

## **Voice Assistants in Hospitality: Using Artificial Intelligence for customer service.**

**Purpose** – Voice Assistants (VAs) empower human-computer interactions by recognising human speech and implementing commands pronounced by users. This paper investigates VA-enabled interactions between hotels and guests in the hospitality context. The research positions VAs within the Artificial Intelligence (AI) enabled Internet of Things (IoT) context, disrupting old practices and processes. Smart hospitality uses VAs to support effortless value cocreation for guests cost-effectively. The research examines consumer perceptions and expectations of hospitality VAs and explores VA capabilities through expert technology providers.

**Design/methodology/approach** – This empirical paper investigates current use and future implications of VAs for hotel environments. It uses qualitative, semi-structured in-depth interviews with 7 expert hospitality VA technology providers and 21 hotel guests who have VA experience. The research adopts a demand and supply approach, addressing the VAs in hospitality holistically.

**Findings** –The findings illustrate the requirements from both end-users' sides, hotels and guests, exploring VA advantages and challenges. The analysis demonstrates that VAs increasingly become digital assistants. VA technology helps hotels to improve customer service, expand operational capability and reduce costs. Although in its infancy, VA technology has made progress towards optimising hotel operations and upgrading customer service. The study proposes a speech-enabled interactions model.

**Originality** – VA studies are often focused on the technology in private households, rather than in commercial or hotel spaces. This paper contributes to the emerging literature on AI and IoT in smart hospitality and explores the acceptance and operationalisation of VAs. The research contributes to the conceptualisation of VA enabled hotel services and explores positive and negative features as well as future prospects.

**Research limitations/implications** – This research stimulates the transformation of hospitality services by using VAs and the development of smart hospitality and tourism ecosystems. The study can benefit from further research with hotel managers, to reflect hoteliers' points of view and investigate their perception of VAs. Further research can also explore different aspects of consumer-VA interaction in different contexts.

**Practical implications** –The paper makes a significant contribution to hospitality management and human-computer interaction best practice. It supports technology providers to reconsider how to develop suitable technology solutions towards improving their strategic competitiveness. It also explains how to use VAs cost-effectively and profitably whilst adding value to travellers' experience.

## Introduction

Technology introduces a range of innovations in the emerging smart hospitality industry (Buhalis and Leung, 2018; Law, et al, 2014), transforming all processes (Liang-Pholsena, 2020; Tussyadiah, 2020a, 2020b; Samala, 2020; Paluch *et al.*, 2020; Mihalic and Buhalis, 2013). While guests are getting more technologically competent in their everyday lives, hotels also modernise through innovative approaches to service delivery. Cobanoglu, et al (2011) have established the impact of technology on guest overall satisfaction. Intelligent systems are an integral part of the tourism industry (Gretzel, 2011) and determine competitiveness based on smartness (Buhalis, 2020).

From robots with Artificial Intelligence (AI) to the Internet of Things (IoT) (Buhalis *et al.*, 2019), hotels have been experimenting with smart technologies and digital strategies (Go, et al, 2020). AI, robots and similar technologies are deployed widely (Ivanov and Webster, 2020). Voice Assistants (VAs) can be defined as voice-activated artificial intelligence devices. They display some level of intelligence through digital interfaces and have the ability to mimic intelligent human behaviour (Poushneh, 2021). VAs are progressive technologies, although they have to overcome issues such as limited awareness of their technical capabilities, user frustration and a certain degree of hostility from both hotel guests and staff (Lukanova and Ilieva, 2019). VAs gradually find their way in hotel operations and in hotel rooms. This research investigates VAs by exploring the views of both users/customers and suppliers/providers.

### ***Voice Assistants empowered by Smart hospitality and the Internet of Things***

VAs are part of the technology developments through the deployment of AI and the IoT. Buhalis (2020) suggests that smartness “takes advantage of interconnectivity and interoperability of integrated technologies to reengineer processes and data in order to produce innovative services, products and procedures ensuring stakeholder value maximisation”. Gretzel *et al.* (2015) defined smart tourism “as tourism supported by integrated efforts at a destination to collect and aggregate/harness data derived from physical infrastructure, social connections, government/organizational sources and human bodies/minds in combination with the use of advanced technologies to transform that data into on-site experiences and business value-propositions with a clear focus on efficiency, sustainability and experience enrichment.” “Interoperability is the key requirement in smart hospitality, as disparate systems can interconnect and exchange information, among public and private organisations.” (Buhalis and Leung, 2018)

Smartness is not about automation, but about value ecosystems that use big data and processes dynamically to optimise network outcomes for all stakeholders. The IoT is a prerequisite of smart hospitality, supporting networking and optimisation for the entire digital ecosystem. Smart technology consists of three main layers: a network layer represented by the IoT; a cloud data layer built around Big Data and Cloud Computing; and an Artificial Intelligence (AI) layer, responsible for analysis, decision-making, and predictions (Buhalis and Leung, 2018). The hospitality industry is the second biggest buyer of IoT devices worldwide, after the health industry (Fischbach, 2019). While providing guests with a high level of personalisation, IoT devices improve the efficiency of hotel operations (Leonidis et al, 2013) and sustainability (Nadkarni *et al.*, 2019). They also reduce dependence on specific suppliers (Porter and Heppelmann, 2014) and support cost control and profitability. Sensors are employed widely in hotel monitor facility systems, (e.g., lifts, lighting, heating, ventilation, and air conditioning to collect big data which, in combination with historical data from databases and external real-time data), and empower hotels to create tailored services, boost guest satisfaction and loyalty (Buhalis and Leung, 2018). Some examples of IoT devices in hotels include: security alarms, beacons, thermostats, light switches, smart TVs, electric blinds, mobile app-

driven smart room keys, smart mirrors, customisable walls, and VAs (Buhalis and Leung, 2018; Car *et al.*, 2019; Fischbach, 2019; Nadkarni *et al.*, 2019; Jabeen, *et al.*, 2022),

