Appendices for “Artificial Intelligence in Digital Service Ecosystems: Towards a Taxonomy and Archetypes”

Appendix 1: Fundamental Characteristics of Resources, Actors, and Agents and their Applicability to Traditional IT and AI

The following table provides an overview of key conceptual characteristics associated with resources, actors, and (non-human) agents as central concepts applied to classify artificial intelligence in service science.

The table includes exemplary sources for each characteristic based on a broader range of literature. The two rightmost columns indicate whether a characteristic is generally (✓), potentially (?), or not (X) applicable to traditional information technology or artificial intelligence, based on the literature and our understanding. Grey-highlighted rows indicate where differences between the two technologies were identified.

The table supports the conceptual discussion in Section 2.2 (The Role of Artificial Intelligence in Service) and informs the taxonomy developed in the manuscript.

Concept	Aggregate Dimensions	Characteristic	Exemplary Sources	Applicable for	
				(Traditional) IT	AI
1 Resources	Resources' role in value co-creation	1.1 Resources are context-dependent and become valuable through integration	Vargo & Lusch, 2004 Vargo & Lusch, 2014 Lusch & Nambisan, 2015	✓	✓
		1.2 Resources are enablers of value co-creation, not recipients	Vargo & Lusch, 2004 Vargo & Lusch, 2016	✓	✓
		1.3 Resources only unfold their value when integrated by actors	Vargo & Lusch, 2016 Tronvoll, 2017	✓	✓
	Nature and composition of resources	1.4 Resources can act (operant) or be acted upon (operand)	Vargo & Lusch, 2004 Vargo & Lusch, 2016 Chou et al., 2023	✓	✓
		1.6 Resources can comprise tangible and intangible components	Vargo & Lusch, 2004 Kleinaltenkamp et al., 2023	✓	✓
	Resource integration as a dynamic process	1.7 Resource integration is an ongoing, dynamic, and adaptive process	Lusch et al. 2008 Mansour & Lindenfalk, 2019 Chou et al., 2023	✓	✓
2 Actors	Actors as resource integrators and value co-producers	2.1 Actors integrate resources to co-produce value	Vargo & Lusch, 2016 Fujita et al., 2018 Chou et al., 2023	✓	✓
		2.2 Actors are able to assign meaning subjectively and experience value-in-use	Lusch & Nambisan, 2015 Tronvoll, 2017	X	?
	Actors are reflexive and purpose-driven	2.3 Actors exhibit intentionality, reflexivity, self-referral and -regulation, purpose, and (in general) agency	Wieland et al., 2012 Lusch & Nambisan, 2015 Tronvoll, 2017	X	?
		2.4 Actors are able to learn and adapt	Lusch et al., 2008	X	✓

			Lusch & Nambisan, 2015 Fujita et al., 2018		
		2.5 Actors are guided by norms and beliefs	Tronvoll, 2017	X	?
	Institutional embeddedness and role fluidity	2.6 Actors shape and are shaped by structures and institutions	Vargo & Lusch, 2014 Vargo & Lusch, 2016 Fujita et al, 2018	✓	✓
		2.7 Actors operate across boundaries and adopt multiple roles	Lusch & Nambisan, 2015 Vargo & Lusch, 2016 Tronvoll, 2017	X	✓
		2.8 Actors engage in networked (A2A) settings (systemic)	Vargo & Lusch, 2016 Mansour & Lindenfalk, 2019 Pakkala & Spohrer, 2019	✓	✓
	Actor scope and accountability	2.9 Actors may include non-human and hybrid forms	Lusch & Nambisan, 2015 Chou et al., 2023	✓	✓
		2.10 Non-human actors remain embedded in governance structures and human accountability	Pakkala & Spohrer, 2019 Beck et al., 2022	✓	✓
3 Agents	Ontological status and enactment of agency	3.1 Agents may include non-human and hybrid forms	Agre 1995 Lusch & Nambisan, 2015 Kleinaltenkamp et al., 2023	✓	✓
		3.2 (Non-human) agents have the capacity to act	Pakkala & Spohrer, 2019 Chou et al., 2023	✓	✓
		3.3 (Non-human) agents do not inherently possess agency; it is enacted through context	Tronvoll, 2017 Kleinaltenkamp et al., 2023	✓	✓
	Autonomy and learning	3.4 (Non-human) agents are able to act autonomously (within defined constraints)	Agre, 1995 Wilga et al., 2024	X	✓
		3.5 (Non-human) agents are able to learn and adapt	Wilga et al., 2024	X	✓

