amazon, 2023a). LLMs in Amazon SageMaker make conversations with AI agents personal and engaging through data-based answers with different languages, available around the clock on various channels (Amazon, 2023a). Additionally, the company uses Amazon Bedrock to build GenAI applications, such as AI agents, which are used to improve customer service with engaging conversations and better sales offerings (Amazon, 2023a). In turn, Brightcove, a streaming technology company, improves its customer support with Amazon's GenAI assistant, Amazon Q Business (Amazon, 2024f). The company has built its own AI assistant, which helps employees, for example, by suggesting solutions to specific customer problems by basing the answer on customer data (Amazon, 2024d).

Amazon offers companies extensive AI tools to improve contact center services. Contact center customer experiences can be improved through cloud-based Amazon Contact, a contact center that is powered by LLMs and FMs in Amazon Bedrock (Amazon, 2023c). The service aims to improve customer experiences by offering ML-powered GenAI

capabilities through sub-services. The capabilities include, for example, recommendations delivered through Amazon Q, contact center analytics, sentiment and trend analysis, and contact summaries by Amazon Connect Contact Lens. Furthermore, Amazon Lex in Amazon Connect offers contact centers change to develop AI self-services by offering tools to create chatbots and IVR systems (Amazon, 2023c). For example, Salesforce uses Amazon Connect to offer better customer experience and improve employee productivity through connected customer insights and automated GenAI-powered assistance (Amazon, 2023d).

Furthermore, a hospitality business company, Accor, has built a GenAI and ML-powered travel assistant by using services in Amazon Bedrock and SageMaker, aiming to improve customer experience and operational efficiency (Amazon, 2023e). The travel assistant is embedded into the company's booking engine, mimicking a real travel agent by offering customers help in the booking process, including data-based recommendations, guidance, inspiration, and a tailored travel plan (Amazon, 2023e). Also, Trip.com Group, another hospitality company, uses Amazon's GenAI capabilities and LLMs to build applications aiming to speed up the booking process, optimize hotel search, and flight ticket pricing by predicting demand (Amazon, 2023f).

Conclusion

Amazon's AI solutions highlight their potential to improve customer experiences, support AI service creation, provide developer tools, and advance innovation. Customer experience can be improved with AI by offering advanced, AI-powered services, for example, through personalized data-based recommendations and conversational self-service. However, the customer experience can also be improved by advancing the tools given to the service representative, for example, by using automated GenAI assistance that bases the answers on data insights. This can also lead to productivity benefits. Consequently, Amazon's AI offerings focus on developer tools that are used to create AI-powered services and assistants. These tools are AI-driven as they are built with several AI capabilities, for example, GenAI, FMs, LLMs, ML, predictive AI, and automation. Hence, Amazon's AI

services advance innovation and optimize operations by offering AI capabilities for building AI services, and the tools allow companies to reform their services.

4.1.3 Alphabet

Alphabet, a parent company of Google, offers AI products for businesses and individuals that are heavily equipped with AI, aiming to improve productivity and offer personalized customer and user experiences. The next sections explore how these themes and the related AI applications can support service development.

Productivity tools

Google Cloud offers businesses and developers AI solutions that can be used to improve operational efficiency and to create AI-powered applications (Alphabet, 2019, p. 2; 2020, p. 3; 2022, p. 1). Google Cloud Platform and Google Workspace give organizations access to AI infrastructure, AI platform, AI models, AI agents (Alphabet, 2023, p. 1), and AI applications (Alphabet, 2024, p. 1). Google's AI models, such as PaLM, Imagen, Phenaki, and Gemini, bring AI capabilities available for developers. For example, PaLM offers advanced reasoning capabilities (Alphabet, 2022, p. 1), and Gemini, formerly Bard, offers multimodal AI capabilities for image, text, audio, video, and code creation (Alphabet, 2023, p. 2; 2024, p. 1). Gemini offers support for image and code creation, and application adaptation (Alphabet, 2024, p. 2). In 2024, Google announced Gemini 2.5 Pro to be the most advanced AI model with high-level reasoning capabilities, powering several Google products (Alphabet, 2024, p. 1). In addition, Google's developer products include the Vertex AI platform, which is designed for developers to create AI applications with different AI models, and Duet AI for Google Cloud, which supports developers with AI agents powered with software operating capabilities (Alphabet, 2023, pp. 2-4). Google also offers developer tools for application development on Google AI on Android (Nugent, 2024).

In addition to AI-powered productivity tools for developers, Google Workspace aims to improve collaboration and productivity in people's work through AI-powered

applications, such as Gmail, Docs, Drive (Alphabet, 2019, p. 2; 2020, p. 3), and Duet AI (Alphabet, 2023, p. 2). In addition, Google AI on Android supports people to be more productive and creative in their work through, for example, the Gemini App on Android and Gemini on Gmail (Nugent, 2024).

Furthermore, Google's ML-powered advertising tools aim to improve advertising efficiency by helping to optimize campaigns and find the target audience (Alphabet, 2018, p. 3). For example, Google Ads offers features, such as Smart Bidding with predictive AI capabilities for demand prediction, and a large language model, MUM, is used to create enhanced search-offer matches with language interpret capabilities (Alphabet, 2022, p. 16). AI-powered Google's marketing tool, Performance Max, creates campaigns and publishes them according to the given rules (Alphabet, 2023, p. 2). Hence, campaigns can be personalized based on the given input (Srinivasan, 2024). It has also been found that the tool improves efficiency by decreasing the campaign creation time (Srinivasan, 2024).

Moreover, Product Studio is Google's AI-powered tool for content creation (Madrigal, 2024). The tool uses AI to create personalized images or videos based on given ideas (Madrigal, 2024). According to Google (Alphabet, 2023, p. 2) and Madrigal (2024), Product Studio is useful for advertising purposes to reduce marketing costs and improve efficiency. In addition, Google has added GenAI-powered features to Google Search and Ads, as retailers can integrate short videos into Ads, and use Virtual Try-On technology on Search, or create and add 3D image-spins to Ads (Madrigal, 2024).

Personalizing customer experiences

Alphabet has embedded AI capabilities into its products, especially Google products, to offer personalized user experiences. Several of Google's products are powered by machine learning, for example, recommendations on YouTube (Alphabet, 2018, p. 3; 2023, p. 3), translation on Google Translate (Alphabet, 2022, p. 1), automated text summarization on Google Docs, or automated image quality improvement on Google Meet

(Alphabet, 2022, p. 8). In addition, Google Assistant (Alphabet, 2019, p. 1), Google Photos (Alphabet, 2018, p. 3), and Google Lens (Alphabet, 2022, p. 1) are powered by ML. Google has applied GenAI capabilities, for example, to Search Generative Experiences, Gmail, and Bard (Alphabet, 2023, p. 3).

In addition to ML and GenAI-powered products, Alphabet has pointed out in the company's annual reports several Google products that aim to improve user experience through AI capabilities. Examples include automated data updates and predictive modeling for forecasting on Google Maps (Alphabet, 2022, p. 7), automated translation on Google Lens (Alphabet, 2022, p. 1), automated chapter creation on YouTube (Alphabet, 2022, p. 4), and AI-driven content creation on Dream Screen (Alphabet, 2023, p. 2). Therefore, Alphabet offers improved user experiences through AI-powered personalized services, creativity tools, and offering efficiency to those who use the above-mentioned Google products. Consequently, these AI products are examples of how AI can be used to improve service quality, and how Alphabet does so through its Google AI products Google. (n.d. -b).

Google offers personalized learning assistance with LearnLM, a group of generative AI models that are applied to different Google products to improve learning (Ibrahim & Manyika, 2024). Accordingly, AI capabilities aim to make learning personalized by offering tailored study guidance and the possibility to take quizzes or ask questions. Similarly, Gemini is applied to Med-Gemini to assist health care professionals in manual tasks, such as documentation, analysis, and prediction (Ibrahim & Manyika, 2024).

Furthermore, Google DeepMind is working on so-called "Project Astra", which aims to develop a universal AI agent that can help people in everyday life with advanced AI capabilities in perceiving, personalized reasoning, and conversing (Hassabis, 2024). This multimodal AI agent will be capable of seeing and talking, and hence can assist, for example, people with low vision (Google DeepMind, n.d.). Moreover, Google has partnered with Japanese telcos, KDDI, to build a virtual agent, Metako, to offer personalized and

improved service experiences (Andrés-Clavera & Okuyama, 2024). Metako is powered by ML to perform audio-driven facial signs, and by Gemini 1.0 Pro to have a database and understand conversations. Japan sees potential for virtual agents as future customer service agents due to an aging population (Andrés-Clavera & Okuyama, 2024).

Google has improved its search algorithms with ML by offering people multiple ways to make the search. Accordingly, search has improved with MUM and BERT LLMs as search can be carried out by voice, images, or questions (Alphabet, 2020, p. 2; 2023, p. 3). This kind of multisearch with multiple different inputs with different languages uses AI to recognize the intent behind the search (Alphabet, 2022, p. 1; 2023, p. 1). Furthermore, Google has brought AI Overviews to Search to offer searchers a summary with a link to the referred website. The idea is to provide information faster, and the results indicate that users are happy with the AI feature (Srinivasan, 2024).

Conclusion

Alphabet's Google products are embedded with AI as they aim to personalize customer experience for their users. This is mainly done through personalized recommendations, content creation, forecasts, and analysis. Google is creating AI agents with advanced reasoning, perceiving, and conversing skills, designed to offer personalized user experiences. Some of them are equipped with facial expression features. AI is used in Google products to automate tasks and improve search algorithms that improve user experience and productivity. Furthermore, Alphabet offers inclusive AI productivity tools that are equipped with multimodal and advanced AI capabilities. The tools are meant, for example, for developers for AI application creation, individuals for improving workflow and creativity, and advertisers for customer acquisition and content creation.

4.1.4 IBM

IBM describes the company in its annual report (2021, 1; 2024, 1) as follows: "*IBM is a software-led, fully integrated platform company*". IBM's strategy focuses on offering businesses solutions for data utilization through AI and hybrid cloud (IBM, 2024, p. 1).

Consequently, key themes in the company's annual reports related to AI's ability to support service development are AI's ability to improve productivity, support other businesses to implement AI, and support customer and employee experience.

Productivity tools

According to IBM's annual report (IBM, 2024, p. 33), businesses can financially benefit from IBM's AI products through productivity and automation advantages. The company highlights that productivity can be achieved by combining hybrid cloud and AI capabilities (IBM, 2024, p. 12). Automation as an AI capability is one way to apply AI to achieve business productivity (IBM, 2021, p. 11), for example, by using AI assistants or AI agents (IBM, 2024, p. 3). AI agents can manage time-consuming tasks, such as customer service, code creation, and reasoning (IBM, 2024, p. 2), and support businesses in service creation (IBM, 2018, p. 23; 2020, p. 2).

IBM emphasizes that its AI solutions, combining hybrid cloud and AI capabilities, help other businesses to transform virtually (IBM, 2024, p. 11) by implementing AI into their business processes (IBM, 2020, p. 2). However, these solutions do not stem only from AI capabilities, but rather from a cluster of capabilities also involving, for example, consulting and research organizations (IBM, 2024, p. 11). The digital transformation is enabled through two strategic platforms: Red Hat OpenShift for hybrid cloud, and watsonx for AI (IBM, 2023, p. 11). Data is used as a strategic resource in digital transformation (IBM, 2019, p. 30).

According to IBM's annual reports, IBM Software combines hybrid cloud and AI, offering companies capabilities for digital transformation, such as data-driven decision making and predictions, automation, application development, IBM infrastructure, and Red Hat hybrid cloud platform (IBM, 2022, p. 12; 2023, p. 12; 2024, p. 11). The company's official website emphasizes that IBM Software is built from tools that connect data, applications, agents, infrastructure, and clouds, aiming to decrease complexity and increase return on investment (IBM, n.d. -c).

Furthermore, IBM's AI platform, watsonx (IBM, 2023, p. 2), enables businesses to implement AI solutions (IBM, 2020, p. 2). The platform allows for managing AI models (IBM, 2023, p. 2), such as Granite AI models that can bring GenAI capabilities (IBM, 2024, p. 2). In turn, a hybrid cloud platform allows businesses to harness AI capabilities, for example, by creating AI-based data analysis capabilities (IBM, 2020, p. 55; 2024, p. 11). AI capabilities build readiness that is used to improve customer and employee experiences (IBM, 2024, p. 11), productivity, and drive insights and decision-making (IBM, 2022, p. 2).

IBM WatsonX consists of AI products aiming to improve productivity by adapting GenAI into people's work (IBM, n.d. -d). Businesses are using WatsonX for application creation (IBM, 2024, p. 2) and automation (IBM, 2023, p. 3) to improve productivity, develop code, and improve customer experience (IBM, 2023, p. 2). The idea is to streamline workflows with intelligent decisions based on data insights achieved with data, AI, and hybrid cloud (IBM, 2019, p. 30; 2021, p. 9). Together, data insights and automation can improve business productivity (IBM, 2022, p. 2).

Improving customer and employee experience

IBM's annual reports underline the ways and cases where AI is used to improve customer and employee experience. The core AI capabilities used to achieve these benefits are delivered through IBM's Watson technologies. Since 2018, IBM has offered businesses Watson Assistant to help employees answer customer problems and offer seamless customer experiences (IBM, 2018, pp. 2-9; 2020, p. 7). Already in 2018, the development of IBM Watson advanced to the point where technology alone managed customer care (IBM, 2018, pp. 2-3). In 2020, the company stated that it would continue AI development, aiming to create more capable AI with advanced reasoning skills (IBM, 2020, p. 24).

Examples include IBM Watson AI that offer digital customer service (IBM, 2018, pp. 3-4; 2019, p. 9) and helps service employees by replying to customer problems (IBM, 2018, pp. 2-3), and improved customer and employee experiences with IBM Watson Studio,

IBM Watson Machine Learning and IBM Cloud Pak for Data (IBM, 2020, p. 7). AI is also used to offer personalized pricing (IBM, 2019, p. 10), automated customer service (IBM, 2022, pp. 2-3), automated service delivery, for example in pension delivery (IBM, 2022, pp. 2-3), predictive weather forecast with Watson (IBM, 2018, p. 11), and creating customized marketing content by discovering customer insights with ML in IBM Watson (IBM, 2019, p. 13).

Together, IBM Consulting and IBM Garage are improving Riyadh Air's travel experience through an AI-powered check-in process and modernizing applications for customers as well as employees to deliver a seamless customer experience (IBM, 2024a). Also, IBM AI solutions are used by BPER Banca bank to improve digital banking experiences and advance innovation and productivity (IBM, 2022). This is achieved by using IBM Consulting and IBM Cloud for Financial Services for updating digital banking services and streamlining and automating services across multiple channels (IBM, 2022).

IBM also supports retail businesses to improve operations with AI from the customer and employee perspective (IBM, 2024b). Accordingly, automation is used to improve productivity in routine tasks and employee training, and GenAI helps employees to manage accounting (IBM, 2024b). AI and GenAI are used to make predictions from data to get insights that guide in updating the store selection, minimizing waste, creating recommendations, and hence, improving consumer experience (IBM, 2024c). In turn, employees can benefit from WatsonX Assistant, which is used to create a virtual assistant to guide them in their work (IBM, 2024c).

Conclusion

IBM's AI solutions focus on improving employee productivity and customer experience through AI-powered services and assistance, for example, through Watson. The AI solutions use different AI capabilities, including reasoning, automated tasks, such as service delivery, personalized pricing, content creation, and data-based predictions. Furthermore, IBM highlights that business productivity can be achieved by combining hybrid

cloud and AI capability, and that automation is a key AI capability used, for example, in AI agents. IBM delivers productivity benefits through WatsonX, offering tools for AI capability implementation, such as automation, data insights, and application creation. IBM Software is a total solution enabling firms' digital transformation through all necessary AI and cloud features.

4.1.5 Alibaba

Alibaba's strategic focus is on investing in AI capabilities as the company believes they are likely to improve operational efficiency in businesses (Alibaba, 2024, p. 21). Alibaba's AI solutions focus on improving the shopping experience in e-commerce. Hence, the following data analysis sections explain how AI improves the shopping experience in e-commerce and AI's impact on operational efficiency.

Productivity tools

Alibaba states in the company's annual reports that digital transformation enables businesses to achieve operational efficiency (Alibaba, 2023, p. 23; 2024, p. 21). Consequently, Alibaba underlines that its technological solutions are largely powered by AI, aiming to improve the organization's operational efficiency (Alibaba, 2021, p. 61; 2022, p. 72; 2023, p. 54). Operations are digitalized with AI, for example, by streamlining product categorization and product listings based on data insights, thus improving e-commerce quality (Alibaba, 2020, p. 43). In addition, Alibaba aims to improve sellers' productivity in e-commerce by offering an AI tool called Aidge (Utley, 2024d). The AI tool offers support, for example, by providing customer service and creating product catalogs (Utley, 2024d).