VAs emerge as AI- and IoT- enabled technologies in hotels. VAs are effectively virtual service robots based on speech recognition (McCartney and McCartney, 2020; Paluch and Wirtz, 2020, Wirtz *et al.*, 2021). Voice triggers VAs to perform specific actions (Pemberton, 2018), encouraging a more natural style of human-machine interaction (Petrov, 2019) in comparison to traditional touchscreens or remote controls. VAs' speech recognition capabilities process human voice inputs, using AI and enable VAs to generate coherent outputs. Conversational AI normally consists of Automatic Speech Recognition (ASR), Natural Language Processing (NLP) and Text-to-Speech (TTS) (Ram *et al.*, 2018). These touchless and screenless user interfaces became very popular in IoT ecosystems. VAs are mainly adopted in private settings, such as home or offices. Zwakman, *et al.*, (2021) explain that the VAs have certain limitations, especially for understanding natural language. Motta and Quaresma (2021) indicate that VA "usability varied across tasks regarding task completeness, error number, error types, and user satisfaction. Checking the weather and making phone calls had the best usability measures, followed by playing songs and sending messages. Adding appointments to a calendar and searching for information were the most incomplete and frustrating interactions. Usability-related factors such as perceived ease of use and the interaction's hands/eyes-free nature influenced task adoption". Improvements in usability, task requirements and user perceptions are required to leverage VAs' usability and adoption.

The main bottleneck of using a VA is that the user cannot know all the commands (Park, *et al.* 2020) "Besides perceived ease of use and perceived usefulness, the quality and diversity of a system, its enjoyment, consumer's technology optimism and risk (surveillance anxiety and security/privacy risk) strongly affect the acceptance of smart speakers" (Kowalczyk, 2018). Fernandes and Oliveira (2021) explain that although functional, social and relational elements drive adoption, "anthropomorphism is not universally positive and adds a new perspective regarding the underexplored role of customer-robot rapport building". Effort expectation has a strong positive impact on consumers' usage experience (Moriuchi, 2021). Consumers follow four paths to trust in smart technology: on one path, consumers relate their trust to the perceived personality of the technology's voice interface and on three non-anthropomorphism-based trust paths (Foehr & Germelmann, 2020). While functional elements drive user attitude toward using VAs, the social attributes, being social presence and social cognition, are the unique antecedents for developing trust (Pitardi and Marriott, 2021).

VAs are gradually making their way to public spaces, including hotels (Klaus and Zaichkowsky, 2020). VA-empowered consumers-brand communications can be beneficial for hotels (Cramer, 2018). The Hospitality Technology (2018) study named AI-powered voice solutions as a top impacting technology and VAs as one of the most important new investments in technology for hotels. After a series of experiments with the installation of VAs in hotel rooms in 2018, Amazon partnered with Marriott International and introduced its hotel room hub, Alexa for Hospitality, in the US. The same year, Baidu started their cooperation with InterContinental Hotels Group in China. In 2020, Google began its active penetration into the US hotel market by adding new hotel-purposive features to its Nest Hub, in addition to the simultaneous interpretation functionality launched in 2019 (Sorrells, 2020).

To explore the use of VAs in hospitality customer service, this research investigates the needs and requirements of both users/customers and suppliers/providers. Appreciating VA capabilities can promote their development, adoption and engagement in hospitality services. Understanding user requirements and investigating possible fears and inhibitions can also lead to improvements in adoption rates and utilisation.

## Methodology

As a new research area, VAs are not fully explored in academic literature. Comprehensive secondary research was undertaken and included not only academic journal articles but also industry and consultancy reports, briefings and product descriptions. These provided a range of different perspectives, explaining the evolution and utilisation of VAs. Academic articles mainly research customer adoption and benefits for home use. There is inefficient literature on VAs adoption in hospitality and what benefits this technology brings.

An inductive qualitative research approach (Denzin and Lincoln, 2017) was adopted to fulfil the research purpose. Semi-structured interviews were selected as the source of primary data to explore the role and usability of VAs holistically, from both the expert hospitality technology provider and hotel guest perspectives. This study investigated their interpretations of the phenomena from the interpretivist/constructivist perspective (Taylor *et al.*, 2015). Following the government safety guidelines during the COVID-19 lockdown periods and aiming to get insights from as many geographical locations as possible, all interviews were conducted online, either via Zoom (synchronously) or Email (asynchronously), according to participants' preferences.

On the VAs supply side, 78 technology providers were found participating at the VOICE Global Summit and on-line media publications and were invited to an interview via email. As a result, 7 in-depth personal interviews were conducted with expert hospitality technology providers with professional expertise in VA implementation (Table 1). Interviews focused on the latest technological developments, the value propositions and the arguments towards adopting this technology. Although it is appreciated that they have a marketing and sales motivation, they are nevertheless driving technological developments and promote adoption based on value propositions for hotels and guests. They also have indepth knowledge in the different systems used in the marketplace.

**Table 1. Hospitality Technology Providers Profile**

Participant's No.	Country	Job Position
P1	UK	Company Director
P2	US	Founder
P3	US	Business Development Director
P4	France	Chief Technology Officer
P5	UK	Chief Executive Officer
P6	UAE	Company Director
P7	UAE	Sales & Marketing Coordinator

On the demand side, a better understanding of hotel guest requirements is essential for the development of VAs in hospitality. Those who have personal experience of using VAs at home are generally better equipped to embrace VA technological innovations. This research targeted travellers that have stayed in hotels in the last year and also use VAs at home or at work. Social media posts enabled to find or to be referred to experienced VA users. Their expectations, requirements and perceptions of a hotel VAs was examined. Out of 27 consumers contacted, 23 (85.19%) responded and 21 (77.78%) in-depth personal interviews were conducted (Merriam and Tisdell, 2015). Consumers were selected to be regular VA users in their regular home or office environment and also

to be regular travellers staying in hotels (Table 2). They are familiar with VA usage and functionality and they also have already expectations from hotel VAs.