	Interaction and environmental embedding	3.6 (Non-human) agents engage with and can shape their environment	Agre, 1995 Pakkala & Spohrer, 2019 Wilga et al., 2024	✓	✓
	Governance and accountability	3.7 (Non-human) agents require human accountability	Pakkala & Spohrer, 2019 Wilga et al., 2024 Beck et al., 2022	✓	✓
	Functional role and delegation	3.8 (Non-human) agents support or extend actor capacities	Wilga et al., 2024	✓	✓
		3.9 (Non-human) agents operate under (a principal's, i.e. an actor's) delegated decision rights	Jensen & Meckling, 1976 Beck et al., 2022	✓	✓

Appendix 2: Ending Conditions during our Taxonomy Development Process

The following table provides an overview of the objective and subjective ending conditions based on Nickerson et al. (2013) for each of our iterations in developing the taxonomy.

Ending Condition	Iteration					
	1	2	3	4	5	6
All objects or a representative sample of objects have been examined	X		X	X		X
No object was merged with a similar object or split into multiple objects in the last iteration	X	X	X	X	X	X
At least one object is classified under every characteristic of every dimension				X		X*
No new dimensions or characteristics were added in the last iteration				X		X
No dimensions or characteristics were merged or split in the last iteration				X		X
Every dimension is unique and not repeated	X	X	X	X	X	X
Every characteristic is unique and not repeated	X	X	X	X	X	X
Each cell is unique and is not repeated		X		X	X	X
Concise (meaningful number of dimensions)			X	X	X	X
Robust (differentiation among objects sufficient to be of interest)					X	X
Comprehensive (all objects can be classified)		X	X	X	X	X
Extendible (new dimension or characteristic can easily be added)	X	X	X	X	X	X
Explanatory (dimensions and characteristics explain something about an object)				X	X	X

*The characteristic “co-creative” in the dimension “human-AI interaction” has not been classified, as we were unable to identify an AI that is currently to be classified as being intentional, i.e., including its own goals into the interaction with a human actor. However, as we explain in the text (Sections 2.2 and 4.3), we foresee AI to be able to do so in the future. Therefore, we excluded this characteristic from the third objective ending condition and see this ending condition as fulfilled for all other characteristics of every dimension.

Appendix 3: Literature Sample for Taxonomy Development (Iterations 1 & 2)

The following table provides an overview of the relevant articles used in iterations 1 and 2 of the taxonomy development process. Out of an initial pool of 92 articles retrieved from EBSCOhost, Scopus, and Web of Science, 76 were excluded due to duplication or lack of relevance to the research question. These articles were sourced from Information Systems journals and conferences ranked A+, A, or B according to the VHB-JOURQUAL 2024 ranking system and service journals with the same ranking, provided they are positioned within or at the interface of the Information Systems discipline. The remaining 16 articles were expanded through backward and forward citation searches, resulting in a final set of 31 articles that form the conceptual foundation for iterations 1 and 2 of the taxonomy development.