Alibaba's productivity platform, DingTalk, is used by organizations to streamline and digitalize workflows (Alibaba Group, n.d.). DingTalk allows businesses to access AI capabilities through its AI products and AI agents that are powered by Tongyi Qianwen LLMs (Alibaba, 2023, p. 50; 2024, p. 38). Alibaba states that it is investing in AI assistant development because AI agents are an essential part of future applications (Utley, 2024c). The company has launched a marketplace for AI agent trading and developed its own

multimodal AI agent, DingTalk AI Assistant, that is able to understand data in many formats (Utley, 2024c).

Furthermore, Alibaba Cloud facilitates the creation of customized AI applications by offering access to GenAI capabilities through Model Studio and Qwen LLMs (Yu, 2024). Furthermore, Alibaba's deep learning platform or ML-platform (Yu, 2024), PAI, gives access to a huge amount of consumer data, which is further used for commercial purposes (Alibaba, 2021, p. 61; 2022, p. 72; 2023, p. 54). AI-driven data insights give the company access to customer understanding and guide the company to match the offering with the customer's needs (Alibaba, 2020, p. 43). For example, LVMH Group uses PAI to create personalized services (Yu, 2024).

Improving customer experience

Alibaba improves its e-commerce business with AI by leveraging consumer insight to offer better search results and recommendations (Alibaba, 2020, p. 32; 2021, p. 27; 2022, p. 32; 2023, p. 26; 2024, p. 24). The company highlights in annual reports that as Alimama improves consumer experience by providing relevant content acquired through careful data utilization, it also improves sellers' productivity (Alibaba, 2021, p. 37; 2022, p. 50; 2023, p. 35). Therefore, the benefit is mutual for consumers and sellers. Also, Alibaba's business customers have noticed growing demand in e-commerce products after the integration of AI-powered recommendations and search features (Alibaba, 2020, p. 47), thus signaling positive effects.

Alibaba underlines that personalized consumer interactions are created by personalizing search results with interactive content powered by deep learning and data analytics, and with smart customer service powered by speech recognition, image, and video analysis (Alibaba, 2021, p. 61; 2022, p. 72; 2023, p. 54). Alibaba Cloud offers businesses AI-powered tools to improve e-commerce user experience through improved search and customer support (Alibaba Cloud, n.d. -b). Accordingly, search can be improved with an ML-

driven image search function, and customer support can be improved with a service robot or chatbot with an advanced self-service experience (Alibaba Cloud, n.d. -b).

Moreover, the company has improved consumer experience in e-commerce by integrating AI-powered virtual avatars into the company's e-commerce platform Tmall (Utley, 2024a). The avatars are chatbots that aim to assist in consumer decision-making by analyzing data and giving suggestions. Chatbots have the possibility to improve operational efficiencies as the system is able to learn, and it is designed to run around the clock (Utley, 2024a). Alibaba's AI shopping assistant, Taobao Wenwen, offers precise recommendations, product comparisons, and pricing analysis (Utley, 2024b). Alibaba's customers have access to customer care around the clock through an AI-powered chat robot that automatically resolves customer issues by using the huge amount of consumer and merchant data (Alibaba, 2021, p. 57; 2022, p. 68).

Further, Alibaba has introduced Tmall Genie, an AI-powered smart speaker, that connects consumers and service providers (Alibaba, 2019, pp. 84-85; 2020, p. 64; 2021, p. 61; 2022, p. 72; 2023, p. 54) assisting users, for example, to shop, make an order, search, control smart devices, and play content (Alibaba, 2018, p. 82). Genting SkyWorlds Theme Park uses Alibaba Cloud's AI-powered virtual queue solution based on real-time data. The aim is to control guests' waiting time and optimize capacity (Alibaba, 2023, p. 47), and hence, improve operational efficiency and customer experience.

Conclusion

Alibaba's AI capability solutions are mainly focusing on two themes: shopping experience improvement on e-commerce, and operational efficiency improvement. Alibaba improves its e-commerce shopping experiences through personalized recommendations based on data insights and improved search results based on deep learning capabilities. In addition, the company delivers various AI capabilities through its AI chatbots, which improve customer care and operational efficiency since they are able to work around the clock. Furthermore, Alibaba aims to improve operational efficiency and e-commerce

service quality by offering, for example, data-based recommendations, content creation, and AI agent-powered workflows.

4.2 Cross-case analysis

The focus of the previous chapter was on analyzing the findings of each case company individually. This cross-case analysis chapter aims to examine the differences and similarities of the case companies through a comparison in order to answer the research question: *How does AI support service development?* The focus is on AI capabilities, and the aim is to find possible evidence of how AI capabilities support service development through AI applications. Additionally, the case companies are compared and analyzed by reflecting on the literature.

The cross-case analysis consists of three main sections. The first section compares case companies' AI focus areas, aiming to discover recurring key themes that are also emphasized by the literature. The second section compares case companies' AI offering from a productivity tools perspective, and the third section compares them from the customer experience improvement perspective, these two being the two key themes discovered from the findings. The subjects of comparison are AI applications, objectives, AI capabilities, and AI types. The comparison focuses on comparing these themes and finding connections across cases, mostly confirming and slightly disagreeing with the validity of the literature. The comparison supports the literature, as the literature expresses the connection between AI capabilities, respected AI types, and AI applications. The idea of the analysis is to identify and compare the possible AI capability supporting use targets on service development and possibly discover a new perception of the supporting role of AI in service development. The last sections end the chapter with the key conclusions.

4.2.1 Comparison of case companies' AI focus areas

Image 9 below gives an overview of case companies' AI focus areas, and the recurring themes of the findings, considering potential benefits of AI capabilities and AI

applications for service development. The two main themes represent the purpose of the AI applications: productivity tools and customer experience improvement. Productivity tools are one category, because the case companies have targeted their AI investment in this area, and they aim to make AI capabilities available for others through these tools. This is supported by the literature, as Sheikh et al. (2023, p. 59) stress that AI applications can bring efficiency benefits through their AI capabilities.

Another recurring theme is customer experience improvement, meaning that the case companies' AI solutions function is to improve customer experience through AI capabilities. These two main themes recur in all case companies. Thus, they represent areas where AI capabilities can bring value. Although the main themes are mostly the same, some dissimilarities can be found when analyzing the main themes more precisely in the next sections.

Main themes of the case companies	Microsoft	Amazon	Alphabet	IBM	Alibaba
	Productivity tools	Productivity tools	Productivity tools	Productivity tools	Productivity tools
	Improving customer experience	Improving customer experience	Personalizing customer experience	Improving customer and employee experience	Improving customer experince (shopping experience in e-commerce)

Image 9. An overview of the case companies' main themes (Sources: company annual reports and secondary sources).

4.2.2 Comparison of case companies' AI applications, objectives, AI capabilities, and AI type in productivity tools

Image 10 below compares the case companies' main AI applications, their objective, AI capabilities, and AI types from the productivity tools perspective.

Theme: Productivity tools	Microsoft	Amazon	Alphabet	IBM	Alibaba
Main AI applications	Dynamics 365, Microsoft 365 Copilot, Azure AI	Amazon SageMaker, Amazon Bedrock, Amazon Q, AWS	Google Cloud Platform, Google Workspace, Vertex AI, Duet AI, AI models, Performance Max, Product Studio	watsonx, Red Hat OpenShift	DingTalk, DingTalk AI Assistant, Aidge, Alibaba Cloud, Model Studio
Objective	Automate business processes, streamlining workflows with AI assistance, AI app & AI service creation, creativity, innovation	AI app, AI agent & AI service creation, work assistance	AI app creation, AI agents, streamlining workflows, innovation, marketing assistance	AI app & service creation, AI model management, streamlining workflows, digital transformation, innovation	Digitalizing operations, streamlining workflows, AI app & service creation
AI capabilities	Automating tasks, insights, predictions, writing, responding, summarizing, translation, code creation, search, vision, speech-to-text, decision-making	Automating tasks, insights, predictions, content, code & image creation, translation, summarization, responding, recommendations, decision-making, sentiment analysis, speech recognition	Automating tasks, predictions, reasoning, content creation (text, audio, image, video, code), software operating, language interpretation, multimodal understanding	Automating tasks, data analysis & insights, prediction, code & content creation, responding, reasoning, decision-making	Automating tasks, content creation, data insights & data analysis, multimodal understanding
AI type	GenAI, ML, LLM, predictive AI	GenAI, ML, LLM, predictive AI, agentic AI	GenAI, ML, predictive AI	GenAI, predictive AI	GenAI, LLM

Image 10. An overview of case companies' main AI applications, objectives, AI capabilities, and AI type from the productivity tools perspective (Sources: Company annual reports and secondary sources).

Main AI Applications

As presented in Image 10 above, all case companies have unique AI applications representing companies' AI offerings that can bring productivity benefits. This means that the case companies do not have the same applications, but they have their own uniquely named AI applications. When comparing the AI application sections, it can be observed that all case companies have more than one main AI application. The number of main AI applications ranges from IBM's two to Alphabet's seven applications. However, these selected AI applications can also be components of AI applications. The wide selection of AI applications indicates that the case companies see the value AI can bring to productivity, as they want to invest in AI tool development. The case companies are willing to answer customer demand for AI by offering AI applications that put AI capabilities into practice.

These AI applications mostly represent software, which is a virtual form of AI (High-Level Expert Group on Artificial Intelligence, 2019). Hence, these productivity applications do not largely represent a physical form of AI. However, when examining the AI capabilities,

these AI applications can be used to create AI applications that can be a virtual or a physical form of AI, or a combination of hardware and software, such as a robot (Jansen & Kelkar, 2025).

Objective

When comparing the objectives of the main AI applications, the case companies seem to have similar objectives to the AI applications. Accordingly, improving workflow efficiency and AI application creation are repeated objectives in all cases. Some differences can be found as well, for example, IBM and Alibaba highlight digital transformation or operation digitalization as their AI application objective. However, this does not indicate a radical difference between cases, because probably all case companies aim for digital transformation with their AI offerings. Furthermore, as part of the workflow efficiency improvement, three companies have highlighted adjustments: business process automation and AI assistance in Microsoft, work assistance in Amazon, and an AI agent in Alphabet. Huang and Rust (2018) underline that automation can benefit the development of standardized service, especially in the service process and service delivery stages. Similarly, Johnson et al. (2000, pp. 17-18) highlight that technology is part of the service delivery system in NSD.

Furthermore, the case comparison reveals that Alphabet is the only case company underlying the marketing assistance objective of AI applications. Johnson et al. (2000, pp. 17-18) emphasize that marketing design is part of the development stage of the NSD process, and hence, AI assistance in marketing could improve the efficiency of marketing tasks. Additionally, IBM underlines AI model management as an objective.

Creativity and innovation

Microsoft is the only company that emphasizes the objective in the context of productivity. Ameen et al. (2024) underline that creativity can support service development and productivity if AI capabilities are combined with organizational agility. Hence, this refers to the company's readiness to adapt to a changing environment and new processes,

which indeed is important when harnessing new technologies. In addition, as the planning phase of the NSD process includes ideation (Johnson et al., 2000, pp. 17-18), it could possibly benefit from AI capabilities that support creativity, such as content creation capabilities that are discussed in the following section. Furthermore, Microsoft, Alphabet, and IBM all highlight innovation as an objective for AI applications in the productivity context. The literature emphasizes that service innovation is part of the service development process (Johnson et al., 2000, pp. 17-18; Jong & Vermeulen, 2003; Melton & Hartline, 2010; Wang et al., 2022; Yu & Sangiorgi, 2018). Johnson et al. (2000, pp. 22-24) underline that the service innovation can be profound, for instance, when a service is delivered with new technology.

Service creation

Interestingly, service creation seems to be an important objective for case companies' AI applications. Alphabet is the only case company that does not highlight service creation as a part of its productivity objective. This might be because it has not been specified for obvious reasons, as the service creation is probably part of application creation, because applications can be created for service purposes. According to the literature, service creation is a fundamental part of service development, or actually, service development is part of service creation (Huang & Rust, 2021). Service creation includes a customer process where customers' individual preferences are discovered (Edvardsson & Olsson, 1996). Similarly, Huang and Rust (2021) emphasize that service creation is a stage where the service process focuses on creating personalized, high-quality services. At the AI intelligence scale by Huang and Rust (2021), the service creation can benefit from using thinking AI and data-based insights. Therefore, data insight and predictive AI capability could be used to create personalized services.

AI capabilities

Automation

There are naturally many similarities in the case companies' AI capabilities, as the objectives of the AI applications are quite similar. Automation is one of the AI capabilities that

repeats across all case companies, and it is probably the most mentioned AI capability in the findings. When reflecting this finding with the literature, Huang and Rust (2018) stress that automation can be used in service processes and in service delivery to carry out transactional services, and that automation is part of the lowest AI intelligence level representing the mechanical AI category (Huang et al., 2019).

Data insights and predictions

Another common AI capability is data insights, repeating in every case except Alphabet. However, the findings and the literature both suggest that data is the underlying resource for AI solutions (IBM, 2019, p. 30), and, for example, predictions are made according to data insights (Sheik et al., 2023, pp. 49-50). Therefore, as Alphabet highlights predictions as its AI capabilities, it can be inferred that the company bases its predictions on data insights. Consequently, prediction is another AI capability repeated in all case companies except Alibaba. However, Alibaba's findings indicate that the company has a deep learning platform where customer data is used for commercial purposes (Alibaba, 2021, p. 61; 2022, p. 72; 2023, p. 54), and hence, one of the purposes for data is to predict with it. Additionally, the findings indicate that the company uses data, for example, when developing product categorizations (Alibaba, 2020, p. 43), which is probably a potential use target for predictions as well.

In the service development context, data, data insights, and predictions have an important role. Data can be used to create personalized services as it reveals valuable insights about customers' preferences. According to Huang and Rust's (2018 & 2021) framework, AI is not yet capable enough to deliver relationalized services when AI is deployed in the service interaction stage, and the service strategy focuses on customer lifetime value and strong relationships (Huang and Rust, 2018 & 2021). However, AI is used to create long-lasting customer relationships and personalized customer experience through data insight capabilities (Ameen et al., 2021; Edelman & Abraham, 2022), and hence, realizing the service strategy of relationalized service. The difference is that

the data insight capabilities are most likely used in the service design stage of the process (Ameen et al., 2021) rather than in service interaction.

Furthermore, in order for services to achieve high quality, profound data-based customer knowledge is a prerequisite for the service (Matintupa, 2020; Zeithaml et al., 2002). Therefore, AI-powered data insights utilized in service design can support relationalized service by offering personalization when the aim is to achieve a high-quality service outcome. Certainly, the offering of personalized service can occur in the service interaction phase.

Content creation

Surprisingly, all case companies highlight content creation as an AI capability. It can be inferred from the case companies that content creation can be done in many different ways. Although all five case companies acknowledge content creation as an AI capability, from all five case companies, Microsoft, Amazon, and Alphabet, among all five case companies, most emphasize content creation capability. Accordingly, Microsoft and Amazon have both named translation, responding, and summarizing as part of AI-based content creation, whereas Alphabet has named text, audio, image, and video generation as part of its content creation AI capabilities. In addition, Microsoft underlines writing, speech-to-text, and search as content creation AI capabilities, whereas Amazon underlines image and recommendation creation AI capabilities. All case companies except Alibaba highlight code creation as a content creation AI capability. Sheik et al. (2023, pp. 54-55) emphasize that these kinds of AI capabilities can use natural language processing. Nevertheless, content creation does not have a strong linkage to service development in the literature, but it seems to possibly offer support to service design and development phases in service creation through creativity, innovation, and productivity benefits.

Reasoning, decision-making, & data-analysis

Two case companies, Alphabet and IBM, highlight the reasoning capabilities of AI. AI HLEG (2019) associates reasoning with AI's operational capability. According to the

literature, reasoning is closely related to decision-making because it can act as a foundation for decision-making (AIBrilliance, 2024). Scrutinizing the findings, three case companies, Microsoft, Amazon, and IBM, underline AI's capability for decision-making, and two case companies, IBM and Alibaba, underline data-analysis capabilities. Consequently, the literature emphasizes that decision-making and data analysis are part of thinking AI, where the AI is capable of learning and processing data, and thus, the intelligence level is higher than in mechanical AI (Huang & Rust, 2018; Huang et al., 2019).

Additionally, Johnson et al. (2000, pp. 17-18) underline that analysis is part of the NSD planning phase, and consequently, AI could support NSD in data-analysis tasks. In addition to the planning phase, reasoning, decision-making, and data analysis could support any data-based tasks in service development, such as service design. AIBrilliance (2024) acknowledges that IBM Watson AI solution uses a hybrid system combining symbolic AI for reasoning and learning capabilities, thus clearly supporting the findings.