**Table 2 Participants' Profiles: Consumers**

Participant	Age	Country	Brand(s) of personal voice assistant(s) in use
C1	32	Ukraine	Alexa
C2	34	Ukraine	Google Home Mini, Apple Siri
C3	32	UK	Alexa
C4	32	Bermuda	Amazon Echo Dot (Alexa)
C5	29	Netherlands	Alexa, Apple Siri
C6	29	Netherlands	Amazon Echo (Alexa), Apple Siri
C7	24	Netherlands	Google Home, Apple Siri
C8	35	US	Google Nest Mini, Google Home Mini
C9	36	Ukraine	Alexa, Google Assistant, Apple Siri
C10	34	UK	Google Home, Alexa
C11	33	UK	Amazon Echo Dot (Alexa)
C12	33	UK	Amazon Echo Dot (Alexa)
C13	32	UK	Alexa
C14	33	Germany	Google Nest
C15	37	UK	Google Home and Amazon (Alexa)
C16	38	Spain	Apple Siri
C17	34	Poland	Google Assistant
C18	26	UK	Google Home
C19	35	UK	Google Assistant
C20	38	UK	Alexa Echo Dot, Google Assistant
C21	38	UK	Alexa

This research was conducted using semi-structured interviews (Charmaz, 2006). A range of open-ended questions (Table 3) were created based on the literature review. These were used as discussion guide in the in-depth interviews with both VA suppliers and users. The interview questions provided the basis for an in-depth discussion with interviewees and they were encouraged to express their feelings and opinions openly. Interviewees were encouraged to discuss about the utility and value VAs bring in both their daily life and also in the hospitality context.

Table 3 Interview structure questions

1. How can you describe the current role of digital voice devices in hotel services in the industry/your personal life?
2. Which service tasks in hotels, in your opinion, can be automated with voice devices? / Which of its functions do you use most frequently?
3. What are the advantages of using digital voice assistants for a hotel?
4. What are the barriers for the adoption of voice-activated devices by a hotel?
5. How can hotel guests benefit from having a smart speaker in their rooms?
6. Which functions of digital voice devices are most useful for hotel guests? / Which functions of voice-activated devices would you use in a hotel room?
7. What is your opinion as to why some guests resist using smart speakers in rooms?
8. Speaking about the current COVID-19 pandemic, in what way may it affect guests'/your attitude to face-to-face service delivery?
9. How do you see the future of in-room digital voice assistants in hotels?

The transcription of all 28 interviews was performed manually by the researchers who listened and transcribed carefully each recording. Thematic analysis was used to analyse answers provided by interviewees. The coding process included indicating themes, subthemes, and categories. QDA Miner 5 was used to systematize all the interviews and identify the patterns. The tool allowed to attach themes and categories to the text within the answers obtained through interviews, and then group them by themes and categories accordingly. Researchers cross-checked the thematic analysis against the interviews to ensure that all points were captured, discussed and elaborated in full detail.