ID	Author(s)	Year	DOI or URL
1	Allam & Dhunny	2019	https://doi.org/10.1016/j.cities.2019.01.032
2	Basole	2021b	https://aisel.aisnet.org/hicss-54/os/innovation/9/
3	Basole	2021a	https://aisel.aisnet.org/hicss-54/os/managing_ecosystems/10/
4	Beverungen et al.	2022	https://doi.org/10.1007/s12525-022-00553-z
5	Beverungen et al.	2021	https://doi.org/10.1108/JOSM-03-2020-0066
6	Conti	2010	https://doi.org/10.1080/14783363.2010.487701
7	Huang & Rust	2018	https://doi.org/10.1177/1094670517752459
8	Kaartemo & Helkkula	2024	https://doi.org/10.1108/JOSM-03-2023-0104
9	LeCun et al.	2015	https://doi.org/10.1038/nature14539
10	Mehta et al.	2021	https://doi.org/10.1109/ICCMC51019.2021.9418360
11	Mikalef & Gupta	2021	https://doi.org/10.1016/j.im.2021.103434
12	Mucha & Seppäla	2020	https://www.econstor.eu/bitstream/10419/237361/1/ETLA-Working-Papers-76.pdf
13	Neuhofer et al.	2021	https://doi.org/10.1007/s12525-020-00433-4
14	Nishant et al.	2020	https://doi.org/10.1016/j.ijinfomgt.2020.102104
15	Pang & Lee	2008	https://doi.org/10.1561/1500000011
16	Porter & Heppelmann	2014	https://hbr.org/2014/11/how-smart-connected-products-are-transforming-competition
17	Purwins et al.	2019	https://doi.org/10.48550/arXiv.1905.00078
18	Reuter-Oppermann et al.	2021	https://aisel.aisnet.org/hicss-54/hc/process/3/
19	Schmidt et al.	2022	https://aisel.aisnet.org/hicss-55/in/ai_based_assistants/5/
20	Schmidt et al.	2023	https://doi.org/10.1007/s12525-023-00671-2
21	Schreieck et al.	2024	https://doi.org/10.1080/07421222.2024.2340825
22	Shi et al.	2024	https://aisel.aisnet.org/hicss-57/cl/ai_and_future_work/9/
23	Shollo et al.	2022	https://doi.org/10.1016/j.jsis.2022.101734
24	Singh & Goyal	2023	https://doi.org/10.1016/j.jclepro.2023.138228
25	Stahl	2022	https://doi.org/10.1016/j.ijinfomgt.2021.102441
26	Toorajipour et al.	2024	https://doi.org/10.1016/j.ijinfomgt.2024.102804
27	Weber et al.	2022	https://doi.org/10.1111/isj.12567
28	Wirtz & Pitardi	2023	https://doi.org/10.1007/s43039-023-00076-1
29	Wirtz et al.	2023	https://doi.org/10.1177/10946705221130467
30	Wünderlich et al.	2015	https://doi.org/10.1108/JSM-01-2015-0040
31	Zhao et al.	2015	https://doi.org/10.1080/23270012.2014.968643

Appendix 4: Questionnaire Used During the Interviews (Iteration 3)

The subsequent table provides an overview of the questionnaire (structure) that guided the ten individual semi-structured interviews with industry experts. Warm-up questions, introductory remarks, explanatory notes, clarification checks, expressions of gratitude, and transcripts have been omitted for brevity.

No.	Topic	Question	Optional sub-questions
1	Person	Please briefly describe yourself and your experience with artificial intelligence/ machine learning.	Please tell me about your age, gender, marital status, place of residence, and your occupation or industry you are working in.
2	Context, experience & industry	Please briefly tell me about your experience with artificial intelligence/ machine learning.	▪ To what extent are you interested in new, innovative technologies such as machine learning/ artificial intelligence? ▪ To what extent have you already gained experience with machine learning/ artificial intelligence?
3	Ecosystem data	To what extent does artificial intelligence/ machine learning process data within digital ecosystems?	▪ To what extent does machine learning/ artificial intelligence process data from different data origins? ▪ What data types does machine learning/ artificial intelligence process?
4	Perceived ecosystem embed-dedness	To what extent is artificial intelligence/ machine learning embedded in digital ecosystems?	▪ In which forms or technologies do you perceive machine learning/ artificial intelligence? ▪ To what extent do the locations where you perceive machine learning/ artificial intelligence differ? ▪ In what ways is machine learning/ artificial intelligence, including its activities, visible?
5	Perceived behavior	To what extent does AI take over tasks typically performed by (human) actors in digital ecosystems?	▪ What specific tasks are performed by machine learning/ artificial intelligence? ▪ What level of autonomy do you perceive when machine learning/ artificial intelligence handles tasks?
6	Further aspects	What other aspects do you consider relevant?	Thank you very much for sharing your insights. I have no further questions at this point. ▪ Are there any additional aspects related to this topic that you feel we have not yet discussed? ▪ Is there anything else you would like to add?