Multimodal capabilities

Furthermore, other AI capabilities that the findings reveal are multimodal understanding on Alphabet and Alibaba, speech recognition and sentiment analysis on Amazon, vision on Microsoft, and language interpretation on Alphabet. According to Sheikh et al. (2023, pp. 49-59), computer vision can be used to analyze visual data, natural language processing is used to understand human language, and speech recognition can understand spoken human language. Thus, most companies have AI capabilities that are likely to use these AI types after Sheikh et al. (2023, pp. 49-59). All case companies have at least some AI capabilities related to multimodal understanding, analysis, problem-solving, and decision-making. Therefore, AI is capable of delivering data-based capability reminiscent of cognitive skills. In the current research, multimodal AI capabilities do not have a straight connection to service development. However, it seems that these AI capabilities could support service development in phases where the understanding of different forms of customer behavior is useful, for example, in service design, or in service interaction by

making service more diverse in customer interface by understanding several kinds of inputs.

AI type

Not surprisingly, all case companies have GenAI as an AI type. When comparing the case companies' AI types, LLMs are used by Microsoft, Amazon, and Alibaba. Based on the literature, LLM is part of the GenAI category based on AI development, and thus, it is the most developed AI (Nordnet Suomi, 2025a). Hence, as all case companies use GenAI, it indicates strong expertise and trust in established AI.

Moreover, all case companies except Alibaba highlight predictive AI, and machine learning is mentioned by three case companies: Microsoft, Amazon, and Alphabet. Sheik et al. (2023, pp. 49-50) emphasize that machine learning is used for many purposes, for example, to analyze data, to make predictions, and to make decisions based on data. Hence, machine learning seems to act as a basis for some AI capabilities. Interestingly, when examining case companies' AI types and AI capabilities, they are not exactly aligned with the literature, as some AI types are missing in the case company findings. However, this does not mean that the case companies do not use these AI types, but rather, this indicates that this research does not focus on AI types, and hence, the research data is limited in this regard.

Surprisingly, Amazon is the only company mentioning agentic AI. Based on the literature, agentic AI is less developed than GenAI and as developed as physical AI (Nordnet Suomi, 2025a). Interestingly, the findings in the productivity tools do not emphasize physical AI, or the least developed AGI at all. This indicates that maybe the case companies have not yet adopted the least advanced AI into their AI products, or they have not reported it publicly, or information has not been available due to data limitations.

4.2.3 Comparison of case companies' AI applications, objectives, AI capabilities, and AI type in customer experience improvement

As noted earlier, the second main theme of the findings is customer experience improvement. Hence, Image 11 below presents the main AI applications, objectives, AI capabilities, and AI type in the context of customer experience improvement.

Theme: Improving customer experience	Microsoft	Amazon	Alphabet	IBM	Alibaba
Main AI applications	Dynamics 365 (Customer Service, Contact Center), Customer Experience Platform, Azure AI	Amazon SageMaker, Amazon Q, Amazon Connect, AWS	Google products (YouTube, Google Assistant, etc.), Project Astra (AI agent)	IBM Watson, Watson Assistant	Alibaba Cloud, virtual assistants & avatars, chatbots, Tmall Genie, PAI
Objective	AI assistance for service agents, voice assistant, chatbots, personalization, customer engagement, self-service, optimizing service operations	GenAI assistant for customer support, personalization, conversational chatbots, creating new CX, optimizing operations	AI assistance in Google products, personalization, text processing, predicting, improved search	Virtual AI agents for customer support, digital customer service, personalization, operational efficiency	AI assistance (in shopping), smart customer service, personalization, improved search
AI capabilities	Recommendations, predictions, data insights, conversational AI, task automation	Recommendations, learning, conversational AI, task & assistance automation	Recommendations, predictions, task automation, perceiving, reasoning, conversational AI, seeing, talking, audio-driven facial signs, multimodal understanding (search), content creation	Recommendations, data insights, predictions, reasoning, responding, service delivery automation	Recommendations, data insights, deep learning, data-analytics, speech recognition, image & video analysis, multimodal search, issue resolution automation, 24/7 operability
AI type	GenAI, ML, predictive AI, agentic AI	GenAI, ML, agentic AI, LLM	GenAI, ML, predictive AI, LLM, NLP	GenAI, ML, predictive AI	GenAI, ML, LLM

Image 11. An overview of case companies' main AI applications, objectives, AI capabilities, and AI type from a customer experience improvement perspective (Sources: Company annual reports and secondary sources).

Main AI applications

When comparing case companies' AI applications they use to improve customer experience, it can be observed that some applications recur in the previous section of productivity AI applications, but mostly the productivity applications are missing, and they are replaced with AI assistance-related applications. Consequently, the literature suggests that AI can act as an assistance for humans (Huang & Rust, 2018; Huang et al, 2019), and this is agreed by the empirical findings. Accordingly, three case companies, Alphabet, IBM, and Alibaba, have AI assistants as the main AI applications. In addition to AI assistants, the findings highlight that Microsoft has a couple of AI applications specifically for customer experience purposes. Accordingly, Microsoft's Customer Experience Platform,

Microsoft Dynamics 365 Customer Service, and Microsoft Dynamics 365 Contact Center indicate that the applications are made for a specific purpose, to support service operations from customer and service provider perspectives.

Additionally, Alibaba highlights the PAI deep learning platform that gives access to customer insights. This means that the case company sees value in customer experience improvement with AI since the company has put effort into designing AI applications for it. Nevertheless, all case companies have some of the same AI applications that were mentioned in the productivity theme. Hence, the same AI applications are able to bring various benefits. These AI applications seem to mainly represent software, but also hardware, since some AI applications focus on physical devices, such as Alibaba's Tmall Genie smart speaker (Alibaba, 2019-2023).

Objective

AI assistance, self-service, chatbots

As Image 11 above presents, all case companies unanimously emphasize AI agents, AI assistance, or chatbots as the objective of the AI applications in the CX improvement context. As can be inferred from the AI applications, an AI assistant can support service delivery by offering assistance for service representatives and for customers. Three case companies, Microsoft, Amazon, and IBM, offer an AI assistant for customer agents to support service delivery. The same case companies offer an AI assistant for customers through digital customer service, such as chatbots, thus supporting service interaction. Hence, the empirical findings, as well as the literature (Hou et al., 2024), suggest that AI assistance has mutual benefits for service employees and customers in service delivery. The findings as well as the literature highlight that as the AI capabilities brought by AI assistants aim to improve customer experience, it also creates efficiency benefits. This is why the main themes of the findings, CX improvement and productivity tools, have many similarities and repeating features. Furthermore, Alphabet has embedded AI assistant capabilities into its products, and Alibaba highlights the AI assistance capabilities in e-commerce by offering shopping assistance.

Interestingly, Microsoft is the only company highlighting self-service in its objectives. According to Microsoft, self-service can be realized in the form of a chatbot, and they are likely to be used in transactions and automated tasks (Microsoft, 2026). Additionally, Amazon uses chatbots, and Alibaba underlines virtual avatars and shopping assistance. Hence, AI self-service or chatbots are likely to be used to deliver service and to interact with customers, but could also be used in other service development stages, for example, in service creation. The literature acknowledges that chatbots can solve customer problems (Bolton et al., 2018) and offer efficiency benefits through their limitless operability (Rizomyliotis et al., 2022). Hence, self-service and chatbots can be used to optimize service operations as they release time from employees.

Personalization

Another repeating objective among all case companies is personalization. The literature strongly supports this. For example, Huang and Rust (2021) emphasize that data insights can be used to learn customer needs and help businesses to design personalized services that can support customer engagement.

AI capabilities

Data insights, recommendations, predictions

Not surprisingly, recommendations are underlined in all case companies. Based on the literature, AI provides data insights that are used to create personalized recommendations (Ameen et al., 2021; Edelman & Abraham, 2022). Although only three out of five case companies (Microsoft, IBM, and Alibaba) highlight data insight capability, the other two companies are probably using AI's data insight capabilities as well, since they underline recommendation capability.

Furthermore, Alibaba is the only company that has deep learning and data analytics mentioned in its AI capabilities. This indicates the company's aim to learn customers' preferences and offer personalized services. Ameen et al. (2021) emphasize that the high

service quality in AI requires personalization in the service delivery phase, where communication between the service provider and customer happens. Therefore, AI's ability to offer personalized recommendations through data insights can support service development in service delivery and service interaction. The findings of all five case companies, as well as the literature, suggest that personalization can also be done with AI predictions. Accordingly, Huang and Rust (2021) emphasize that personalization is created with thinking AI by learning customer preferences from data by using predictive analytics and machine learning (Sheik et al., 2023, pp. 49-52).

Automation

Automation is repeating AI capabilities across all case companies used for many purposes. Microsoft, Amazon, and Alphabet use automation to provide efficiency benefits for employees by automating tasks, releasing employees' time for more meaningful things. According to Microsoft (Microsoft, 2026), self-service and chatbots are likely to be automated. IBM uses automation for service delivery, and Alibaba for issue resolution. Hence, automation is a versatile capability for different service operations. As noted earlier in this analysis, automation is also highlighted in literature, for example, by Huang and Rust (2021), stressing that it is a mechanical capability, and it is suggested to be used in service processes and service delivery, specifically for transactional service offering (Huang & Rust, 2018).

Limitless operability

Both the findings and the literature emphasize AI's ability to provide the service around the clock. Accordingly, Alibaba highlights that AI capabilities delivered by AI assistants or chatbots offer limitless operability around the clock. Amazon underlines that AI assistance uses automation, and consequently, it seems reasonable that limitless operability is achieved by automation. Rizomyliotis et al. (2022) support the findings by stating that AI offers efficiency benefits as the AI chatbot is able to serve around the clock, thus improving the service delivery performance. However, Rizomyliotis et al. (2022) highlight that AI's operability is not limitless regarding AI capabilities because AI's capabilities are

limited. Accordingly, the current AI is mainly able to manage analytical and mechanical tasks (Huang & Rust, 2021; Nordnet Suomi, 2025a, 15:00), and it is not fully capable of delivering empathetic capabilities (Huang & Rust, 2021).

Multimodal capabilities

As noted in the previous section, two out of five case companies, Alphabet and Alibaba, have powered search with AI's multimodal search capabilities to improve customer experience in search. Multimodal search or understanding means that the search can be done with many kinds of inputs, for example, with an image or voice (Alphabet, 2023 & 2024). This allows the search or service to be accessible to a wider audience. Alphabet and Alibaba have embedded multimodal AI capabilities into their other products and services as well to improve customer experience.

Furthermore, three case companies (Microsoft, Amazon, and Alphabet) underline conversational AI capability, or AI's ability to understand and respond with natural language. Hence, conversational AI seems to have the potential to support service interaction. However, this finding is somewhat contradictory to the current research, as Huang et al. (2019) judge that conversational AI is part of feeling AI, which is the most undeveloped AI with empathetic and responsive capabilities. According to Huang and Rust (2018), feeling AI is mostly carried out by humans, because AI does not have similar empathetic capabilities. However, as three out of five case companies (Microsoft, Amazon, and Alphabet) present, conversational AI is used in their AI applications, and hence, part of their AI capabilities. Since Huang and Rust's framework is from 2019, the research findings are probably outdated to some extent, because AI has developed rapidly. Therefore, AI nowadays possesses some feeling AI capabilities, such as conversational AI, although it is probably not able to deliver fully empathetic skills.

Moreover, Alibaba underlines speech recognition, image and video analysis, where, according to the literature, image and video processing are delivered by computer vision (Sheikh et al., 2023, p. 49). In addition, Alphabet emphasizes perceiving, reasoning,

seeing, talking, audio-visual facial signs, and content creation. Hence, AI is capable of identifying, understanding, and creating outputs from inputs in various formats, thus making it multimodal.

Interestingly, the findings do not mention AI's possible empathetic capabilities, while the current research profoundly discusses the topic. It has been studied that AI's empathy could have both positive and negative effects on customer experiences (Juquelier et al., 2025; Kim et al., 2022). Accordingly, feeling AI or empathetic AI can generate positive customer outcomes, but it depends on the service goal or the customer's aim regarding the service (Larivière et al., 2024). Thus, it requires case-by-case consideration whether to use empathetic AI in service interactions or not.

AI type

When comparing AI types across CX improvement and productivity tool themes, mostly the same AI types repeat across the case companies. Accordingly, GenAI and ML are repeating the AI type in all cases of companies. As the literature highlights, GenAI is the most developed AI (Nordnet Suomi, 2025a), and thus, it indicates that the case companies are investing in the most advanced AI. Naturally, the second most popular predictive AI is used by three case companies: Microsoft, Alphabet, and IBM. LLM is repeating in three case companies: Amazon, Alphabet, and Alibaba. Additionally, Alphabet highlights the use of natural language processing (NLP). However, it seems that Microsoft and Amazon use NLP since, according to Sheikh et al. (2023, p. 49), NLP is used to create conversational AI.

Interestingly, two case companies, Microsoft and Amazon, mention agentic AI in their AI types. When compared to the productivity findings where agentic AI was only mentioned on Amazon, this demonstrates that agentic AI is more popular among CX improvement than productivity tools. The empirical findings are aligned with the literature, as the literature emphasizes that the agentic AI is more developed than GenAI (Nordnet Suomi, 2025a), and agentic AI is only mentioned in two case companies, meaning that it

is less advanced AI that has not been broadly adopted. However, the research data of this thesis is limited to the year 2024, and AI has supposedly advanced a lot since then. Anyhow, it is not surprising that, for example, AGI is not presented among these case companies since it represents the least advanced AI (Nordnet Suomi, 2025a). Nevertheless, AGI is possibly reaching human capabilities in the future, and hence, it is likely to offer the same or higher capabilities than humans (Morris et al, 2025).

4.3 Summary of the findings

The purpose of the previous cross-case analysis is to compare and examine AI capabilities and AI applications' supportive effect on service development across the case companies. The analysis discusses empirical findings from the current research that has been studied in the literature review. Figure 9 at the end of this section presents the conclusion created from the analysis and discussion, and the key findings of this thesis.

Although some differences across the selected multinational technology companies emerged in the analysis, the study revealed many similarities. Hence, the findings of this study might recur in other technology companies with regard to AI applications, the AI capabilities, and the benefits they bring to service development. Specifically, the benefits related to the improvement of productivity and customer experience through AI capabilities and AI applications are quite similar across all case companies. Several references regarding the possible benefits of AI capabilities in service development were raised in the literature review, which also emerged in the empirical analysis. The mutual benefits result from AI’s capability to automate and provide data insights, predictions, and recommendations.

Furthermore, both the current literature and the findings of this thesis highlight the connection between AI capabilities and service development. AI’s automation capability is seen to bring efficiency benefits by its unlimited ability to operate around the clock. Automation is seen to be particularly beneficial in service delivery, for example, in self-service and chatbots, but also seems to support the entire service process. Similarly, AI-

based data insights and predictions seem to support service development in its several stages. From a productivity-benefit perspective, data insights and predictions can optimize operations and, hence, support service development in service design and service creation. On the other hand, data insights and predictions can be used to improve customer experience through personalized recommendations, and hence, they support service delivery and service interaction stages of the service process.

In addition to these previously mentioned AI capabilities and their supportive effects on service development, a few more AI capabilities were found to be beneficial in service development. Accordingly, AI's content creation capability seems to bring creativity, innovation, and productivity benefits, and hence, they can support service development in service creation, planning, and development stages of the NSD process. AI-powered reasoning, decision-making, and data analysis seem to support the analysis and service design stages of the service development. Finally, multimodal AI capabilities offer a diverse understanding that can support service design and service interaction.

Interestingly, although they disagreed in the former research, the empirical findings of this research provide novel insights by suggesting that AI is capable of responding to relationalized service types. This refers to AI capabilities that can support responding to the characteristics of relationalized service in service interaction. There are two AI capabilities found that can deliver the so-called "feeling AI" capability. The first AI capability is personalization, because AI is highly capable of analyzing huge amounts of data, creating data insights and predictions that are used to create personalized service offerings and engage with customers. The second AI capability is conversational AI, AI's ability to understand and respond with natural language. Therefore, these findings provide novel insights by first suggesting that AI capabilities can deliver empathetic skills and second, suggesting that these capabilities can support the service process in the service interaction phase.

Moreover, besides examining AI capabilities' supportive effect on different stages of service development, this study investigated the relationship between AI applications, AI types, and AI capabilities. The prior research identifies two main types of AI applications: software and hardware, and a combination of these two. However, the prior research does not draw a connection between AI applications and AI capabilities. Thus, this thesis offers another novel insight by suggesting that AI applications that aim for productivity benefits are mainly software-based applications for developers, employees, and individuals. In turn, AI applications that aim for customer experience improvement are mostly software-based applications for employees and individuals, highlighting AI assistance. A couple of case companies (Microsoft and Alibaba) have a few applications specifically for improving customer experience. CX improvement applications also include hardware-based applications due to physical AI devices. Therefore, both software and hardware-based AI applications can be used to support service development.