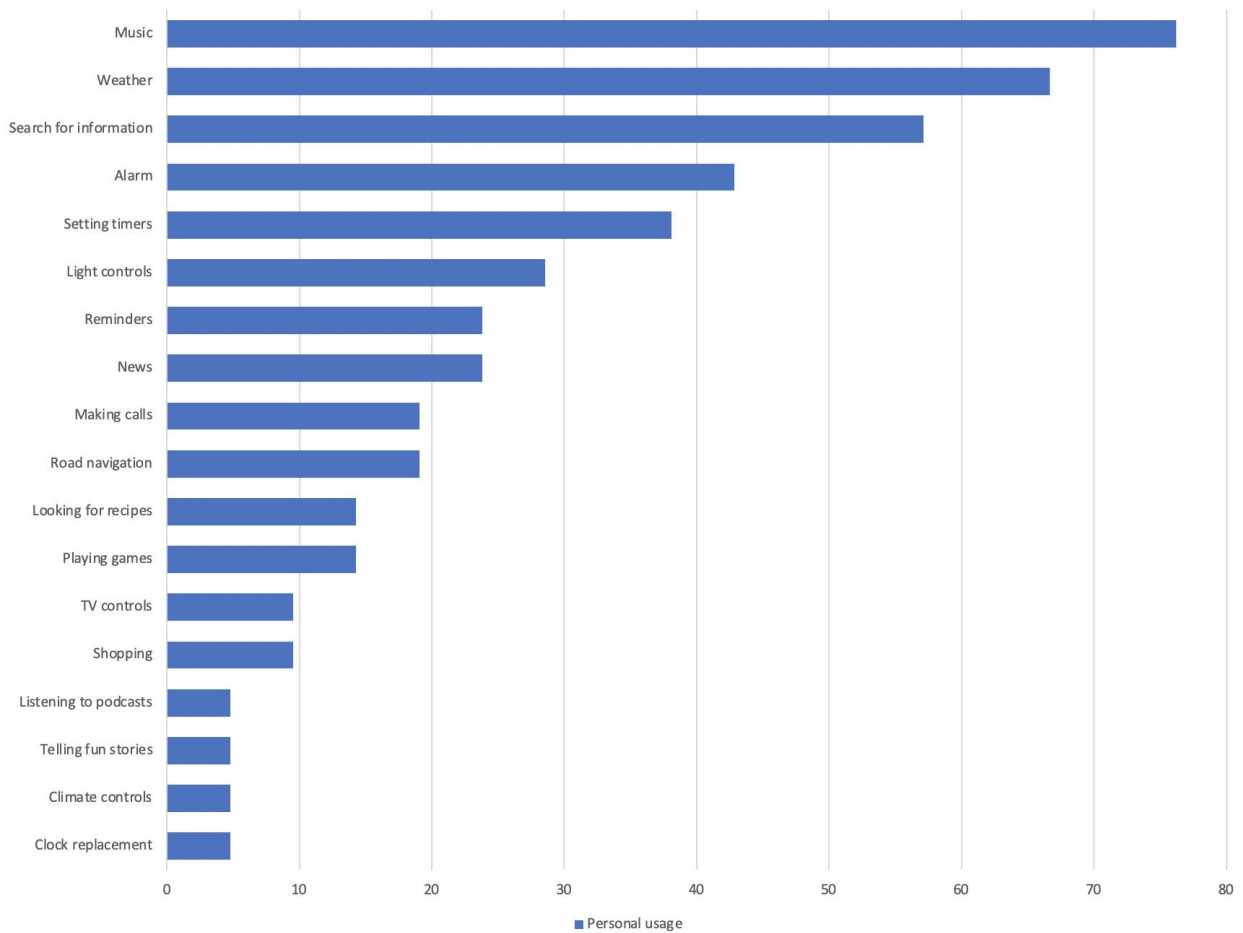
## **Findings**

The analysis demonstrates that VAs introduce strategic and operational benefits for hotel operations. These benefits are expressed vividly by suppliers of systems that are keen to demonstrate the VA functionality. Consumers express strong feelings towards VAs functionality, value cocreated and support potential. The research explores the views of both users/customers and suppliers/providers and offers an in-depth understanding of the VAs capabilities.

### ***Voice Assistants through guests' perspectives***

Consumers welcome VAs when they are easy to use and provide clear value to their stay. They explained that hoteliers should analyse interactions consumers have with technology in their everyday lives to adjust their services and meet guest expectations, to make VAs more acceptable and useful. A sense of newness, which comes with any new technology according to Meyer *et al.* (2020), is an appealing factor for guests, especially those who are more technology savvy. Customers who use such devices at home, including the leading three systems, Alexa, Google Assistant, and Siri, are much more familiar with their functionality and benefits. Hence, they appreciate the convenience and innovation they offer and have fewer problems when using them in hotels. Understanding the use of VAs in private settings can help appreciating what functionality they can assume in hotel and travel settings. However, the use at home is different from that in public spaces (hotels) not only because of devices' settings, but also because of guest expectations and preferences. Therefore, this study investigated separately the two types of settings and the differences and similarities between features of VAs in private and public settings are explained. Figure 1 presents all features of voice assistants that interviewees use in private settings.

**Figure 1.** Commonly used features of VAs in private settings (in %)



As the participants were preselected to be users of VAs, the majority highlighted the convenience of using VAs in private settings for music, checking the weather, searching for information, setting alarms, timers, controlling lights, and reading news. These findings are in line with existing papers (Bohouta and Kėpuska, 2018) on VAs' usage in private households. Making calls, navigating roads, looking for recipes, playing games, and doing shopping were also named by some interviewees as important, yet less common, features. The advantage of VAs matching with consumers' digital habits was supported by most interviewees of this study.

*"Usually simple tasks, like setting up an alarm or timer, turning lights on and off and checking the weather. I often do very quick fact checks through the voice assistant (that are simple enough)."*

*"I use it while travelling when navigating in the car or overall, when controlling smartphone in the car."*

*"I tried to play some games with Alexa. It wasn't as fun as I could have imagined, but that was interesting."*

Some participants were particularly happy about using VAs as a source of fun stories and jokes as well as a clock replacement at night. Though these functions were less frequently mentioned, they can potentially add value to the overall hotel experience.

*"Music - that is why we got an Alexa for streaming music via Amazon. We do also use it for things like football results and news and weather."*

*"If I cook at home, and I have, let's say, in front of me some celery root and I can ask like 'Hey, what can I cook with the celery root?'..."*

*"I use it mostly for music and to check on my Amazon orders."*

*"With Google, it's also quite cool that it's a better entertainer than Siri, so I can say 'Tell me a story about cats' and it will start telling me this really nice story about a cat. I quite enjoy that [laughing]."*

When exploring the possibility of using VAs in hotel premises, the majority of interviewees were convinced that they would eagerly use the devices for controlling lights in a hotel room, ordering room service, setting alarms, and listening to music. Among other useful functions, participants highlighted automatic checking out, weather forecast, replacing hotel directory, ordering taxis, setting reminders, and adjusting climate controls.

*"...I suppose a sort of a more seamless experience if you've got Alexa at home..."*

*"There's voice assistant, there's still something new, fresh. People are even more interested to try to use those services."*

*"I would definitely go for the alarm because I already do it with my Google Assistant at home. I liked the function with the light as well... this kind of immediate actions. Yeah, probably it's going to be more about settling up my comfort in the room."*

*"I would definitely try to order some food and for UBER."*

*"There are a lot of questions often you have at a hotel, so a smart speaker to be able to answer them would be really useful."*

*"It would be useful to alter the heating."*

This study unveiled a range of opportunities for VAs including leaving feedback about one's stay or using smart devices for emergency warnings. Making maintenance requests, asking for travel tips when on holiday, making handsfree phone calls, and using VAs as TV controls were also mentioned by many interviewees.