Appendix 5: Category System and Applied Coding Rules (Iteration 3)

The coding rules in the following table were applied to process the material from the semi-structured interviews. The coding was conducted twice, once deductively (guided by the findings from the literature review) and once inductively (for new dimensions and characteristics not being part of the literature sample).

	Dimension	Coding rule	Sub-category	Coding rule	Illustrative statement
Ecosystem Data	Data origin	All statements assigned to this category refer to data origins within digital ecosystems.	Internal data	All statements assigned to this sub-category refer to data originating from internal processes of an actor or organization.	*"In the public water sector, for example, most data collected through IoT devices in individual households already qualifies as internal data at the point of collection. It is immediately managed and stored internally on the organization's own server. Consequently, I see internal data as particularly relevant in specific contexts" (interviewee 8).*
			External data	All statements assigned to this sub-category refer to data originating from external sources (including actors, organizations, databases, etc.) within the ecosystem.	"*While internal data is undoubtedly important, external data often plays a pivotal role. Tapping into various sources, such as raw material prices or news, is critical, particularly in application contexts like supply chain management. External data is, therefore, key" (interviewee 8).*
			Both internal and external data. (This characteristic was removed as a result of	All statements assigned to this sub-category refer to data originating from a combination of internal processes and external ecosystem sources (e.g.,	*"To establish benchmarks and effectively support the learning approach in machine learning, I consider it essential to use both internal and external data whenever machine learning algorithms are applied. Only through this*

			the focus group sessions in iteration 4).	datasets combining customer feedback with industry reports).	*combination can the algorithm truly be optimized" (interviewee 4).*
	Types of processed data	All statements assigned to this category refer to data types within digital ecosystems.	Image data	All statements assigned to this sub-category refer to visual data, such as photographs, video frames, images, or pixel-based information.	*"For example, images of warehouses can be used to perform inventory measurements" (interviewee 6).*
			Text data	All statements assigned to this sub-category refer to written or typed language data, such as documents, posts, chat logs, or other textual formats.	"T*ext data is certainly important, as not everything can be captured through images. Input such as age, gender, or medical history of individuals can be essential, for example in medical contexts" (interviewee 5).*
			Audio data	All statements assigned to this sub-category refer to sound-based data, such as recordings, speech recognition, music files, or any other acoustic input.	*"Audio files could become highly relevant, perhaps more so in the future. Consider applications like voice assistants or Google searches—analyzing aspects such as tone of voice or emotional state could help determine, for example, whether it is worthwhile to target advertising to a depressed user" (interviewee 5).*
Perceived ecosystem embeddedness	AI form	All statements assigned to this category refer to perceived AI forms within	Smart device	All statements assigned to this sub-category refer to AI being perceived to be embedded in single, smart devices, such as smartphones, self-driving vehicles, or service robots.	*"The embedding of AI depends on the context. Some applications are well-suited for implementation as smart products, while others are more aligned with a platform-based approach" (interviewee 4).*
			Digital platform	All statements assigned to this sub-category refer to	*"The embedding of AI depends on the context. Some applications are well-suited for*

		digital ecosystems.		AI being perceived to be part of digital platforms like intelligent chatbots or generative AI.	*implementation as smart products, while others are more aligned with a platform-based approach" (interviewee 4).*
	AI location	All statements assigned to this category refer to perceived AI locations within digital ecosystems.	User/ customer	All statements assigned to this sub-category refer to AI operating locally within the customer space.	*"Some applications must reside directly with the user to enable them to draw their own conclusions from the data" (interviewee 3).*
			Provider	All statements assigned to this sub-category refer to AI operating within the service provider space.	*"In some cases, AI is better embedded with the provider, allowing them to market and channel their products more effectively" (interviewee 9).*
			External third party	All statements assigned to this sub-category refer to AI operating within an (unknown) external party space.	*"Organizations must ask themselves: Do you have the expertise and resources to maintain, implement, or develop machine learning solutions internally? If not, you need to rely on external resources" (interviewee 2).*
	AI visibility	All statements assigned to this category refer to perceived AI visibility within digital ecosystems.	Visible	All statements assigned to this sub-category refer to AI being visible to customers when operating in frontstage capacity such as chatbots or robots.	*"[Sometimes,] when the core solution is already integrated into a device itself, it often results in a visible improvement [through AI]" (interviewee 5)*
			Invisible	All statements assigned to this sub-category refer to AI being invisible to customers when operating backstage, i.e., while supporting human service providers.	*"As a user, I think I sometimes just don't care. I want personalized advertising, I provide the data, and I'm indifferent to who ultimately uses it. I don't see it anyway, and it shouldn't be traceable back to individual users" (interviewee 1).*