The third and final novel insight this study offers relates to AI types. The prior research identifies AI types and related AI capabilities, but does not connect them with service development. In both productivity and CX improvement contexts, the empirical findings highlight generative AI, machine learning, and predictive AI being the most used AIs. In addition, AI applications used for customer experience improvement seem to use natural language processing. Agentic AI is only used by Microsoft and Amazon, and in any case, the company does not mention AGI. Therefore, yet another key finding is that service development is supported by traditional AI, being the most popular AI, and agentic AI, which is becoming more popular. AGI is not yet in use but is likely to be the AI of the future. To summarize, Figure 9 depicts the supporting impact of AI capability and AI application on the service process.

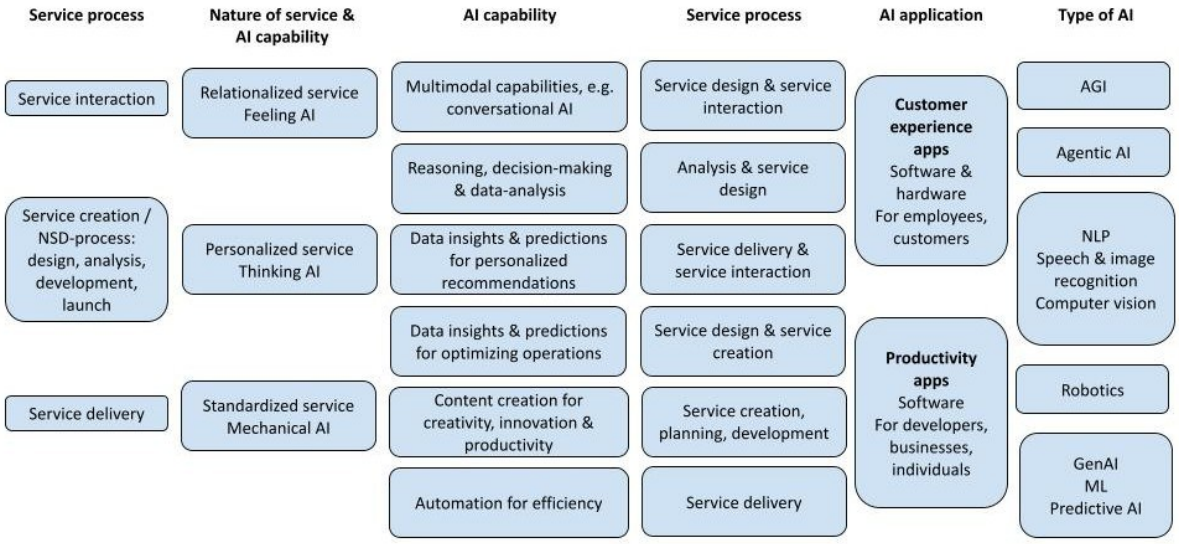

Figure 9. AI capabilities' and AI applications support in the service process.

5 Discussion

This chapter starts by presenting theoretical and managerial implications. The next section gives suggestions for future research. The chapter ends by expressing the limitations of the study.

5.1 Theoretical implications

This thesis provides many theoretical implications. Firstly, the findings of the multiple case study analysis contradict the existing theory by judging that the current AI capabilities are not limited to only carrying out analytical and mechanical tasks to support the service process. Therefore, the empirical findings of this thesis suggest that AI is already capable of carrying out tasks requiring some level of empathy. Precisely, responsiveness created by conversational AI and precise data-based personalization are both used to generate characteristics of relationalized service. The current research argues that AI capabilities are not yet advanced enough to deliver “feeling AI” capability, and hence, AI is not able to support service processes alone without human intervention, as a higher level of AI intelligence is needed to respond to relationalized service types. This thesis offers new empirical insights by suggesting that AI’s conversational and personalization capabilities can be adapted into the service interaction stage of the service process to match the characteristics of the relationalized service type, and thus, to support the service process.

Secondly, when it comes to the AI capabilities supportive impact towards service development, the empirical findings are in line with the literature by arguing that the supportive factors stem from productivity and customer experience improvement. Furthermore, current literature as well as empirical findings highlight that AI-powered automation, data insights, predictions, and recommendations support service development in different stages. Another research insight of this study is that AI’s capability for content

creation, reasoning, decision-making, data analysis, and multimodal capabilities can all support service processes in different stages.

Thirdly, this study highlights the importance of AI applications in AI capability realization in the context of service development. Accordingly, this thesis suggests that software-based AI applications can support service development by providing productivity benefits for developers, employees, and individuals in several stages of the service process. In addition, software-based AI applications can support service development through AI applications specialized in customer experience improvement and AI assistance. The connection between the AI applications and AI capabilities in the current research is rather vague, as it mainly focuses on studying AI applications and AI capabilities as separate concepts.

Fourthly, this research offers novel insight by connecting AI types to AI applications and related AI capabilities in the service development context. Accordingly, the findings suggest that GenAI and predictive AI are the most popular AIs used to improve both productivity and CX, while NLP is mainly used to improve CX. Agentic AI is used for both purposes by only a few companies. AGI seems not to be in use, as companies do not mention it. The researcher was not able to find prior research that would support this connection. Furthermore, as there seemed not to be an existing theoretical framework suitable for the purpose of this study, one was created based on the literature to support the empirical section.

5.2 Managerial implications

As the main results of this thesis suggest, AI capabilities can support service development and service processes in different stages through AI applications. However, the realization of the AI benefits and AI utilization in service development is not completely unambiguous, and hence, this thesis suggests several managerial implications.

Firstly, the empirical findings of this study suggest that service organizations' managers need to realize that AI needs to be embedded into business processes in order to stay competitive. This is because AI is advancing rapidly, and it is changing business processes and customer expectations. It is important for the business leaders to consider how AI creates value, in which specific activities or business processes AI creates value, and to which challenges a service firm wants to find a solution. Business leaders should also think about how to verify the value of AI, or how to measure the value AI brings. For example, Bauer et al. (2006) present the eTransQual model that can be used to measure online service quality, and thus, it could be one potential tool for managers to estimate the value of an AI innovation.

Furthermore, according to the empirical findings and prior research, it seems that at the moment, companies get the greatest advantage of AI when using the most settled AI, GenAI, to get productivity benefits. As the results suggest, a service company can benefit from AI by embedding it into the business processes to improve efficiency, for example, through automation. However, the current research highlights that it is always important to consider customers' service goals when deploying different AIs in services (Huang & Rust, 2018; 2021; Larivière et al., 2024; Schepers et al., 2022). Service developers need to understand customer expectations in order to design high-quality services (Zeithaml et al., 2002). Accordingly, service developers need to consider the current service objective and discover whether or not the AI solution can meet the specific service objective, in order to avoid customer experience and AI investment failing. For example, service can benefit from automation in transactional service offerings. However, customer experience is likely to fail if a customer expects highly personalized service with a hedonic or experience-oriented service goal, and the service is delivered by AI that aims for high performance and a utilitarian service goal. Therefore, it would be beneficial for service developers to consider which service situation AI could fit, and if possible, test it and analyze the results.

Moreover, service developers need to be updated on the development of AI, because AI is developing rapidly, and consequently, customer expectations are changing. The findings of this study also indicate the rapid advancement of AI, since a couple of case companies reportedly already use agentic AI. The rapid development of AI was also confirmed by several AI experts whose speeches the researcher got to hear in a couple of events (E. Bogsnes & K. A. Fiskvik, Strawberry Hotels Winter Conference, January 11, 2026; K. Bär & K. Kettukari, Haaga-Helia Tulevaisuusfoorumi, March 31, 2026). Accordingly, it seems that the agentic AI is going to change how services are purchased in the future, and hence, business leaders might need to think about how the services can be found by AI agents. As the service process changes, service developers could benefit from a flexible service development strategy rather than a strict, predefined strategy (Zomerdijk & Voss, 2011).

Reportedly, the greatest benefit of AI relates to data and AI's ability to process huge amounts of data. The results of this study also highlight AI's potential to improve customer experience, for example, by personalizing offerings and recommendations, and making predictions based on a large amount of data. Therefore, business leaders should consider whether they could utilize a large amount of data and improve services with data-based solutions. One insight of this study is that different technology companies offer AI applications with embedded AI capabilities for specific purposes, for example, for customer experience development. Hence, business leaders could explore different options and ready-made AI solutions that technology companies offer in order to find the best solution for a specific business problem.

5.3 Suggestions for future research

Several future research suggestions occurred during the research process. Firstly, since this study focused on examining multinational technology companies and their AI applications, it would be interesting to explore more closely how AI applications are used to support service processes or service development in different fields, for example, in a service industry from the perspective of a service provider. Furthermore, as this study

focuses on researching AI capabilities in service development, another interesting research line would be to investigate AI capabilities or AI applications' supportive effects on some other business operation, such as sales and marketing. Another interesting future research suggestion would be to validate or extend the findings of this research by gathering more data through interviews or by conducting quantitative research.

Furthermore, since the empirical data of this study is limited to 2024 and AI has developed rapidly since then, one potential research line would be to investigate how AI has developed since 2024 and study the topic with the latest information. Another interesting research line would be to investigate the use of some specific AI type, such as agentic AI, by investigating how it supports service development. It would be interesting to explore how agentic AI affects the service business, for example, service design and customer acquisition. Finally, when AGI has advanced enough and is in use, it would be interesting to examine what kind of problems AGI can solve, for example, in the field of service business.

5.4 Limitations

This thesis is subject to limitations, especially regarding the scope of the empirical study. Firstly, the empirical study is limited to only five case companies, and therefore, the sample size of the study is relatively small. Additionally, the empirical data were collected mainly from case companies' annual reports and from the secondary data sources, such as press releases and other online sources. Thus, the data is based only on these sources. In order to increase the validity of the results, the study would have benefited from expert interviews. Although interviews were attempted at the beginning of the thesis project, the novelty of the topic and the limited research schedule limited the chances of interviews.

Furthermore, possible biases can exist in the study results as the researcher decided on the data that was taken to further analysis, and hence, other researchers could have ended up with different results. Also, the interpretation of the findings relies only on the

researcher, and hence, other researchers could have interpreted the findings differently. Finally, AI is a quite novel and quickly evolving topic. Therefore, the information can quickly be outdated, for example, the names of some AI applications in some companies change relatively often.

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Appendices

Appendix 1. AI capabilities in service development - key themes of annual reports.

Microsoft

Automation

How does AI support service development through automation?

Power Platform helps developers to create, automate, and analyze
"We're also applying AI across our low-code/no-code toolchain to help domain experts across an organization automate workflows, create apps and webpages, build virtual agents, or analyze data, using just natural language with copilots in Power Platform. More than 63,000 organizations have used AI-powered capabilities in Power Platform to date." (2023, 2, CEO's forewords)

Generative AI in Power Platform
"We are also integrating generative AI across Power Platform, enabling anyone to use natural language to create apps, automate workflows, or build a website." (2024, 3)

Copilot Studio for building autonomous AI agents
"And with Copilot Studio, customers can extend Copilot with agents and build their own agents that proactively respond to data and events from their own first- and third-party business data. … just this week, we announced new capabilities that will make it possible for customers to build autonomous agents using Copilot Studio." (2024, 3)

AI capabilities for automation, prediction, and insights in Microsoft 365
"We are infusing AI across Microsoft 365 to enable new automation, prediction, translation, and insights capabilities. Meetings are more inclusive in Microsoft Teams, presentations more accessible in PowerPoint, videos more searchable in Stream, and emails more relevant in Outlook." (2019, 3)

Automating manual documentation work with DAX Copilot in healthcare
"In healthcare, for example, we introduced the world's first fully automated clinical documentation application, DAX Copilot. The application helps physicians reduce documentation time by half, freeing them to spend more time face-to-face with patients." (2023, 3, CEO's forewords)

Automated threat detection with Azure Sentinel
"In identity, Azure Active Directory now provides identity and access management to more than 345 million monthly active users across more than 200,000 organizations. In security, Defender offers broad coverage, spanning identities, cloud apps, devices, IoT,

and more. It complements Azure Sentinel, which uses AI to detect, investigate, and automatically remediate threats." (2020, 4)

Productivity

How does AI support service development by improving productivity?

AI-powered applications through Dynamics 365

“Dynamics 365 once again took share, as organizations use our AI-powered apps to transform their marketing, sales, service, finance, and supply chain functions.” (2024, 3)

Improving operational efficiency and customer experience with intelligent applications in Dynamics 365

“Together, the Microsoft Cloud, Dynamics 365, Microsoft Teams, and our AI offerings bring a new era of collaborative applications for every role and business function to get insights and business impact faster. Dynamics 365 is a portfolio of intelligent business applications that delivers operational efficiency and breakthrough customer experiences. ” (2024, 11)

Getting insights through Dynamics 365 AI apps

"Every process inside a business is being digitized, and we are winning customers with our differentiated approach, enabling organizations of all sizes to digitize critical business functions – from sales to marketing to HR. Dynamics 365 is the alternative to monolithic, siloed suites of business applications with modular, extensible and AI-driven apps that are part of a connected data graph and unlock insights across every part of the organization." (2018, 2)

Reducing manual work with Dynamics 365 Copilot

"We are bringing the next generation of AI to employees across every job function and every line of business with Dynamics 365 Copilot, which works across CRM and ERP systems to reduce burdensome tasks like manual data entry, content generation, and notetaking." (2023, 2-3, CEO's forewords)

Streamlining processes through insight and assistance with Microsoft 365 Copilot, Copilot for Service

Our role-based extensions of Microsoft Copilot – Copilot for Sales, Copilot for Service, and Copilot for Finance – bring together the power of Copilot for Microsoft 365 with role-specific insights and workflow assistance to streamline business processes.” (2024, 11)

Improving productivity and creativity with Microsoft 365 Copilot, combining Microsoft Graph and Microsoft 365 apps

"Microsoft 365 Copilot, which combines next-generation AI with business data in the Microsoft Graph and Microsoft 365 applications to help people be more productive and unleash their creativity at work." (2023, 3, CEO's forewords)

Improving productivity in general tasks and automating processes and workflows with Microsoft 365 Copilot and generative AI
“… employees at nearly 60 percent of the Fortune 500 now use Copilot to complete tasks faster, hold more effective meetings, and automate business workflows and processes. In fact, internal and external studies show as much as a 70 percent improvement in productivity using generative AI for specific work tasks. And early Microsoft 365 Copilot users were 29 percent faster in a series of general tasks like searching, writing, and summarizing.” (2024, 3)

Productivity and security through Outlook Mobile’s AI-infused experiences
"More than 135 million people use Office 365 commercial every month, and Outlook Mobile is helping people be productive and stay secure on more than 100 million iOS and Android devices worldwide – with AI-infused experiences they use every day." (2018, 2)

AI is improving search and browsing capabilities, and content creation in Microsoft Edge and Bing
“In February 2023, we launched an all-new, AI-powered Microsoft Edge browser and Bing search engine with Bing Chat to deliver better search, more complete answers, and the ability to generate content.” … "Quick access to AI-powered tools, apps, and more within Microsoft Edge’s sidebar enhances browsing capabilities." (2023, 12)

Windows 11 and Windows Copilot are improving developer productivity
"Windows 11 offers innovations focused on enhancing productivity, including Windows Copilot with centralized AI assistance and Dev Home to help developers become more productive." (2023, 12)

Windows 10, a productivity platform
"Windows 10 continues to gain traction in the enterprise as the most secure and productive operating system. It empowers people with AI-first interfaces ranging from voice-activated commands through Cortana, inking, immersive 3D content storytelling, and mixed reality experiences." (2020, 12; 2019, 12; 2018, 11)

Copilot in Dynamics 365 Customer Service for improving customer experience through enhanced productivity, AI tools in Supply Chain Platform for predictions, Microsoft Sales Copilot for infused customer interactions through data insight
“our own support agents are using Copilot in Dynamics 365 Customer Service to resolve more cases faster and without having to call on peers to help. With our Supply Chain Platform, we’re helping customers apply AI to predict and mitigate disruptions. And, with our new Microsoft Sales Copilot, sellers can infuse their customer interactions with data from CRM systems—including both Salesforce and Dynamics—to close more deals.” (2023, 2, CEO's forewords)

Microsoft Fabric, an AI-powered analytics platform with data and analytics tools

“Microsoft Fabric is an end-to-end, unified analytics platform that brings together all the data and analytics tools that organizations need.” (2024, 12)

“Microsoft Fabric, our AI-powered, next-generation data platform we made generally available this year, now has over 14,000 paid customers who can go from data, to insights, to action—all within the same unified SaaS solution.” (2024, 2)

Cloud services

How do cloud-based AI tools help in building AI services?