*"I would use appliances control functions, such as TV controls. I would be comfortable using this to report minor problems..."*

*"Asking for information about local restaurants and services (manicure, hair stylist etc), informing staff of an issue..."*

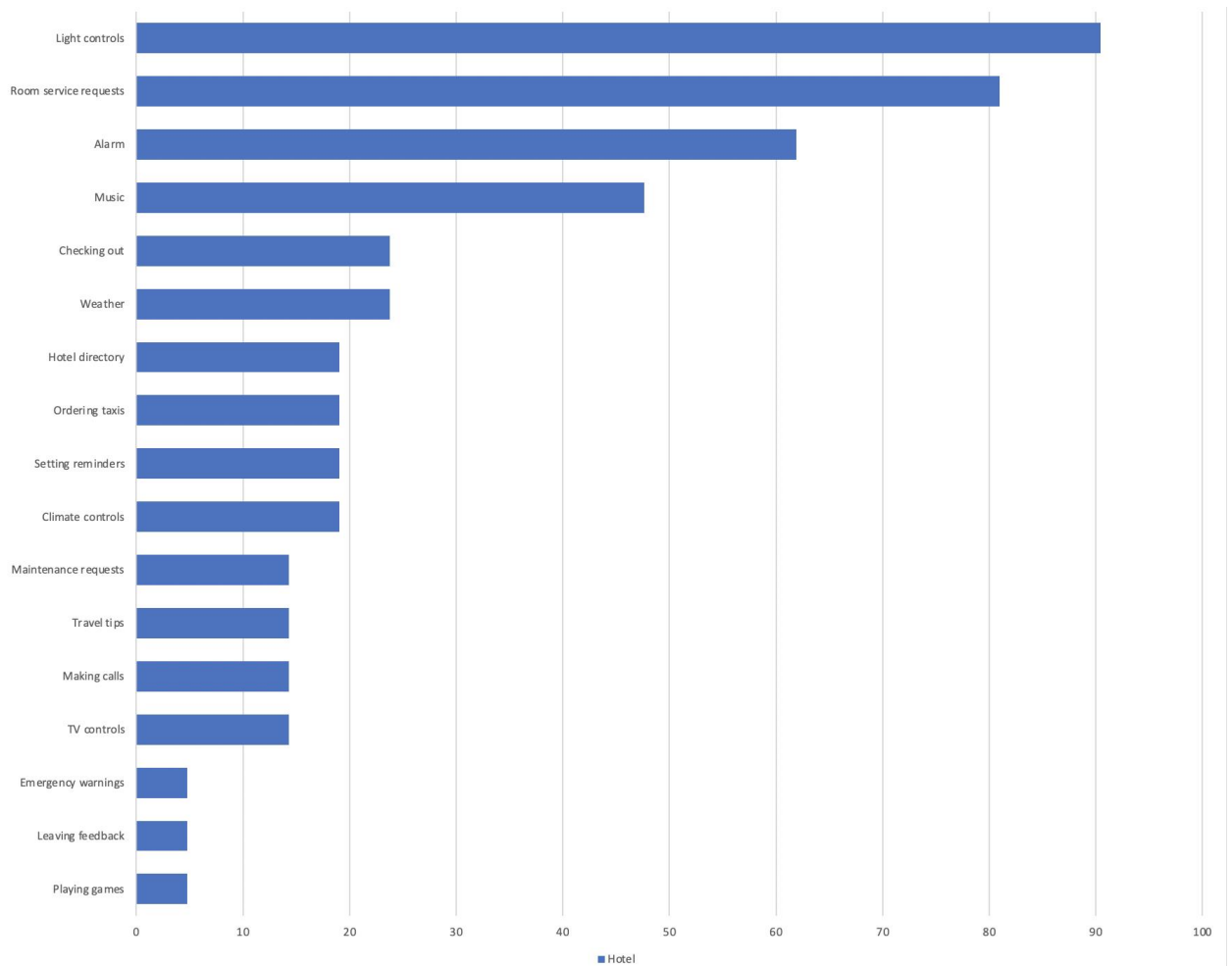
*"I would prefer to leave feedback or complaints with the help of the voice assistant..."*

*"I'm also thinking from a point of safety, for example, if someone breaks into your room..."*

The list of features which hotel guests expect to be available when using voice assistants in their rooms is outlined in Figure 2.



**Figure 2.** Features of VAs applicable for hotels (out of %)



VAs bring extended opportunities for personalisation, if guests can access their personal accounts through hotels' devices. By logging into what they regularly use at home, they are in a position to contextualise services and use technology efficiently in their temporary / travel related context.

*"If the devices were able to temporarily link to guests own accounts, their alarms, reminders, calendar events, etc. would be useful to have for business trips."*

*"Using my home settings makes life so much easier as the system has my favourite playlists, credit card details and seems to know me very well. It makes sense to use the VAs to access my VAs preferences at home and see what is around at the hotel."*

Travellers explain that there are some key functional benefits using VAs, namely time and touchless services. VAs enable instant service in real time as the services can scale and handle many requests simultaneously. VAs provide instant gratification and this is a major benefit for users. When using VAs, the idea of guests being 'on hold' while contacting room service or asking a concierge for anything completely disappears. The majority of participants were convinced that the key advantage of VAs is that they provide immediate responses and meet consumers' need for instant gratification (Buhalis and Sinarta, 2019).

*“If you’re working from a hotel, you’re not taking time to go and make a phone call downstairs to order food or you’re not calling somebody to ask them to call you and wake you up in the morning.”*

*“I had enough waiting for someone answering my call, especially at busy times like midday when there are lots of checkouts, many receptions will be unable to take calls for service”*

During the COVID-19 period touchless services became favourable for travellers as it was safer to use. Contactless devices, including VAs, offer boundaryless interactions. The physical aspect of increased hygiene, became paramount in the COVID-19 era and is likely to remain so during the recovery phase (Godovykh, et al, 2021). This can also lower the barrier of interactions with hotels for those guests who normally would be reticent to communicate with staff. Guests are often embarrassed to request some types of services and feel uncomfortable to disclose information to a service provider, especially across different cultures. Communicating in different languages is also an additional benefit that consumers enjoy.