			Partially visible	All statements assigned to this sub-category refer to AI being partially visible to customers when AI operates frontage as well as backstage.	*"While AI visibility might not always be necessary, it can be important for users to know that AI operates in the background. […] Making the process visible—such as explaining that data is transmitted anonymously but patterns are derived to provide suggestions—can build trust" (interviewee 5).*
Perceived behavior	Assumed task	All statements assigned to this category refer to perceived AI tasks within digital ecosystems.	Data collection	All statements assigned to this sub-category refer to AI being perceived to collect data.	*"Data collection is the first and most essential step. Without it, no necessary analysis could occur—and that's exactly what I aim for" (interviewee 5).*
			Data structuring	All statements assigned to this sub-category refer to AI being perceived to structure data.	*"Data must be structured and prepared, for example, to ensure pseudonymization or anonymization. It's essential to focus on the key aspects, which might involve duplicating certain elements if necessary" (interviewee 5).*
			Data analysis	All statements assigned to this sub-category refer to AI being perceived to analyze data.	*"Analysis is crucial, leveraging data from other sources or [including] various factors to support decision-making" (interviewee 5).*
			Decision support	All statements assigned to this sub-category refer to AI being perceived to make decisions.	*"It is important to emphasize that AI does not make decisions. However, it provides guidance to a certain extent. In specific scenarios, AI can be applied effectively to support decision-making" (interviewee 8).*
			Coordination	All statements assigned to this sub-category refer to AI being perceived to coordinate.	*"[In certain human resource applications], decisions are automatically supported [by AI], as filters or criteria are applied to determine whether candidates proceed to the next stage or are declined. This process is essentially a coordination task, as allowing a candidate to proceed to the interview stage also enables*

					administrative processes to be coordinated effectively" (interviewee 5).
	Degree of autonomy	All statements assigned to this category refer to perceived AI autonomy within digital ecosystems.	Supportive/ assisting	All statements assigned to this sub-category refer to AI being perceived to support and assist service providers to serve customers.	*"In certain scenarios, such as capital investments, AI can play a supporting role in reducing risk. However, I believe quality assurance must always be carried out by humans" (interviewee 10).*
			Autonomous	All statements assigned to this sub-category refer to AI being perceived to substitute the service providers while serving customers.	*"In many cases, the impact is not significant enough to require human involvement. These tasks can be handled autonomously" (interviewee 2).*
Perceived value Important note: The category perceived value was (completely inductive) identified under miscellaneous aspects. We used the following	Internal value	All statements assigned to this category refer to perceived internal AI value within digital ecosystems.	Increased convenience	All statements assigned to this sub-category refer to AI being perceived to increase convenience.	*"For instance, automating repetitive tasks […]. This includes everything from automated order processing and sending offers to customers to intra-logistics" (interviewee 3).*
			Saved time	All statements assigned to this sub-category refer to AI being perceived to save time.	"*Strong automation saves time and improves quality standards, especially in product testing" (interviewee 3).*
			Improved quality	All statements assigned to this sub-category refer to AI being perceived to improve quality.	"*Strong automation saves time and improves quality standards, especially in product testing" (interviewee 3).*
			Enhanced resource planning	All statements assigned to this sub-category refer to AI being perceived to plan resources.	"*Resource optimization and risk reduction also exist, particularly in the supply chain" (interviewee 3).*