Microsoft Intelligent Data Platform - an infrastructure needed for building AI apps
"Every AI app starts with data, and having a comprehensive data and analytics platform is more important than ever. Our Intelligent Data Platform brings together operational databases, analytics, and governance so organizations can spend more time creating value and less time integrating their data estate." (2023, 2, CEO's forewords)
“The Microsoft Intelligent Data Platform fully integrates databases, analytics, and governance.” (2024, 12)

Azure AI, a cloud-based AI platform, and a set of cloud services for creating AI services
"Azure is a trusted cloud with comprehensive compliance coverage and AI-based security built in." (2020, 11-12; 2021, 12)
"Azure is a comprehensive set of cloud services that offer developers, IT professionals, and enterprises freedom to build, deploy, and manage applications on any platform or device." (2022, 21; 2023, 18)
"With Azure AI, we are making foundation models available as platforms to our customers. … More than 11,000 organizations across industries are already using it for advanced scenarios like content and code generation." (2023, 2, CEO's forewords)
"Azure AI offerings provide a competitive advantage as companies seek ways to optimize and scale their business with machine learning. Azure’s purpose-built, AI-optimized infrastructure allows advanced models, including GPT-4 services designed for developers and data scientists, to do more with less. Customers can integrate large language models and develop the next generation of AI apps and services." (2023, 18)
"Our AI platform, Azure AI, is helping organizations transform, bringing intelligence and insights to the hands of their employees and customers to solve their most pressing challenges. Organizations large and small are deploying Azure AI solutions to achieve more at scale, more easily, with the proper enterprise-level and responsible AI protections." (2023, 11)
"Being a global-scale cloud, Azure uniquely offers hybrid consistency, developer productivity, AI capabilities, and trusted security and compliance." (2022, 13; 2021, 13; 2019, 11; 2018, 10)

Azure Machine Learning for model building
"Azure Machine Learning helps organizations build and deploy models faster, while ensuring they can do so responsibly and safely." (2020, 2)

Azure AI Studio, a toolchain for combining models with data

“Azure AI Studio provides a full lifecycle toolchain customers can use to ground these models on their own data, create prompt workflows, and help ensure they are deployed and used safely.” (2024, 12)

Creating data insight with Azure AI solutions: Azure Cognitive Services, Azure Machine Learning and data services
"We are democratizing data science and AI with Azure Cognitive Services, Azure Machine Learning and data services such as Azure Cosmos DB – the first globally distributed, multi-model database – to help organizations of all sizes convert their data into insights and experiences for competitive advantage." (2018, 3-4)
"We are driving new advances in our underlying cloud infrastructure, building the world’s first AI supercomputer in Azure.” (2018, 3-4)

Building applications that accelerate decision-making with Azure Cognitive Services
"In AI, we have the most comprehensive portfolio of tools, frameworks, and infrastructure. Azure Cognitive Services makes it easier to build applications that see, hear, speak, search, understand, and accelerate decision-making." (2020, 2)

AI tools through Azure Cognitive Services and ML-models through Azure Machine Learning
"we are democratizing AI infrastructure, tools, and services with Azure Cognitive Services, so any developer can embed the ability to see, hear, respond, translate, reason, and more into their applications. Azure Cognitive Services is the most comprehensive portfolio of AI tools available, and this year, we added new speech-to-text, search, vision, and decision capabilities, as well as updates to Azure Machine Learning to streamline the building, training, and deployment of machine learning models." (2019, 2)

Coding and language models through Azure OpenAI Service
"We are helping organizations apply the world’s most advanced coding and language models to a variety of use cases, such as writing assistance, code generation, and reasoning over data with our new Azure OpenAI Service." (2022, 5)

Azure Machine Learning Studio offers tools for AI developers to build ML-models, and Azure Machine Learning Workbench for AI-modeling
"Our innovation helps every developer be an AI developer, with approachable new tools from Azure Machine Learning Studio for creating simple machine learning models, to the powerful Azure Machine Learning Workbench for the most advanced AI modeling and data science." (2021, 13; 2020, 12; 2019, 12; 2018, 11)

Customer experience
How do AI solutions support customer experience?

“Dynamics 365 once again took share, as organizations use our AI-powered apps to transform their marketing, sales, service, finance, and supply chain functions.” (2024, 3)

“Dynamics 365 is a portfolio of intelligent business applications that delivers operational efficiency and breakthrough customer experiences. (2024, 11)
“our own support agents are using Copilot in Dynamics 365 Customer Service to resolve more cases faster and without having to call on peers to help.” (2023, 2, CEO's forewords)

Creativity, collaboration, and innovation
How does AI improve creativity, collaboration, and innovation?

"Microsoft 365 brings together Office 365, Windows, and Enterprise Mobility + Security to help organizations empower their employees with AI-backed tools that unlock creativity, increase collaboration, and fuel innovation, all the while enabling compliance coverage and data protection." (2022, 12; 2021, 12; 2020, 11; 2019, 11; 2018, 10)
“With Pages, which we just announced last month, you can take any information from the web or your work and turn it into a multiplayer, AI-powered canvas. You can ideate with AI and then easily share what you create for collaboration with other people.” (2024, 3)
“In February 2023, we launched an all new, AI-powered Microsoft Edge browser and Bing search engine with Bing Chat to deliver better search, more complete answers, and the ability to generate content.” … "Quick access to AI-powered tools, apps, and more within Microsoft Edge’s sidebar enhances browsing capabilities." (2023, 12)

Miscellaneous
"Artificial intelligence ('AI') capabilities are rapidly advancing, fueled by data and knowledge of the world." (2018, 9; 2019, 10; 2020, 10; 2021, 11; 2022, 11)
"In a world of increasing economic complexity, AI has the power to revolutionize many types of work. Microsoft is now innovating and expanding our portfolio with AI capabilities to help people and organizations overcome today’s challenges and emerge stronger. Customers are looking to unlock value from their digital spend and innovate for this next generation of AI, while simplifying security and management. Those leveraging the Microsoft Cloud are best positioned to take advantage of technological advancements and drive innovation. Our investment in AI spans the entire company, from Microsoft Teams and Outlook, to Bing and Xbox, and we are infusing generative AI capability into our consumer and commercial offerings to deliver copilot capability for all services across the Microsoft Cloud." (2023, 10)

Amazon

Customer experience
How Amazon uses AI used to enhance customer experience?

Focus on GenAI
"However, a question people never ask, and might be even more interesting is what’s the next set of primitives you’re building that enables breakthrough customer experiences? If you asked me today, I’d lead with Generative AI (“GenAI”)." (2023, 7, CEO's forewords)

“Generative AI is going to reinvent virtually every customer experience we know, and enable altogether new ones about which we’ve only fantasized.” (2024, 6)
“Increasingly, you’ll see AI change the norms in coding, search, shopping, personal assistants, primary care, cancer and drug research, biology, robotics, space, financial services, neighborhood networks—everything. Some of these areas are already seeing rapid progress; others are still in their infancy. But, if your customer experiences aren’t planning to leverage these intelligent models, their ability to query giant corpuses of data and quickly find your needle in the haystack, their ability to keep getting smarter with more feedback and data, and their future agentic capabilities, you will not be competitive.” (2024, 6)
“there are more than 1,000 GenAI applications being built across Amazon, aiming to meaningfully change customer experiences in shopping, coding, personal assistants, streaming video and music, advertising, healthcare, reading, and home devices.” (2024, 7)

Machine learning capabilities
“Amazon has been using machine learning extensively for 25 years, employing it in everything from personalized ecommerce recommendations to fulfillment center pick paths, to drones for Prime Air, to Alexa, to the many machine learning services AWS offers (where AWS has the broadest machine learning functionality and customer base of any cloud provider)." (2022, 7, CEO's forewords)

LLMs
"More recently, a newer form of machine learning, called Generative AI, has burst onto the scene and promises to significantly accelerate machine learning adoption. Generative AI is based on very Large Language Models (trained on up to hundreds of billions of parameters, and growing), across expansive datasets, and has radically general and broad recall and learning capabilities. We have been working on our own LLMs for a while now, believe it will transform and improve virtually every customer experience, and will continue to invest substantially in these models across all of our consumer, seller, brand, and creator experiences." (2022, 7, CEO's forewords

Optimizing operations and advancing innovation
Three-layer GenAI
"Much of the early public attention has focused on GenAI applications, with the remarkable 2022 launch of ChatGPT. But, to our “primitive” way of thinking, there are three distinct layers in the GenAI stack, each of which is gigantic, and each of which we’re deeply investing." (2023, 7, CEO's forewords)

The bottom layer, Amazon SageMaker, a service for AI developers building own FMs
"The bottom layer is for developers and companies wanting to build foundation models (“FMs”). (2023, 7, CEO's forewords)
"Customers building their own FM must tackle several challenges in getting a model into production. Getting data organized and fine-tuned, building scalable and efficient training infrastructure, and then deploying models at scale in a low latency, cost-efficient

manner is hard. It's why we've built Amazon SageMaker, a managed, end-to-end service that's been a game changer for developers in preparing their data for AI, managing experiments, training models faster (e.g. Perplexity AI trains models 40% faster in SageMaker), lowering inference latency (e.g. Workday has reduced inference latency by 80% with SageMaker), and improving developer productivity (e.g. NatWest reduced its time-to-value for AI from 12-18 months to under seven months using SageMaker)." (2023, 7, CEO's forewords)

The middle layer, Amazon Bedrock, a service for customers using existing FMs
"The middle layer is for customers seeking to leverage an existing FM, customize it with their own data, and leverage a leading cloud provider's security and features to build a GenAI application—all as a managed service. Amazon Bedrock invented this layer and provides customers with the easiest way to build and scale GenAI applications with the broadest selection of first- and third-party FMs, as well as leading ease-of-use capabilities that allow GenAI builders to get higher quality model outputs more quickly." (2023, 7-8, CEO's forewords)

Top layer, GenAI applications
"The top layer of this stack is the application layer. We're building a substantial number of GenAI applications across every Amazon consumer business. These range from Rufus (our new, AI-powered shopping assistant), to an even more intelligent and capable Alexa, to advertising capabilities (making it simple with natural language prompts to generate, customize, and edit high-quality images, advertising copy, and videos), to customer and seller service productivity apps, to dozens of others." (2023, 8, CEO's forewords)

Amazon Q, a work assistant
"We're also building several apps in AWS, including arguably the most compelling early GenAI use case—a coding companion. We recently launched Amazon Q, an expert on AWS that writes, debugs, tests, and implements code, while also doing transformations (like moving from an old version of Java to a new one), and querying customers' various data repositories (e.g. Intranets, wikis, Salesforce, Amazon S3, ServiceNow, Slack, Atlassian, etc.) to answer questions, summarize data, carry on coherent conversation, and take action. Q is the most capable work assistant available today and evolving fast." (2023, 8, CEO's forewords)

Three layers as a basis for transforming CX and creating new ones
"These AWS services, at all three layers of the stack, comprise a set of primitives that democratize this next seminal phase of AI, and will empower internal and external builders to transform virtually every customer experience that we know (and invent altogether new ones as well)." (2023, 8, CEO's forewords)
"AWS launched a slew of new infrastructure and AI services that make it even easier to build remarkable customer experiences, including our latest custom AI silicon (Trainium2), a new set of frontier foundation models in Amazon Nova, and significant expansion of available models and features in our leading Generative AI ("GenAI") services Amazon SageMaker and Amazon Bedrock." (2024, 2)

“AWS is quickly developing the key primitives (or building blocks) for AI development, such as custom silicon AI chips in Amazon Trainium to provide better price-performance on training and inference, highly flexible model-building and inference services in Amazon SageMaker and Amazon Bedrock, our own frontier models in Amazon Nova to provide lower cost and latency for customers’ applications, and agent creation and management capabilities.” (2024, 7)
“The early AI workloads being deployed focus on productivity and cost avoidance (e.g. customer service, business process orchestration, workflow, translation, etc.). This is saving companies a lot of money.” (2024, 6)

Alphabet

Improving user experience
How AI is used in Google’s products to improve user experience?

Machine learning in Google products
“Within Google, our investments in machine learning over a decade have enabled us to build products that are smarter and more useful -- it's what allows you to use your voice to ask the Google Assistant for information, to translate the web from one language to another, to see better YouTube recommendations, and to search for people and events in Google Photos.” (2018, 3)
“Machine learning powers the Google Assistant and many of our newer technologies." (2019, 1)
“And, thanks to a new machine learning technique, we added 24 new languages to Google Translate, including its first indigenous languages of the Americas." (2022, 1, CEO's forewords)
“Some of our most popular products at Google — including Lens and Translate — were built entirely using artificial intelligence technologies such as optical character recognition and machine learning.” (2022, 1)
"We were one of the first to use machine learning in our products, starting in the early 2000s, for spelling corrections, improving the quality of ads, and showing suggestions and recommendations." (2023, 3, CEO's forewords)
“Using AI, we built a machine learning model for text summarization in Google Docs. With automated summaries distilling the content, people can quickly gather the main points, a significant step for our natural language processing capabilities in Docs.” (2022, 8, Year in Review 2022)
"Automated summaries generated by AI help users quickly grasp the main points of documents in Docs." (2022, 8, Year in Review 2022)
“With image processing powered by machine learning, Meet now automatically improves image quality so we can see one another as vividly as possible." (2022, 8, Year in Review 2022)

Generative AI in Google products

"Now generative AI is helping us reimagine our core products in exciting ways – from our new Search Generative Experience (SGE) to “Help Me Write” in Gmail. And earlier this year, we launched Bard, an early experiment that lets people collaborate with generative AI." (2023, 3, CEO's forewords)

AI capabilities in Google products
"we’ve continued to make incredible progress in building and deploying AI across all of our products, including Search, Cloud, and YouTube.” (2023, cover page, CEO's forewords)
"Things that we now consider routine – like spell check, mobile check deposit, or Google Search, Google Translate, and Google Maps – all use AI." (2023, 2)
“Today, AI in our products is used by billions of people globally through features like autocomplete suggestions in Google Search; translation across 133 languages in Google Translate; and organization, searching, and editing in Google Photos." (2023, 1)

Google Maps
“With new updates, Maps feels more and more like the real world. The AI behind Maps keeps pace with how communities are changing, automatically updating things like business hours and speed limits. With immersive view, you can now see photorealistic multidimensional views of more than 250 global landmarks like Big Ben or the Acropolis." (2022, 7, Year in Review 2022)
"To help people plan their visit, weather, traffic, and busyness information are layered on top, and predictive modeling anticipates what the next day or week might be like. Thanks to a combination of AI and contributions from Maps users, the new neighborhood vibe feature shows an area’s most popular spots with photos and helpful information to give people a feel for where they might explore." (2022, 7, Year in Review 2022)
"We’ve mapped around 1.6 billion buildings and over 60 million kilometers of roads in Google Maps, and with advances in AI, we’re able to map remote and rural areas." (2022, 7, Year in Review 2022)

Google Lens, translation
“People use Lens more than 10 billion times per month to search with their camera or images, and its new, AI-powered translation feature blends translated text seamlessly into the background of images.” (2022, 1, CEO's forewords)
“With Google Lens, you can take a photo of the tomato plant in front of you and add “care instructions” to quickly learn how to nurse the plant back to health.” (2022, 4, Year in Review 2022)

Auto-generated chapters on YouTube
“On YouTube, people are often searching for a specific moment in a video, and with the launch of auto-generated chapters, it’s easier to jump straight to the point they need." (2022, 4, Year in Review 2022)

Dream Screen tool on YouTube

“Dream Screen, a new experimental feature in YouTube, allows for the creation of AI-generated video or image backgrounds to Shorts by typing an idea into a prompt." (2023, 2)

Gemini, recommendations on YouTube
“Additionally, we are using Gemini to improve recommendations on YouTube.” (2024, 2)

AI assistance in devices
"Over the years, our Pixel phones have incorporated AI compute directly into the device and built experiences on top of it. Our latest Pixel devices were built around AI, bringing the best AI-assistive experiences to our users, such as Best Take, Magic Editor, and Audio Magic Eraser. As we look ahead, we are designing our Android and Chrome operating systems with new AI-forward user experiences." (2023, 2)
“Our latest Pixel devices were built with Gemini Nano, bringing the best AI-assistive experiences to our users, such as Gemini on Pixel, Pixel Screenshots, and Pixel Studio.” (2024, 2)

AI Overviews, NotebookLM
“Examples include AI Overviews, which allow users to ask their most complex questions, break down concepts in a format that is useful for them, or take a video and ask a question out loud, and NotebookLM, which helps users understand complex information by summarizing sources and providing relevant quotes.“ (2024, 2)

Use cases
“machine learning helps self-driving cars better detect and respond to others on the road, assists delivery drones in determining whether a location is safe for drop off, and can also help clinicians more accurately detect sight-threatening eye diseases." (2018, 3)
"AI is also helping us to find solutions to some of the world’s biggest problems. We partnered with iCad to license our mammography technology for breast cancer screenings, which is being used in clinics for the first time.” (2022, 2, CEO's forewords)
"Project Euphonia is a Google AI research effort aimed at helping to make speech recognition more accessible for people with atypical speech, like Steve Saling, an ALS technologist." (2020, 19, Year in Review)
"My favorite moments are seeing how our products can make a difference in people’s lives: Whether it’s a busy parent taking a photo of their craft drawer and using Bard to inspire a rainy day project for their kids; a traveler using Lens to translate a train schedule in a foreign country; or, more profoundly, a family able to hear the voice of a man with ALS, thanks to our research on speech recognition and synthesis" (2023, 3, CEO's forewords)

Supporting others to improve operational efficiency
How do Google’s AI products support other businesses to improve operational efficiency?