*“And when you're ordering food... you might have these weird thoughts: ‘What if you ordered too much? What if your order is weird?’ I prefer to say that to a computer because the computer won't judge me in the first place.”*

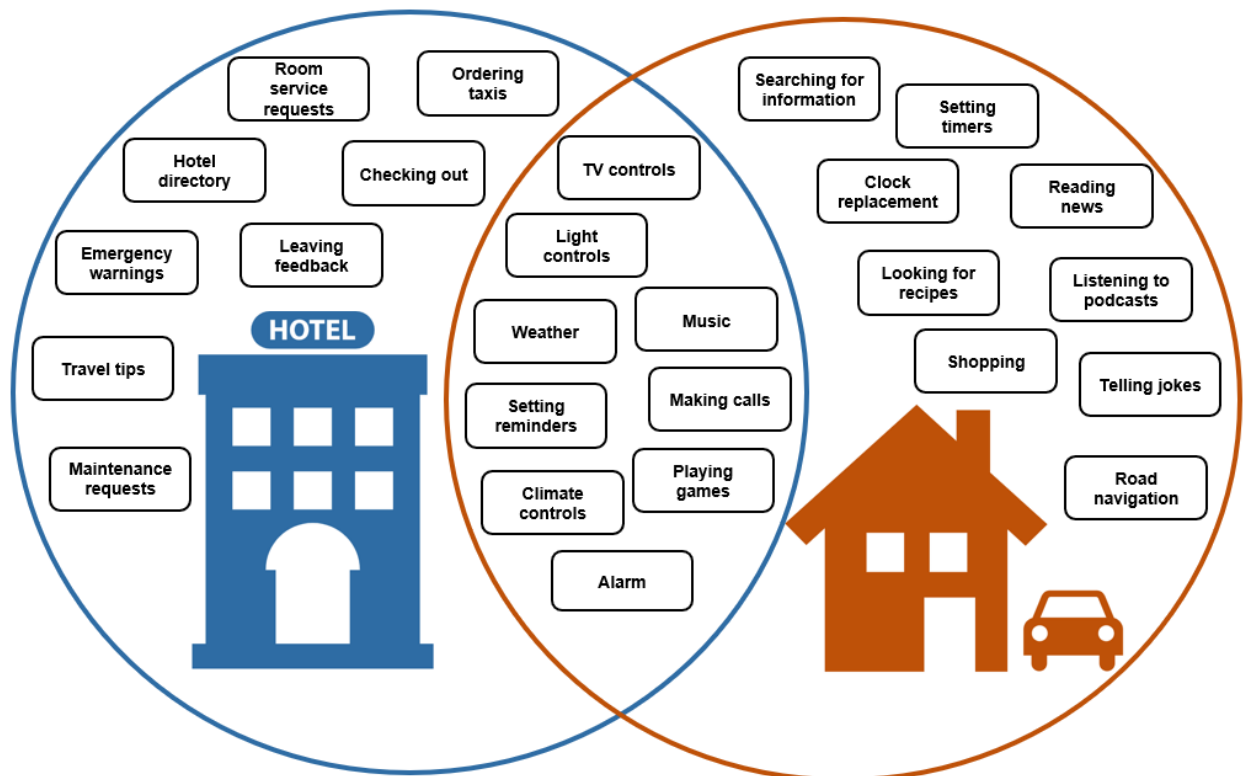
*“Many desks are manned 24 hours but I would be reluctant to call out of hours if I had an issue.”*

*“I remember the first time I asked for some hot boiled water in a hotel in the USA the waiter looked at time like a strange people. Then I noticed that everybody was drinking iced water! I would feel more comfortable to order through a robot or online.”*

*“Although Alexa finds my French accent difficult in English and therefore struggles to understand the commands, once I change the settings to French I can have a perfect interaction”*

When examining the key features of VAs in hotels interviewees mentioned functions used in private settings. These are the functions that consumers feel utmost confident using, based on their experience. There is also an overlap of requirements between different systems that are used in private and public settings. Interestingly consumers do not make a distinction between fixed space VAs, such as the Amazon Echo (Alexa), and smartphone VAs, such as the Apple Siri. They feel that VAs are digital personal assistants offering personalised services consistently. They expect these systems to access their personal preferences and offer digital concierge services in any context. They expect that systems are connected through smart interfaces to provide efficient services. These findings encourage technology providers to rethink ways of meeting consumer needs and wants. as presented in Figure 3.

**Figure 3.** Summative functionality of VAs in hotels and private locations



However, consumers mentioned several VAs disadvantages and adoption issues, such as reoccurring malfunctions and general inconsistencies (Cramer, 2018). These were highlighted by experienced users: failures of speech recondition, especially when different accents are involved, poor Internet connection or conflicting outputs when more than one voice device is activated in the same space.

*“It happens millions of times when you ask ‘Okay, Google, call something’ and then she starts to tell you ‘Sorry, I didn’t understand to whom you want to talk’ or ‘Which number should I use?’ I mean, that it sometimes becomes more annoying and it’s just easier to do it by yourself...”*

*“It’s not very able to deal with foreign pronunciation.”*

*“If you have two devices with the same Google assistants, and then you say, ‘Hey, Google’ they both react and then one says ‘there is a problem with that’, and the other one gives you an answer. So, you hear two voices at the same time, they are confused, you’re confused...”*

The most important challenge discussed is data security and privacy. Paluch and Wirtz (2020) agree with technology providers as well as consumers. They state that personal data protection and information processing procedures transparency are vital for the acceptance of VAs. There is a growing concern that professional data is being leaked. This is very important when offering VAs to business travellers in hotels. More tech savvy consumers express fewer concerns of their personal data privacy, proving that being informed on the device capabilities can improve their perception and readiness to adopt.