question: "What other aspects do you consider relevant?"			Reduced risk	All statements assigned to this sub-category refer to AI being perceived to reduce risks.	"*It extends to production scheduling that learns to identify risks and properly sequence orders" (interviewee 3).*
	External value	All statements assigned to this category refer to perceived external AI value within digital ecosystems.	Product and service extension	All statements assigned to this sub-category refer to AI being perceived to extend the product and service portfolio.	*"I don't just want to optimize, but also ensure that my supply chain availability is better than that of competitors. This naturally leads to product and service improvements, […] which in turn result in increased customer satisfaction and retention" (interviewee 9).*
			Business model extension	All statements assigned to this sub-category refer to AI being perceived to extend the business model.	*"I can also say, okay, I no longer have just one […] product, but […] now also an additional app. This means I'm offering not only the product but also additional services that extend my business" (interviewee 2).*
			Increased customer retention	All statements assigned to this sub-category refer to AI being perceived to increase customer retention.	*"I don't just want to optimize, but also ensure that my supply chain availability is better than that of competitors. This naturally leads to product and service improvements, […] which in turn result in increased customer satisfaction and retention" (interviewee 9).*

Appendix 6: Quality Criteria for Qualitative Content Analysis

The following quality/ trustworthiness criteria for qualitative studies after Lincoln and Guba (1985), were rigorously adhered to, as positively checked in the table below.

Quality criteria (Lincoln & Guba 1985, pp. 294-300)	**Assessment of the criterion**
Truth value Credible results are ensured through re-evaluation of assumptions, triangulation of data sources, and communicative validation.	**Positive.** The derived categories and coding rules were iteratively revised. In addition, communicative validation was achieved through the focus group discussions.
Applicability The results can be transferred to other contexts through detailed descriptions of the research context and interview participants.	**Positive.** Detailed information about the study design, sample composition, and data collection techniques is provided both in the main body of the paper and in the appendix document.
Consistency The research can be replicated as often as desired and will yield the same results under identical conditions.	**Positive.** Due to the detailed documentation of the methodical procedures, including the coding rules and clear definitions of the categories, the research can be replicated as often as desired and is expected to yield similar results.
Neutrality An objective stance towards the research subject is maintained by adopting a value-neutral attitude.	**Positive.** The researchers approached the study content at all times without prejudice or preconceived notions.

Appendix 7: Questionnaire for the Focus Group Sessions (Iteration 4)

In two qualitative focus groups conducted with the same experts from the interview study, the extended version of the taxonomy (iteration 3) and its usefulness were discussed until mutual agreement was achieved. The characteristics of the taxonomy were streamlined before the experts confirmed all dimensions. Detailed notes were taken during the focus group sessions to capture the key discussion points. The following table encompasses the guiding questions following Nickerson et al. (2013) used within the focus groups to check the usefulness of our taxonomy.

Criteria (Nickerson et al. 2013)	**Guiding question**
Consciousness	To what extent does the taxonomy appear simple and effective (parsimonious) for describing real-world cases? Which dimensions and/or characteristics may be obsolete?
Robustness	To what extent do the dimensions and characteristics remain consistently applicable to new or more complex cases?
Comprehensiveness	To what extent does the taxonomy cover all relevant properties necessary to describe AI as an agent in digital service ecosystems?
Extendibility	To what extent can additional dimensions and characteristics be easily integrated, if needed?
Explanatory power	To what extent does the taxonomy help explain differences or patterns across cases?

Appendix 8: Case Comparison and Taxonomy Application (Evaluation of Taxonomy)

The following table provides information about the 12 illustrative cases enabling a cross-case comparison and pattern recognition to identify similar applications of AI sharing similar taxonomic profiles, being part of the derivation of the four AI archetypes, following the method of Kluge (2000).