Google Cloud for businesses

“Because more and more of today’s great digital experiences are being built in the cloud, our Google Cloud products help businesses of all sizes take advantage of the latest technology advances to operate more efficiently.” (2019, 2; 2020, 3)
“Google Cloud continues to build AI into numerous solutions that our customers can use to develop AI-powered applications — including processing documents, images, and translation — to understand and analyze data more efficiently, and to use packaged solutions for a variety of industries.” (2022, 1)
“We’re also growing our subscriptions business and seeing great momentum across our Cloud business to bring AI advances to organizations around the world." (2023, cover page, CEO's forewords)
“Like our advertising clients before them, Cloud’s partners are operating better, growing faster, and creating jobs with our help." (2023, 2, CEO's forewords)
"Google was a company built in the cloud, and we continue to invest in our Google Cloud offerings, including Google Cloud Platform and Google Workspace, to help organizations stay at the forefront of AI innovation with our AI-optimized infrastructure, mature AI platform and world-class models, and assistive agents." (2023, 1)
“Our Google Cloud products, including Google Cloud Platform and Google Workspace, help organizations stay at the forefront of innovation with our AI-optimized infrastructure, AI development platform, world-class models, as well as assistive agents and applications.” (2024, 1)

Developer tools
“Our AI tools are also helping people and organizations create, learn, and get things done in ways they couldn’t a couple of years ago — from brainstorming new ideas with Gemini Live to quickly generating interactive web app prototypes in Gemini app’s Canvas” (2024, 1, CEO forewords)

PaLM AI model
“In the area of natural language understanding, our latest model, PaLM, demonstrates breakthrough capabilities in language, reasoning, and code tasks. Breakthroughs in “chain of thought” prompting are helping to build systems that can perform multistep reasoning and break down complex problems into smaller tasks.” (2022, 1, CEO's forewords)
“we introduced PaLM API, an easy and safe way for developers to build on top of our language models, and generative AI capabilities in Google Cloud and Workspace.” (2022, 1-2, CEO's forewords)

Imagen & Phenaki AI models
“We also shared new generative models, including Imagen, our text-to-image model, and Phenaki, which can generate long, coherent videos from text prompts." (2022, 1, CEO's forewords)

Gemini (formerly Bard), a multimodal AI model

“We also launched Bard, an early experiment for people to collaborate with generative AI. It’s one way we are giving users direct access to large language models" (2022, 1-2, CEO's forewords)
“Bard allows users to collaborate with experimental AI with new features that include image capabilities, coding support, and app integration.” (2023, 2)
“In December 2023, we launched Gemini, our most capable and general model. It was built from the ground up to be multimodal, which means it can generalize and seamlessly understand, operate across, and combine different types of information, including text, code, audio, images, and video." (2023, 2)
“Our most intelligent AI model yet, Gemini 2.5 Pro launched as the best model in the world on tasks requiring advanced reasoning.” (2024, 1, CEO forewords)
“Gemini is now used across all of our 15 products, with half a billion users” (2024, 1, CEO forewords)
“In 2023, we took a significant step on our journey to make AI more helpful for everyone with the introduction of Gemini, our natively multimodal AI model. In 2024, we launched Gemini 2.0, our most capable model yet. Gemini can generalize and seamlessly understand, operate across, and combine different types of information including text, code, audio, image, and video. Gemini is powering AI features across our products and services that are helping people everyday. Today, all seven of our two billion-user products — Android, Chrome, Gmail, Maps, Play Store, Search, and YouTube — are using Gemini” (2024, 1)
“We are embedding the power of generative AI to continue helping our users express themselves and get things done. For example, the Gemini app allows users to collaborate with new AI features that include image generation capabilities, coding support, and app integration. Gemini for Google Workspace helps users write, organize, visualize, accelerate workflows, and have richer meetings.” (2024, 2)
“Our teams across Alphabet leverage Gemini, as well as other AI models we have previously developed and announced, to deliver the best product and service experiences for our users, advertisers, partners, customers, and developers.” (2023, 2; 2024, 2)
“Gemini for Google Cloud provides pre-packaged AI agents that can assist developers to write, document, test, and operate software as well as assist cybersecurity teams to analyze, detect, protect, and respond to threats.” (2024, 2)

Vertex AI platform
“Our Vertex AI platform gives developers the ability to train, tune, augment, and deploy applications using generative AI models and services such as Enterprise Search and Conversations.“ (2023, 2-4)
“we are focused on making it easy and scalable for others to innovate, and grow, with AI. That means providing advanced computing infrastructure and expanding access to Google’s latest AI models. Our Vertex AI platform gives developers the ability to train, tune, augment, test, and deploy applications using Gemini, Imagen, Veo, and other generative AI models.” (2024, 2)

Duet AI, AI agents for developers

“Duet AI for Google Cloud provides pre-packaged AI agents that assist developers to write, test, document, and operate software." (2023, 2-4)

Tensor Processing Units, AI chips
“We also make our Tensor Processing Units, the same chips we used to train our most capable AI models, available to businesses through Google Cloud.” (2024, 1, CEO forewords)

Use cases
"For enterprise customers, Google Cloud launched a pilot program to help customers transition to clean energy by building a clear picture of their electricity emissions profile using AI-generated historical and real-time insights." (2022, 28, Year in Review 2022)
“Our work in AI is helping to produce earlier and more precise flood warnings.” (2019, 1)
"Anticipating environmental risks is a critical challenge; we globally launched FloodHub, an AI-powered platform that displays flood forecasts and shows when and where floods may occur to help organizations prepare." (2022, 28, Year in Review 2022)
“Partners across industries are using Google technology to improve customer support and supply chain efficiency, reduce their carbon footprint, build new applications, and get more done with AI.” (2023, 2, CEO's forewords)

Google Workspace (formerly G Suite), productivity & collaboration tools
“Our G Suite productivity tools — which include apps like Gmail, Docs, Drive, Calendar, and more — are designed with real-time collaboration and machine intelligence to help people work smarter.” (2019, 2)
“Our Google Workspace collaboration tools — which include apps like Gmail, Docs, Drive, Calendar, Meet and more — are designed with real-time collaboration and machine intelligence to help people work smarter.” (2020, 3)
"The breakthroughs we’re seeing are poised to transform every industry, and we’re helping businesses tap into the new opportunities AI creates. Last year, we announced new products to help businesses solve problems using AI, including Translation Hub, which can be used to translate documents into 135 languages at a previously unimaginable scale and speed. We brought more AI-powered features to Google Workspace, including automatic summarization for Google Docs and Chat to help people get work done faster.” (2022, 1, CEO's forewords)
“As offices reopened and organizations adapted to the hybrid workplace, Workspace helped to boost collaboration and productivity.” (2022, 8, Year in Review 2022)
“Through Google Workspace, we delivered more than 300 new capabilities to support hybrid and front-line work, including AI-powered features to automate transcriptions and extend the power of smart canvas.” (2022, 17, Year in Review 2022)
"While we have been integrating AI into our products for years, we are now embedding the power of generative AI to continue helping our users express themselves and get things done. For example, Duet AI in Google Workspace helps users write, organize, visualize, accelerate workflows, and have richer meetings.” (2023, 2)
“Collaboration Tools: Google Workspace and Duet AI in Google Workspace provide easy-to-use, secure communication and collaboration tools, including apps like Gmail, Docs,

Drive, Calendar, Meet, and more. These tools enable secure hybrid and remote work, boosting productivity and collaboration. AI has been used in Google Workspace for years to improve grammar, efficiency, security, and more with features like Smart Reply, Smart Compose, and malware and phishing protection in Gmail. Duet AI in Google Workspace helps users write, organize, visualize, accelerate workflows, and have richer meetings." (2023, 4)

Advertising tools

How do AI-powered tools support advertising?

"Our advertising tools also use machine learning to help marketers find the right audience, deliver the right creative, and optimize their campaigns through better auto-bidding and measurement tools." (2018, 3)

"AI already powers Google's core products that help billions of people every day and has been at the foundation of our core ads quality systems for years, helping large and small businesses all over the world to produce and run effective and efficient ad campaigns that help grow their businesses." (2022, 1)

Broad match with LLMs

"To help advertisers create meaningful performance, last year we started incorporating large language models into broad match, a tool that makes it easier to match advertiser offers to search queries." (2022, 1, CEO's forewords)

Ads, Smart Bidding, MUM (LLMs) for businesses to generate better matches in search

"Our AI breakthroughs enabled a number of improvements to make our Ads work harder for businesses. For instance, with Smart Bidding we use AI to predict future ad conversions and their value, helping businesses anticipate and quickly respond to rapid shifts in demand. Additionally, our large language models like MUM have enabled us to increase understanding of intent behind language, leading to more precise search-query matching with advertiser offers. As a result, when businesses use Smart Bidding and upgrade exact match keywords to broad match in campaigns that use a target CPA, they can see an average of 35% more conversions." (2022, 16, Year in Review 2022)

Google Ads

"We also know businesses of all sizes around the world rely on Google Ads to find customers and grow their businesses — and we make that even easier with AI." (2023, 2)

"advertisers are able to use our updated image generation in Google Ads to produce high-quality imagery for their campaigns, and Demand Gen helps them reach their target audiences." (2024, 2)

Performance Max

"It was also crucial for us to help businesses reach shoppers at the right moments, and with Performance Max, our AI-powered, goalbased campaign type, Local and Smart Shopping campaigns were optimized to help businesses reach new and existing

customers wherever they were in their journey with relevant, useful content." (2022, 16, Year in Review 2022)
"With Performance Max, advertisers simply tell us their campaign goals and share their creative assets, and AI will automatically produce and run a highly effective ad campaign across all of Google's properties, to meet their budget." (2023, 2)

Search and Shopping ads in Search Generative Experience
Additionally, we are experimenting with Search and Shopping ads that are directly integrated into the AI-powered snapshot and conversational mode in Search Generative Experience." (2023, 2)

Product Studio for creating personalized imagery
"Product Studio brings the benefits of AI to businesses of all sizes, helping them easily create uniquely-tailored imagery featuring their products — for free. (2023, 2)

Improve search algorithms
How AI is used to improve search algorithms?

BERT, natural language understanding in search
"Our investments in machine learning over the past decade have enabled us to build products that are smarter and more helpful. For example, a huge breakthrough in natural language understanding, called BERT, now improves results for almost every English language search query." (2020, 2)
"Search results for complex queries got much more helpful because of large language models like MUM and BERT. We've created entirely new ways for people to express what they're looking for through voice, images, and even asking questions about what they see with multisearch." (2023, 3, CEO's forewords)
"Large language models (LLMs) are an exciting aspect of our work in AI based on deep learning architectures, such as the Transformer, a neural network architecture that we introduced in 2017 that helped with language understanding. This led to the Bidirectional Encoder Representations from Transformers, or BERT, in 2019 that helped Search understand the intent of user search queries better than ever before." (2023, 1)

Multisearch
"It's been especially exciting to see how AI advancements are making our products more helpful. Last year, we launched multisearch, a new way to search using both text and images, and it's now available in more than 70 languages." (2022, 1, CEO's forewords)
"AI makes it possible to search in new languages, with multiple inputs, such as using images and text at the same time with the Google App." (2022, 1)
"We launched multisearch, a way of searching with both images and text at the same time using AI." (2022, 4, Year in Review 2022)

IBM

Customer and employee experience

How AI is used to improve customer and employee experience?

Digital customer service and innovation by IBM Watson AI
“BNP Paribas, a leading European bank, is working with IBM to speed and scale the launch of new digital and AI customer services across the cloud, while protecting the security and confidentiality of customer data.” (2018, 3-4)
"When the global bank BNP Paribas began accelerating its digitization strategy, its goal was to deliver superior services to its customers and corporate clients while ensuring the security and confidentiality of their data.” … “The bank will also benefit from IBM Watson AI and other services—enabling it to tap into new technologies, innovate more quickly and, ultimately, deliver a better customer experience." (2019, 9)

Watson virtual assistant for employees to optimize customer service
"François-Xavier Maille, director of one of the premier branches of Crédit Mutuel bank in Paris, was the first to deploy the initial AI solution: a Watson virtual assistant that helps employees answer customers’ questions. “The application has liberated our people from a few recurring tasks so they can devote their time and talents to understanding our clients’ aspirations, challenges, and circumstances,” says François-Xavier. Today, 23,000 Crédit Mutuel advisors across France rely on the Watson tool, which helps employees answer business-related questions 60% faster. The bank intends to use Watson across all of its business lines." (2018, 9)

Watson Assistant to answer questions
"Organizations turned to Watson Assistant, IBM’s AI-powered virtual agent for business, to field COVID-related questions from customers, employees and the general public. Use of Watson Assistant surged 64 percent between February and November 2020." (2020, 7)

Quick access to information with AI
"AI accelerates access to relevant information and liberates people to provide a human touch." (2018, 9)

Customer service through IBM Watson
“Orange Bank, one of the fastest growing mobile banks in France, now manages all customer service through IBM Watson.” (2018, 2-3)

IBM Watson helping service employees by replying to customer problems
“Banco Bradesco is now using IBM Watson to assist every member of its services team—resolving customer inquiries in seconds with nearly 95 percent accuracy." (2018, 2-3)

Improved customer and employee experiences with IBM Watson Studio, IBM Watson Machine Learning and IBM Cloud Pak for Data
“Deutsche Lufthansa AG is using IBM Watson Studio, IBM Watson Machine Learning and IBM Cloud Pak for Data to achieve operational excellence and enhance customer and employee experiences.” (2020, 7)

Personalized prizing
"airlines are using AI to offer personalized pricing and other new services." (2019, 10)

Automated customer experience
"Examples include IBM's work with McDonald's to automate the drive-thru experience with AI at scale." (2022, 2-3)

Automating pension (service) delivery
"We also partnered with the U.S. Department of Veterans Affairs to automate the delivery of pension benefits, accelerating the claims process, and freeing up VA staff to focus on higher value work." (2022, 2-3)

Innovating AI capability delivery with IBM
"global telecom leader Vodafone Business is partnering with IBM to innovate the way it delivers multicloud and digital capabilities—including AI, edge computing, 5G and software-defined networking solutions—to its customers." (2018, 3-4)

Building more advanced AI with reasoning capabilities
"IBM Research continues to advance these technologies, for example integrating neural and symbolic techniques to build AI that can perform more complex tasks by understanding and reasoning more like humans." (2020, 24)

Developing weather services with predictive AI in Watson
"Predictive intelligence is starting to create new options that can make extreme weather more manageable and less disruptive."..."Now, however, Derek doesn't just keep up with the weather—he stays ahead of it. This shift was made possible because Derek and his team put data and AI to work: they trained Watson to predict outages using five years of Hydro One historical outage data and a massive amount of Ontario's historical weather information. Derek's new predictive tools help him paint a clearer picture of how a storm will affect the utility's electrical distribution network. Hydro One has committed itself to a more proactive approach, and the utility has not only gained a new way to fight storms, but has also changed its basic business operations to strengthen its customers' experience and service quality. The predictive power of AI enables Hydro One to activate its emergency organization structure in advance and create detailed team deployment plans, positioning some crews in the storm's predicted path while making sure other crews are well rested." (2018, 11)

Creating customized campaigns by discovering customer insights with ML in IBM Watson
"Wunderman Thompson Data, the data and analytics arm of global creative and technology agency Wunderman Thompson, had data dispersed across many clouds. The company knew that if it could pull together and mine this data, it could build new and expanded customized campaigns for its clients. It partnered with IBM to create an unprecedented machine learning practice using IBM Watson to discover new customer insights and deliver increased ROI for brands. The use of Watson also helped Wunderman

Thompson Data amplify its capabilities by being able to leverage the company's entire portfolio of data assets. To make it happen, it brought in IBM's Data Science Elite team—all experts in helping companies push AI and machine learning models into production—to accelerate and modernize the building of their machine learning practice." (2019, 13)

Improving business productivity

How AI is used to improve business productivity?