*“I totally believe that we are being listened and recorded even if we don’t want to. And of course, this information is used for retargeting... Google Assistant or Alexa or whatever other device are*

*not worse than our phones. For example, for me, it's just 'Okay, one more device is doing that but having or not having it wouldn't change your life'... In terms of privacy, I mean."*

*"...What if I go to like 6 different hotel rooms in a year and all these people will know my phone number and like hear me talking to my kids. Just like from a privacy perspective it's a little bit creepy."*

*"it doesn't matter if people want to listen to my conversations, that's up to them. But you know, for people in slightly more sensitive industries, I mean, industrial espionage is huge. So, for people that work in more industrial espionage-sensitive industries than I do, it could be a major issue."*

From a guest perspective, the advantages of VAs, can be summarised in: streamlined service delivery; matching consumers' digital habits, providing a sense of newness; and offering boundaryless real-time interactions. Disadvantages are epitomised in data privacy and security issues as well as functionality restrictions.

### ***Voice Assistants through hotel supplier perspectives***

VA suppliers are enthusiastic about the range of the VA capabilities. They suggest that VAs effectively act as sensors for hotels' IoT systems, using voice as an input to the smart hotel ecosystem to trigger a range of processes. Hotels collect data from guests' interactions with VA devices, in real time (Buhalis and Sinarta, 2019). VAs can understand the meaning of that interaction by analysing the voice command and empowered to take action supporting customer service. Interactions may lead to another machine performing an act (e.g, a Property Management System issuing a bill for a departing guest and taking a credit card payment) or initiating a service process by staff (e.g. delivering breakfast through room service). Some commands can be simple, such as asking VAs to play Jazz music, activating a jazz playlist to be played in the room entertainment system. Other commands may be more complex and involve multiple hotel departments. A VA command that orders food and drink from the room service menu needs to be instantly forwarded to the relevant kitchen for preparation and to the room service teams, starting a range of relevant processes including cooking and delivery services.

Interconnected with all relevant departments, equipment service providers, and systems, VAs should integrate a holistic approach to customer service based on the smart hospitality ecosystem that interconnects all systems and processes (Buhalis and Leung, 2018). The compatibility of internal systems through the IoT, is an essential requirement to allow VAs to deliver value efficiently. This is facilitated by the seamless integration and interconnectivity of all relevant operational units within the smart ecosystem. This can be complicated and costly, which is an obvious downside of the VAs from the hotel owners' perspectives. VAs empower hotel operations and reduce service frictions by negotiating the context of consumers with the service provision in real time, improving guest experiences and value cocreation (Buhalis and Foerste, 2015). The ability to process updates automatically, without requiring any additional costs or external interference is key for hotel owners, (Ahmadi, 2019). Interviewees suggest:

*"So that's where we think it'll be huge in hospitality is operational efficiency, freeing the front desk up to do what they do best, which is provide the exemplary guest experience and then allowing small requests to just go to the people that need to see them and take care of them."*

*"The functionality to date has been largely restricted by the belief that a large investment is required up front to do things like voice enablement of smart home features such as turning on the lights, opening the blinds or changing the temperature in higher end hotels. These features require a much more complex and costly implementation plan. Similarly, integration with hotel/property management systems has been another barrier to entry."*

*“Interconnecting all processes and key players improves efficiency, reduces errors and updates all systems automatically. This is a great benefit reducing transactions costs dramatically. For example, if a guest orders 4 beers on room service, the VA already understands the room number, customer name, order, time of order and process generated. This can then drive a range of systems. Room service staff receive and execute the order and we can know how fast this happened. At the same time the bill of the customer is updated, the room service department is debited, the stock control is updated and perhaps procurement is initiated if stock is getting low. All this due the simple VA order.”*

Customer experience is determined by technology usability and the intuitive way of engaging with systems. Travellers interact through online and face-to-face social contacts simultaneously (Fan et al, 2019). Guests often need technical support and external guidance to benefit from VAs. Hotels must educate, curate and increase general awareness of VAs’ capabilities purposefully for hotel spaces. They should use intuitive systems as well as provide clear instructions. The same is true for hotel staff, whose initial hostility to technology has to be overcome by providing relevant training (Pillai, and Sivathanu, 2020; Wirtz et al., 2021). Respondents explained that unlike devices used in private settings which can be focused on one user, VAs located in hotels must adjust to multiple guests with different languages, accents and distinct speech styles. This determines their usability and the satisfaction of users. Progress in speech recognition capabilities and multilingual options will effectively determine their future implications in hotels. Interviewees emphasised that VA human-computer interaction, needs human support when commands are not understood or the complexity of issue requires human intervention. This is critical for the success of VAs and for restoring trust to the system.

*“In my opinion, there has not been enough focus on providing curated information and content for the property and local area to enable the voice assistant to deliver.”*

*“The one barrier, I would say, is people not necessarily knowing what to do with the device..*

*“I think it'd be very handy if the smart speaker speaks most major languages in the world. It's going to be very helpful for people. They don't have to pick up the phone and struggle with their English to someone else's English.”*

VAs can support hoteliers to control and reduce energy consumption by switching lights, heating, TV, and other devices off when they are not in use (Medeiros, 2020). This is an important feature of VAs contributing to developing eco-friendly hotel strategies, vital in the global context. There is an expectation for hotels that VAs will remain in certain types of accommodation or hotel packages.