Case Study			Ecosystem data		Perceived ecosystem embeddedness			Perceived behavior				Perceived value		Archetype
ID	Case name	Short case description	Data origin	Type of processed data	AI form	AI location	AI visibility	Assumed task	Resource output	Human-AI interaction	Degree of autonomy	Internal value	External value	
1	UPS Orion	AI-based delivery route optimizer	Internal data, external data	Text data	Smart device	Provider	Invisible	Data analysis, decision support	Operand resources	Instrumental	Supportive/ assisting	Saved time, enhanced resource planning, reduced risks	Increased customer retention	Discriminative Experience Enhancer
2	Netflix	AI-driven recommender system for movies and shows	Internal data	Image data, text data	Digital platform	Provider	Invisible	Data structuring, data analysis, decision support	Operand resources	Instrumental	Supportive/ assisting	Increased convenience, saved time, improved quality	Increased customer retention	Discriminative Experience Enhancer
3	Sephora	Virtual AI artist for customized beauty advice	Internal data	Image data, Text data	Smart device	Provider	Partially visible	Data analysis, decision support	Operand resources	Instrumental	Supportive/ assisting	Increased convenience, saved time, improved quality, reduced risks	Product and service extension, increased customer retention	Discriminative Experience Enhancer
4	Stitch Fix	AI that curates personalized clothing selections and creation	Internal data, external data	Image data, text data	Digital platform	Provider	Partially visible	Data collection, data structuring, data analysis, decision support	Operand resources	Instrumental	Supportive/ assisting	Increased convenience, saved time, improved quality	Increased customer retention	Discriminative Experience Enhancer
5	PayPal	AI-powered fraud detection system for financial transactions	Internal data, external data	Text data	Digital platform	Provider	Invisible	Data collection, data structuring, data analysis, coordination	Operant resources	Instrumental, delegated/ proxy	Supportive/ assisting	Reduced risks	Product and service extension, increased customer retention	Protective Ecosystem Orchestrator
6	Darktrace	AI-driven cybersecurity system that safeguards against cyberattacks	Internal data, external data	Text data	Digital platform	Provider, external third party	Partially visible	Data collection, data structuring, data analysis, coordination	Operant resources	Instrumental, delegated/ proxy	Autonomous	Reduced risks	Product and service extension, increased customer retention	Protective Ecosystem Orchestrator
7	Amazon's Lex chatbots	AI-powered chatbot that can be individualized for customer conversations	Internal data, external data	Text data, audio data	Digital platform	User/ customer, provider	Visible	Data collection, data structuring, data analysis, decision support, coordination	Operand resources, operant resources	Delegated/ proxy	Autonomous	Increased convenience, saved time, improved quality, reduced risks	Product and service extension, business model extension, increased customer retention	Ecosystem Innovation Companion

8	Siemens Industrial Copilot	AI tool helping with building solution for predictive maintenance in manufacturing	Internal data	Image data, text data, audio data	Digital platform	User/ customer, provider	Visible	Data collection, data structuring, data analysis, decision support	Operand resources, operant resources	Delegated/ proxy	Autonomous	Increased convenience, saved time, improved quality, enhanced resource planning, reduced risks	Product and service extension, business model extension, increased customer retention	Ecosystem Innovation Companion
9	Adobe Sensei	AI assistant for analyzing, creating, and editing digital content	Internal data, external data	Image data, text data, audio data	Digital platform	User/ customer, provider	Partially visible	Data collection, data structuring, data analysis, coordination	Operand resources, operant resources	Instrumental, delegated/ proxy	Supportive/ assisting	Increased convenience, saved time, improved quality	Business model extension, product and service extension, increased customer retention	Personalized Service Composer
10	Spotify	Personalized AI playlist curator	Internal data	Text data, audio data	Digital platform	User/ customer, provider	Visible	Data structuring, data analysis, decision support, coordination	Operand resources	Instrumental, delegated/ proxy	Autonomous	Increased convenience, saved time, improved quality	Increased customer retention	Personalized Service Composer
11	Google Maps	Chatbot in Google Maps to discover new places and personalized recommend-dations	Internal data, external data	Image data, text data	Digital platform	User/ customer, provider	Visible	Data structuring, data analysis, decision support	Operand resources	Instrumental, delegated/ proxy	Supportive / assisting, autonomous	Increased convenience, saved time, improved quality	Product and service extension, increased customer retention	Personalized Service Composer
12	OpenAI's DALL·E	Visual content from textual descriptions	Internal data, external data	Image data, text data	Digital platform	User/ customer, provider	Visible	Data collection, data structuring, data analysis, coordination	Operand resources	Delegated/ proxy	Autonomous	Saved time, improved quality	Product and service extension, business model extension	Personalized Service Composer