Improving productivity with Watsonx through automation

"IBMers are also embracing watsonx to unleash greater productivity, eliminate complexity, simplify workflows, and automate manual tasks. Examples include processing HR and IT tasks more easily, generating code up to 60% faster, and answering client inquiries more quickly." (2023, 3)

Watsonx to improve productivity, code quality, and improve CX

"Financial institutions like Citi, Bradesco, and NatWest are using watsonx to help increase productivity, improve code quality, and enhance customer experiences." (2023, 2)

Intelligent workflows with data insights

"A new era of business reinvention is emerging as leading companies are moving from merely improving their processes to creating truly "intelligent workflows," processes that are not only efficient at what they do, but intrinsically smart: capable of finding, connecting and analyzing data to uncover deep insights that can inform intelligent decisions. Data and AI, in concert with hybrid cloud, are making intelligent workflows possible." (2019, 30)

Automating business processes for productivity

"Our value proposition builds on five core capabilities, addressing our clients' hybrid cloud and AI needs:" … "(3) Automate the end-to-end enterprise processes, for effectiveness and efficiency with AI driven decision-making" (2021, 11)

Productivity through insights and automation

"AI is expected to unlock $16 trillion in value from the global economy by 2030 – including massive boosts in productivity – by scaling data-driven insight and automating business workflows in everything from IT operations and financial reporting to human resources and customer service." (2022, 2)

Improving workflows, modernizing applications

"Among other things, for example, we are leveraging our hybrid cloud and AI capabilities to help clients reimagine critical workflows, at scale, and modernize applications to increase agility, drive innovation and create operational efficiencies." (2021, 9)

ROI for client's investments in AI through productivity and automation

"Our clients have moved beyond experimentation and are now looking to scale AI in their businesses and generate return from their investments. The portfolio of AI offerings we

have built is focused on generating that return through productivity improvements and automation." (2024, 33)

Improving productivity through automation, e.g. AI assistant does contract creation
"we have aggressively adopted AI-powered automation to drive productivity. For example, 94% of IBM's basic HR queries are now answered by an AI assistant. Our contract drafting process is now 80% faster. Overall, we have delivered approximately $3.5 billion in productivity savings since the beginning of 2023." (2024, 3)

Business productivity through the combination of cloud and AI
"Hybrid cloud and AI together have the power to unleash business productivity." (2024, 12)

AI agents managing customer service, code creation, reasoning
"AI assistants manage key tasks, including customer service and writing code. We are developing pre-built AI agents that deliver multitask reasoning for specific business domains." (2024, 2)

IBM watsonx, portfolio of AI products for app creation and data management
"IBM watsonx provides a robust portfolio of AI products for developing AI apps, managing data, and governing the entire lifecycle of AI models." (2024, 2)

Improving productivity and CX with watsonx
"As AI becomes a top priority, our clients are using watsonx – IBM's flagship AI and data platform – to help revolutionize customer service, modernize countless lines of code, and automate enterprise tasks to boost employee productivity."(2023, 1)

Providing insight into business processes with Watson to improve productivity
"We have built a hybrid cloud platform, based on open technologies, that allows clients to realize their digital and AI transformations across the applications, data and environments in which they operate. Watson is IBM's industry leading AI for business, a portfolio of enterprise-ready pre-built applications and tools designed to reduce the costs and hurdles of AI adoption through industry-leading natural language processing, automation and trust in our responsible use of AI. Building on our hybrid cloud platform, our software collects and analyzes data from across our clients' enterprises, training our AI to provide insights into their business processes. These insights enable intelligent workflows, reinventing the way businesses operate and driving improved business outcomes that accelerate our clients' adoption of AI." (2020, 23)

Help other businesses to develop AI services
"Health: IBM has become a leader in applying advanced digital technologies to healthcare, including the application of AI and data analytics to the diagnosis and treatment of patients, bringing smart decisions to Health Care payers, and helping Life Sciences companies develop innovative products and services." (2018, 23)

"Putting Watson Assistant, natural language processing and enterprise AI search capabilities to work as multilingual virtual agents, IBM helped Children's Healthcare of Atlanta create the "COVID-19 Pediatric Assessment Tool" for parents." (2020, 2)

Support other businesses to implement AI

How do IBM's services support other businesses to implement AI?

IBM's AI platform enabling the implementation of AI into business processes

"Clients are moving to deploy AI at scale. More than 40,000 clients have turned to IBM to unlock value from their data. IBM's AI platform is differentiated by automation, natural language processing and trust. It is the only AI platform that can run anywhere—on premise, private cloud and public cloud. Clients across industries are using it to infuse AI into their core business processes, such as hiring, supply chains and customer service." (2020, 2)

Helping businesses in digital transformation, and deploying AI capabilities through hybrid cloud platform

"IBM will accelerate our open hybrid cloud platform growth strategy and AI capabilities to drive clients' digital transformations."…"We are unlocking the full value of the cloud for clients, further accelerating their digital transformations and adoption of the platform. This platform facilitates the deployment of powerful AI capabilities to enable the power of data, application modernization services and systems."..."Our business, strategy and technology consultants help clients transform by modernizing their existing applications, and by building new AI-infused data analysis capabilities on the leading open hybrid cloud platform."(2020, 55)

Capabilities for cloud and AI: cloud, insights, automation

"We draw upon five core capabilities to address our clients' hybrid cloud and AI needs: (1) build and modernize for the hybrid cloud environments that operate with speed, consistency and agility, (2) create AI-infused, datadriven business insights regardless of where data lives, while maintaining enterprise grade data governance, privacy and trust, (3) automate the end-to-end enterprise processes for efficacy with AI-driven decision-making, (4) secure everywhere, with consistent governance and compliance across environments, and (5) bring it together by transforming our clients' businesses and processes into sustainable best-in-class industry practices." (2022, 11)

Supporting digital transformation

"Our hybrid cloud platform and AI technology and services capabilities support clients' digital transformations and help them engage with their customers and employees in new ways. These solutions draw from an industry-leading portfolio of capabilities in software, consulting services and a deep incumbency in mission-critical systems, all bolstered by one of the world's leading research organizations." (2024, 11)

AI capabilities on IBM Software: data insights, automation

"IBM Software extends the value of our hybrid cloud platform with four critical capabilities: (1) “Modernize” for agility and speed from legacy to hybrid cloud architecture, (2) “Data-driven”, predicting outcomes from distributed data and applying AI to empower predictive decision-making, real-time digital intelligence and sustainable operations, (3) “Automate” at scale to make experiences and tasks more productive and impactful, and (4) “Secure” all touchpoints, all the time, employing real-time threat insights, automated detection and orchestrated response." (2022, 12)

AI capabilities on IBM Software: AI for applying GenAI to processes and apps, and data for data-driven decision-making, automation and app modernization for productivity and improved CX, Red Hat for hybrid cloud
"IBM Software brings to life the combined value of hybrid cloud and AI with capabilities that deliver improved client outcomes: (1) AI and data to infuse generative AI at scale into applications and business processes, leveraging the power of data to drive decisions in real-time; (2) Automation and Application Modernization to improve business and IT productivity with digital labor and create outstanding customer experiences; (3) Security of all touchpoints using AI to drive real-time, automated detection, and an orchestrated response; (4) Transaction Processing software that powers IBM Z; (5) Red Hat, also reported in our Software segment, that delivers our hybrid cloud platform with OpenShift as well as market leading capabilities of Red Hat Enterprise Linux and Ansible." (2023, 12)

AI capabilities on IBM Software: automation for improving app performance and optimizing costs, data for improving productivity through decision-making, hybrid cloud platform (Red Hat) for connecting clouds, developing apps and AI models
“IBM Software … Automation, boosting application performance and optimizing costs across clients’ technology operations and reducing overall complexity; Data, accelerating productivity by infusing AI at scale into applications and business processes to drive decisions in real-time; Hybrid cloud platform (Red Hat), unifying on-prem, public and private clouds, and the edge to scale applications and AI models across environments.” (2024, 11)

IBM Infrastructure
“IBM Infrastructure enables hybrid cloud environments for mission-critical transactions and AI workloads” (2024, 11)

Granite AI models
“Granite family of fit-for-purpose AI models, when tuned with proprietary data, can deliver enterprise-grade generative AI with up to 90% improved cost efficiency. Granite allows clients to bring their own data into the models, and can be trained on that data in weeks, not months.” (2024, 2)
Two strategic platforms for technological transformation: Red Hat OpenShift in hybrid cloud and watsonx in AI
"Client demand for technology to drive business outcomes is accelerating. Our two strategic platforms deliver impact to serve that demand: Red Hat OpenShift in hybrid cloud

and watsonx in AI. These two strategic platforms complement one another. AI benefits from hybrid cloud through seamless access to data and applications across heterogeneous environments. Conversely, hybrid cloud is differentiated by AI's delivery of insights and automation to streamline business, IT, and security processes." (2023, 11)

Watsonx
"Watsonx is our comprehensive AI and data platform, built to deliver AI models and give our clients the ability to manage the entire lifecycle of AI for business, including the training, tuning, deployment, and ongoing governance of those models." (2023, 2)
Hybrid cloud and AI, a key to AI solutions
"Our perspective on technology is clear and consistent: hybrid cloud and AI are helping to usher in a new era of greater productivity, faster insights, better decision-making, and enhanced employee and customer experiences. That is why we have designed our products and services to maximize the business value of hybrid cloud and AI for our clients." …
"These powerful, hybrid cloud environments also allow clients to infuse AI across their business operations." (2022, 2)
"We want to help clients transform their businesses— leveraging our hybrid cloud and AI software to modernize their applications, improve customer service and dramatically cut costs." (2020, 7)
"Our hybrid cloud platform and AI technology and services capabilities support clients' digital transformations and help them engage with their customers and employees in new ways." (2023, 11; 2022, 11; 2021, 11; 2020, 23)
"Our strategy continues to build upon the two technological foundations of AI and hybrid cloud, which clients need to unlock the full value of their data." (2024, 1)

Miscellaneous
New business model adaptation through AI innovation
"Perhaps the most profound and exciting change our clients are experiencing is the adoption of new business models based on digital technologies that IBM is building. This is evident whether you look at the use of AI-powered assistants to offset the massive increase of requests flooding call centers, the meteoric rise of telemedicine, or the use of hybrid cloud to build rich, personalized and secure experiences in areas like digital banking." (2020, 1)

Data as a strategic resource. AI capabilities for data management, insights and predictions
"We have been a pioneer of technologies and services that help clients collect, organize, and analyze their vast data stores and then operationalize AI across their business. Our long-running innovation in automation, data science, and natural language processing is helping clients manage their data as a strategic resource and deploy AI for greater insight and more accurate, trusted predictions." (2019, 30)

Alibaba

Improving consumer experience in e-commerce

How does AI enhance consumer experience in e-commerce

Better search results and recommendations with consumer insights
"The massive amount of user and merchant activities taking place every day on our China commerce platforms generate significant consumer insights. By leveraging proprietary AI and data technologies, we are able to aggregate and build on deep consumer insights to provide more accurate search results and relevant recommendation feeds that enhance the shopping experience for our consumers." (2020, 32; 2021, 27; 2022, 32; 2023, 26; 2024, 24).

Insights through deep learning platform PAI
”Our proprietary, distributed deep learning platform, PAI, has access to insights across diverse businesses involving a rich variety of consumer experiences as well as real-time feedback from clients of Alibaba Cloud. As a result, we believe we are in a unique position to develop large-scale commercial use of AI.“ (2021, 61; 2022, 72; 2023, 54)

Customer understanding through data insights
"Empowered by our AI technology, we develop significant insights from our digital economy. These insights give us a comprehensive understanding of how to correlate diverse profiles of products and services with our consumers’ needs.” (2020, 43)

Alimama providing relevant content that also improves merchant productivity
"The relevance and comprehensiveness of insights based on commercial activity and user activity in our ecosystem as well as our AI capabilities provide a unique advantage for Alimama to deliver the most relevant information to users through highly engaging content and effective format, which in turn enables merchants to improve their efficiency." (2021, 37; 2022, 50; 2023, 35)

AI capabilities in search functions and customer service
“We have applied various AI technologies across our digital economy to enhance the consumer experience. These enhancements include personalized search results and shopping recommendations empowered by deep learning and data analytics, speech recognition and image analysis technology adopted in search functions, and intelligent customer service.” (2018, 86; 2019, 84-85)
“We have applied various AI technologies across our digital economy to enhance consumer experience and business operational efficiency. These enhancements include personalized search results and shopping recommendations empowered by deep learning and data analytics, speech recognition, image and video analysis technologies adopted in search functions, as well as intelligent customer service.” (2020, 64)
"We have applied various AI technologies across our ecosystem to enhance consumer experience and business operational efficiency. These enhancements include personalized search results and shopping experiences as well as various interactive content formats enabled by deep learning and data analytics adopted in search functions, as well

as intelligent customer service, leveraging speech recognition, image and video analysis technologies." (2021, 61; 2022, 72; 2023, 54)

Growing demand through AI solutions
"Lazada (a leading and fast-growing e-commerce platform in Southeast Asia for SMEs) has seen large demand in particular in the apparel, accessories and FMCG categories, where AI recommendations and an efficient search engine have been key drivers for growth." (2020, 47)

Tmall Genie, a smart speaker, works as a shopping assistant
"our AI capabilities enable us to introduce innovative products, such as our AI-enabled Tmall Genie smart speaker." (2019, 84-85; 2020, 64; 2021, 61; 2022, 72; 2023, 54)
"Tmall Genie, our AI-powered voice assistant, helps consumers to shop, order local services, search for information, control smart appliances and play interactive content, including educational stories and music for children." (2018, 82)
"Tmall Genie, our AI-powered smart speaker… It connects our customers with services offered by digital economy participants in an interactive way." (2019, 80; 2020, 57)
24/7 service by an AI chat robot
"we provide services 24 hours a day, seven days a week through an AI chat robot (2020, 60) and merchant service center." (2021, 57; 2022, 68)

Automated customer issue resolution system
"Merchants on our platforms serve their customers with commerce technologies and services we provide. By leveraging analyses on transactions conducted on our platforms and consumer and merchant feedback, we have developed an automated system to facilitate the resolution of many customer disputes. The majority of disputes are handled in real-time." (2022, 68)

Operational efficiencies
What is the impact of AI on operational efficiencies?

Digital transformation improving operational efficiency
"With the onset of generative AI, digital transformation of enterprises and organizations will further accelerate to achieve higher level of operating efficiency and business growth." (2023, 23)
"We have applied various AI technologies across our ecosystem to enhance consumer experience and business operational efficiency." (2021, 61; 2022, 72; 2023, 54)

Improved e-commerce efficiency through AI powered product categorization, and product listings
"Empowered by our AI technology, we develop significant insights from our digital economy."…"We then aggregate and build on these insights to design standardized, themed and interconnected product categorization frameworks throughout our marketplaces that digitalize and standardize product listings effectively on behalf of merchants." (2020, 43)

DingTalk productivity platform offering AI-powered products
"DingTalk unveiled its product integration of launched intelligent capabilities based on Alibaba's Tongyi Qianwen large language model, which help customers and ecosystem partners unlock the potential of AI capabilities." (2023, 50)
"DingTalk has also introduced a suite of AI products and AI agents leveraging Alibaba's Tongyi Qianwen LLM, enabling enterprises to harness AI technology on DingTalk. We believe DingTalk is a highly effective platform that enables enterprises to achieve fully customized digital transformation." (2024, 38)

AI-powered virtual queue solution by Alibaba Cloud
"Genting SkyWorlds Theme Park introduces Alibaba Cloud's AI solution to improve the guest experience and reduce queuing times" … "Malaysia's Genting SkyWorlds Theme Park partnered with Alibaba Cloud to launch an AI-powered Virtual Queue solution that utilizes the latest cloud-based technology to deliver seamless and engaging visitor experiences. Alibaba Cloud's virtual queue reservation leverages advanced AI algorithms to analyze real time intelligence from the waiting time and capacity of the facilities, allowing operations teams to have better crowd control and capacity optimization. With the solution designed by Alibaba Cloud, Genting SkyWorlds can reduce visitor waiting time flexibly and securely, which handles a higher volume of visitors." (2023, 47)

Appendix 2. Supplementary research material regarding the case companies.

Microsoft

Microsoft				
Theme	**Year**	**Application**	**Purpose**	**Type of AI**
Productivity tools	2023	Cloud services & tools	Using data insights	GenAI
	2024	Dynamics 365 apps	Imrpoving operational efficiency	
	2018, 2023, 2024	Microsoft Dynamics 365 Copilot: Dynamics 365 Sales and Viva Sales, Dynamics 365 Customer Service, Dynamics 365 Customer Insights, Dynamics 365 Marketing, Dynamics 365 Business Central, Microsoft Supply Chain Center, and Microsoft Dynamics 365 Supply Chain Management	Reducing repetitive work with insights. For manual work, such as writing meeting summaries, emails, response to inquiries or chats, do calculations, or help with content creation, ideation, and predictions	Traditional AI, predictive AI
	2023, 2024, 2026	Microsoft 365 Copilot	Rerducing manual work in different departments with AI assistance	GenAI
	2023, 2024	Job spesific Copilots: Copilot for Service or Copilot for Sales	For streamlining processes through insights & assistance	
	2026	Copilot Chat, Researcher, Analyst, Copilot Studio, and Copilot Dashboard	AI capabilities in Microsoft's offerings	
	2023	Microsoft Graph & Microsoft 365 apps in M. 365 Copilot	Improving productivity & creativity	
	2023	Microsoft Sales Copilot	Improving trading speed	
	2024	Azure AI	Improving developer productivity	
	2026	Microsoft 365 apps: Word, Excel, PowerPoint, OneDrive, Outlook, and SharePoint	AI assistance / Copilot	
	2018	Microsoft Outlook Mobile	Improved productivity and security	
	2023	Windows 11 & Windows Copilot	Imrpoving developer productivity with AI assistance	
	2023	Microsoft Edge, Bing & Bing Chat	Improved browsing & searching efficiency, content creation	
	2024	Microsoft Fabric	Improved productivity with insights	
	2022	Azure OpenAI Service	Improving coding productivity	
	2024	Azure OpenAI Service	AI assistant helping in routine tasks	GenAI
	2018-2021	Azure Machine Learning Studio & Azure Machine Learning Workbench	Improving developer productivity	
Automation	2023	Power Platform	Workflow automation	GenAI
	2024	Copilot	Workflow and process automation	GenAI
	2024	Copilot Studio	For building autonomous AI-agents	
	2019	Microsoft 365 apps	Automation in apps	
	2019	Microsoft 365	AI capabilities for prediction, translation and insights	Predictive AI
	2023	Supply Chain Platform	Prediction	Predictive AI
	2023	DAX Copilot	Automated documentation	
	2020	Azure Sentinel	Automated threat detection	
	2026	Dynamics 365	For automating business processes	Traditional AI
Creativity, collaboration, & innovation	2018-2022	Microsoft 365 and its AI-powered tools in Office 365, Windows, and Enterprise Mobility + Security	Enhanced creativity, collaboration and innovation in work	
	2024	Pages	Enhanced creativity, collaboration and ideation	
	2023	Edge & Bing	Improved search results and answers, innovation and content creation	ML, LLMs
Cloud services / AI app creation	2023-2024	Microsoft Intelligent Data Platform	Basis for application creation	
	2020-2023	Azure AI	A platform for creating AI services	
	2023	Azure AI	Code & content creation	
	2023	Azure AI	Intelligence & insights for employees	
	2018-2019, 2021-2022	Azure AI	Developer productivity, AI capabilities	
	2020	Azure Machine Learning	For model building	
	2024	Azure AI Studio	For renewing workflows, integrating models with data	
	2018	Azure Cognitive Services, Azure Machine Learning and data services	Unlocking insights	
	2019-2020	Azure Cognitive Services	Comprehensive set of tools	
	2019	Azure Machine Learning	Streamlining AI model developement by adding new AI capabilities: speech-to-text, search, vision, and decision-making	

Customer experience	2024	Dynamics 365 apps	Transforming service, imrpoving CX	ML, predictive AI
	2026	Dynamics 365 apps	Improve customer engagement	AI, ML & data analytics
	2023	Customer Experience Platform	Improving CX with recommendations based on insights	GenAI
	2023	Apps: Dynamics 365 Customer Insights, Dynamics 365 Marketing, Dynamics 365 Sales, Dynamics 365 Customer Service, Dynamics 365 Commerce, Microsoft Advertising, Microsoft PromoteIQ, Microsoft Clarity, Microsoft Azure Synapse Analytics, and Microsoft Purview		
	2022	Microsoft Cloud & Azure	Streamline operations and improve travel experience with insights	AI capabilities, cloud & ML
	2023	Azure OpenAI Service	Voice-assisted booking process	GenAI
	2023	Azure OpenAI Service	Conversational AI through virtual assistant	GenAI
	2020	Azure AI	Personalize CX with insights	Agentic AI
	2024	Dynamics 365 Contact Center	Improving self-service through personalized conversations	
	2024	Dynamics 365 Contact Center	Improve contact center agent work & operational efficiency by providing sentiment analysis, translation, summary, transcription, and other automated routine tasks	
	2026	Microsoft Dynamics 365 Customer Service	Streamline service processes by doing manual tasks & creating lasting customer relationships	
	2026	Microsoft Dynamics 365 Customer Service	AI capabilities/Copilots for service representatives: solving customer problems, providing insights	Automation
	2026	Microsoft Dynamics 365 Customer Service	Self-service: GenAI chatbots, GenAI IVR, automated repetitive tasks & transactions	
	2026	Microsoft Dynamics 365 Customer Service	Providing insights: channel analytics and KPI's, identifying trends and development targets, automating processes, & predicting the staffing levels	
	2024	Microsoft Dynamic 365 Customer Service	Improving service agent productivity by automating tasks and manual searches, increased call resolution time and de-creased misrouted calls with automated call routings	
Miscellaneous	2018-2020	Windows 10	AI interface and experiences	
	2018	AI supercomputer in Azure		

Amazon

Amazon				
Theme	**Year**	**Application**	**Purpose**	**Type of AI**
Customer experience	2023		Improving CX	GenAI
	2023, 2024	AWS services in three layers	Transforming virtually CX, and creating new CX with GenAI	GenAI
	2022		ML-powered services, e.g. personalising recommendations	ML
	2022		Transforming virtually CX, LLMs as a basis for GenAI, learning capabilities	LLMs, GenAI
	2023	Amazon Connect	GenAI capabilities, AWS's cloud contact center	GenAI
	2023	Amazon Q	GenAI capabilities, e.g. recommendations	GenAI, ML
	2024	Amazon Q Business	GenAI assistant for customer support	GenAI
	2023	Amazon Connect Contact Lens	Contact center analytics, summarizing data	GenAI, ML
Productivity tools	2023, 2024	Amazon SageMaker	A GenAI service for AI developers creating services, building own FMs, improving developer productivity	
	2024	Amazon SageMaker	A service for building ML models	
	2023, 2024	Amazon Bedrock	A GenAI service for creating services, customers using existing FMs, tools for building GenAI apps	
	2023	Amazon Lex	For chatbot & IVR system creation (self-service)	
	204	Amazon Bedrock	A service for using FM's, available through API, to make precise decisions based on data modeling and patterns	
	2023	Ready to use GenAI apps	GenAI apps to improve consumer business	
	2023	Amazon Q	A work assistant in AWS	GenAI
	2024	Trainium2	Custom AI silicon chip, an AI service for creating services, ML chip	
	2024	Inferentia2	ML chip	
	2024	Amazon Nova	FMs, an AI service for creating services	
	2024		Tools for AI agent creation	
	2023	AWS HealthScribe	A service for building clinical apps	speech recognition, GenAI
	2024		Productivity, cost savings through customer service, business process orchestration, workflow, translation, etc.	
	2024	Amazon Titan Text Embeddings V2	suited for a variety of tasks such as information retrieval, question and answer chatbots, and personalized recommendations	
	2024	Amazon Titan Image Generator	Image creation & edition	
	2024	Meta Llama 3 FMs	LLMs for text summarization, sentiment analysis, translation, and code generation	

Alphabet

Alphabet				
Theme	**Year**	**Application**	**Purpose**	**Type of AI**
Personalizing customer experience	2023	Google products	ML in products to offer recommendations	ML
	2018	Google products	ML in Google products: translation	ML
	2018, 2019	Google Assistant	Ask questions with voice	ML
	2018	YouTube	Better recommendations	ML
	2024	YouTube	Better recommendations using Gemini	
	2022	YouTube	Autogenerated chapters	
	2023	Dream Screen on YouTube	Creation of AI-generated video or image backgrounds to Shorts	
	2018	Google Photos	Search for people and events	ML
	2022	Google Translate	New languages	ML
	2022	Google Lens	Camera / image search & translation	Optical character recognition
	2022	Google Docs	Text summarization	ML, natural language processing
	2022	Google Maps	Automatically updated information, immersive view	Automation
	2023	Google Search	Autocomplete suggestions	Automation
	2022	Meet	Automatically improved image quality	ML, automation
	2023	Search Generative Experience (SGE), Gmail, Bard	Writing assistance in Gmail, collaboration with GenAI in Bard	GenAI
	2023	Best Take, Magic Editor, and Audio Magic Eraser on Pixel devices	AI-assistive experience	
	2024	Gemini on Pixel, Pixel Screenshots, and Pixel Studio on Pixel devices	AI-assistive experience	
	2024	AI Overviews, NotebookLM	Learning & text processing tools providing answers	
Improved search algorithms	2020	BERT (LLM)	Natural language understanding in search	ML
	2023	MUM & BERT (LLMs)	Better search results for complex queries, voice, images, asking questions with multisearch	
	2022	Multisearch	Search in new languages using both text and images	

Productivity tools	2023	Gemini	Support Google to offer beter services for developers	
	2023	Gemini, amultimodal AI model	Generalize, understand, operate across, combine information, including text, code, audio, images, and video	
	2024	Gemini 2.5 Pro	For tasks requiring advanced reasoning	
	2024	Gemini Live	Brainstorm ideas	
	2024	Gemini app's Canvas	Create web app prototypes	
	2024	Gemini app	E.g. image generation, coding support, app integration	
	2024	Gemini for Google Workspace	Helps users write, organize, visualize, accelerate workflows, and have richer meetings	
	2024	Gemini for Google Cloud	Pre-packaged AI agents for developers, assist to write, document, test, and operate software	
	2022	PaLM AI model	Capabilities for developers in language, reasoning, and code tasks	
	2022	Imagen & Phenaki AI models	Text-to-image model & model for creating videos from text	
	2022	Bard (nowadays Gemini)	GenAI capabilities, LLMs	GenAI, LLMs
	2023	Bard (nowadays Gemini)	Image capabilities, coding support, and app integration	
	2023-2024	Vertex AI platform	A platform for developers to train, tune, augment, and deploy apps with GenAI models	
	2023	Duet AI for Google Cloud	AI agents that assist developers to write, test, document, and operate software	
	2024	Tensor Processing Units	AI chips	
	2019-2020	Google Cloud products	Help to improve operational efficiency	
	2022	Google Cloud	For developing AI apps	
	2023-2024	Google Cloud Platform (Google Cloud offering)	Offering capabilities for AI innovation: AI-optimized infrastructure, AI development platform, AI models, assistive agents & apps	innovation
	2023-2024	Google Workspace (Google Cloud offering)	Offering capabilities for AI innovation: AI-optimized infrastructure, AI development platform, AI models, assistive agents & apps	innovation
	2019	G Suite (nowadays Google Workspace)	Productivity tools: e.g. Gmail, Docs, Drive, Calendar	
	2020	Google Workspace	Collaboration tools: e.g. Gmail, Docs, Drive, Calendar, Meet	
	2022-2023	Google Workspace	Boost collaboration, communication & productivity, automatic summarization for Google Docs & Chat, automate transcriptions, extend the power of smart canvas, tools, including apps like Gmail, Docs, Drive, Calendar, Meet.	Automation
	2023	Duet AI in Google Workspace	Helps users write, organize, visualize, accelerate workflows, and have richer meetings.	
	2018	Advertising tools	Help marketers find the right audience, deliver the right creative, and optimize their campaigns through auto-bidding and measurement tools	ML
	2022	Broad match	A tool that makes it easier to match advertiser offers to search queries	LLMs
	2022	Smart Bidding	To predict future ad conversions and their value	
	2022	MUM (LLM)	Understanding of intent behind language, more precise search-query matching with advertiser offers	
	2023	Google Ads	To find customers and grow business	
	2024	Google Ads	Image generation	
	2024	Demand Gen	Helps reaching target audience	
	2022	Performance Max	AI-powered, goalbased campaign type, optimizing campaigns to reach customers	
	2023	Performance Max	Automatically produce and run ad campaign	Automation
	2023	Search and Shopping ads in Search Generative Experience		
	2023	Product Studio	Helping to create uniquely-tailored imagery of products	
	2020	BERT (LLM)	Natural language understanding in search	ML
	2023	MUM & BERT (LLMs)	Better search results for complex queries, voice, images, asking questions with multisearch	
	2022	Multisearch	Search in new languages using both text and images	

IBM

IBM				
Theme	**Year**	**Application**	**Purpose**	**Type of AI**
Improving customer & employee experience	2020	Watson Assistant	AI-powered virtual agent for business, help to answer questions	
	2018	Watson	Improving weather services: predicting outages with data and AI	Predictive AI
	2018-2019	IBM Watson AI	Improving CX and innovation through digital customer service	
	2018	Watson virtual assistant	Helping employees to optimize customer service	
	2018	IBM Watson	Managing customer service	
	2018	IBM Watson	Helping employees to resolve cases faster with high accuracy	
	2020	IBM Watson Studio, IBM Watson Machine Learning and IBM Cloud Pak for Data	Improve customer and employee experience, and operational efficiency	
	2019	IBM Watson	Personalizing campaigns by discovering customer insights	ML
	2022-2023	IBM Software	AI capabilities: using GenAI to leverage data in decision-making	GenAI
	2024	AI agents	managing customer service, code creation, reasoning	
	2023	watsonx	Improve productivity, simplify workflows, automate manual tasks, code generation, answering inquiries faster	
Productivity tools	2023	watsonx	improve productivity, code quality, and improve CX	
	2021		Automating business processes with AI-driven decision-making	Automation
	2019		Creating intelligent workflows: finding, connecting and analyzing data to uncover insights that can inform intelligent decisions	Data, AI, hybrid cloud
	2022, 2024		Automating processes for productivity	
	2024		Business productivity through the combination of cloud and AI	
	2024	IBM watsonx	AI products for AI app creation	
	2020	Watson (AI for business)	Providing insight into business processes with Watson to improve productivity	
	2018		Providing insight into business processes with Watson to improve productivity	
	2020	Watson Assistant	Helps to create AI services	
	2023	Watsonx	AI and data platform, AI models, access to magane AI for business	
	2020	IBM's AI platform	to add AI into business processes	
	2020, 2024	Hybrid cloud platform	Businesses can transform digitally and deploy AI capabilities through the platform	
	2020-2024	Hybrid cloud + AI	Key to AI solutions & digital transformation, to take advantage of data	
	2024	Red Hat Enterprise Linux AI and OpenShift AI	AI & hybrid cloud platforms, bring together the data, models, governance and monitoring capabilities	
	2022	IBM Software	Capabilities: cloud, data insights, automation	Automation
	2023	IBM Software	Capabilities: AI & data, automation & app modernization, Red Hat for cloud	Automation
	2024	IBM Software	Capabilities: automation, data, cloud	Automation
	2024	IBM Infrastructure	Enable cloud environments for AI	
	2024	Granite AI models	can deliver GenAI	
	2023	Red Hat OpenShift	Strategic platform in cloud for digital transformation	
	2023	watsonx	Strategic platform in AI for digital transformation	
	2020		New business model adaptation through AI innovation	
Miscellaneous	2019		Data as a strategic resource	

Alibaba

Alibaba				
Theme	**Year**	**Application**	**Purpose**	**Type of AI**
AI-powered shopping expereince in e-commerce	2020-2024		Using consumer insight to improve search and recommendations	
	2021-2023	Alimama	Providing relevant content & improving merchant productivity	
	2021-2023		Peronalized search results by interactive content	deep learning, data analytics
	2021-2023		Smart customer service	speech recognition, image & video analysis
	2021-2023	PAI	Deep learning platform to get the consumer insights	
	2018-2023	Tmall Genie	AI-powered smart speaker work as a shopping assistant	
	2021-2022	AI chat robot	24/7 service	
	2022	Customer issue resolution system	Automated system for customer issue resolution	
	2024	Virtual avatar	Assisting shoppers in decision-making	
	2024	Taobao Wenwen	LLM-powered GenAI app, AI-powered shopping assistant	LLM, GenAI
	2020		AI powered product categorization, and product listings	Automation
Productivity tools	2023-2024	DingTalk	Productivity platform offering AI-powered products	
	2023-2024	Tongyi Qianwen	LLM's powering AI products	
	2023	Virtual queue solution by Alibaba Cloud	Genting SkyWorlds Theme Park uses the solutio poweres by advanced AI algorithms to analyse real-time data	
	2024	Aidge	A set of AI-powered tools for sellers	
	2023	Tongyi Qianwen	LLM used for business and app integration, improve user experience	LLM
		Model Studio in Alibaba Cloud	To create customized AI apps	GenAI
		Qwen LLMs in Alibaba Cloud	To create customized AI apps	LLM, GenAI
		PAI (ML-platform)	To create personalized services	