*“Overall, this may also improve the carbon footprint of the hotel.”*

*“Once the VAs capability is provided across the hotel space, a range of additional functionality can be included, bringing smart features in the hotel experience”.*

*“In a few years, it wouldn't be a surprise if it completely replaces all physical and tactile interfaces in guest rooms - at least at the premium level hotel segments.”*

*“If you would just be there just in and out, you're barely going to be in a hotel. Then the service itself, can be kind of more 'low key'. And then an automated system is perfect. But sometimes if you go more to like a resort, you're probably going to spend the whole day there...Then, having more face-to-face interaction with people it's nicer ...”*

Interviewees from the supply side agreed that hospitality VAs bring clear benefits to hotels operationally and strategically. Enhanced operational efficiency, improved customer experience, automated updates, operational and efficiency gains and reduced energy consumption are the key benefits explained. To benefit from VAs, it is worth exploring prerequisites, limitations and disadvantages as well. Interviewees mentioned the upfront costs required; internal software compatibility; customers' hesitation to implement the new technologies as they feel that their jobs may be threatened and staff's limited tech aptitude. VAs perform best in a smart hospitality ecosystem, where different organisations, departments, processes and data are interconnected through the IoT.

### **Discussion and conclusions: implications and future prospects of VAs**

It is evident from the research that the VAs' role as facilitators within the Smart Tourism and Hospitality framework will grow. VAs should be considered as voice sensors, allowing different stakeholders to communicate and provide voice-activated commands in the smart ecosystem. AI, and the IoT propel Ambient Tourism and VAs will be a critical component (Buhalis, 2020). VAs are within the AI-enabled IoT context that propels smart hospitality. Clear strategic implications demonstrate that VAs will disrupt old practices and processes by offering natural human-computer interfaces between consumers and service providers. Smart hospitality will use VAs to support effortless value cocreation for guests whilst reducing costs and increasing profitability. This study identified that voice assistants can be beneficial for both hotels and their guests, despite their downsides.

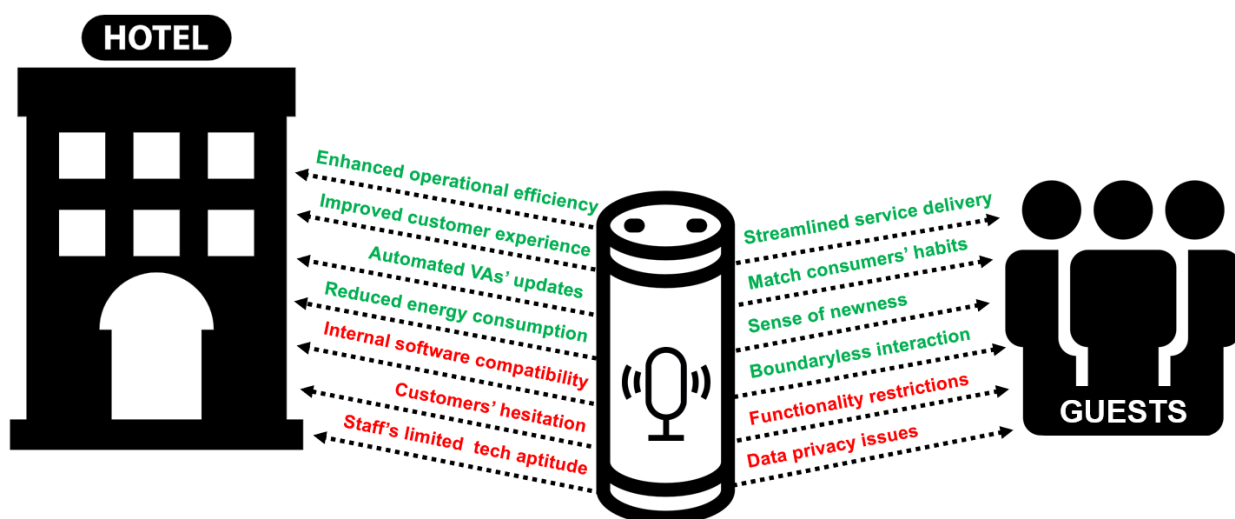
The theoretical implications of the research to the human-computer interaction theory reflect the requirements of different stakeholders and contributes to technology adoption literature. As hotel guests are different than home users, interfaces need to be simple and easily adjustable to user preferences and profiles. Lessons need to be learned about the applicability of VAs to private and public settings and the usability required. Hotel guests would not be prepared to spend time and effort educating or adjusting a hotel VA, when they spend only a few days in the property. Users may spend effort and time to adjust VA parameters in their private space, as they use them regularly for a long period of time. Consumer needs and wants should drive both VA technological developments and designs of smart ecosystems towards adding value in the cocreation process. Personalisation of systems benefits from examining private settings that can be adapted to hotel VAs. Interviewees explained that they prefer VAs, as they are less judgemental than hotel staff or because VAs are capable of communicating in their language. Although understanding different accents in English has been challenging in the past, VAs should be able to operate and engage in every language, adding personalisation and comfort. Interactions with VAs may be easier than communicating with a human service provider and that may change the attitude towards robots and other similar technologies (Ivanov and Webster, 2020). Adjusting voice activation to different accents and ensuring that consumers are aware of key commands was highlighted. These are areas that have been under-researched in technology adoption theory and the hospitality industry provides a natural lab for further research investigation.

Practically from a technological perspective, suppliers have already invested in the development of sophisticated voice-empowered devices as well as VAs capabilities to become smarter. Third-party integrations, like *Alexa Skills* or *Google Actions*, strengthen their positions as new distribution channels for brands in the voice-first marketing reality. The content of these third-party services should be carefully monitored by hotels and be used to influence the overall guest experience. Technology developers need to integrate VAs with the entire smart hospitality ecosystem and ensure that all data and processes are interconnected and interoperable. Stylos, et al, (2021) identify insights into how barriers to the diffusion of smartness can be surpassed, and how smart technologies can be assimilated into existing hotel organizational structures and operations. From the hotel business

perspective, voice is becoming a new marketing touchpoint to enhance pre-stay and booking functions (Klaus and Zaichkowsky, 2020) as well as on-site hotel experiences (Paraskevas *et al.*, 2011). Hotels need to develop effectively VEO (Voice Engine Optimisation) strategies in addition to the ongoing SEO (Search Engine Optimisation) initiatives. Hotels also need to reengineer their processes to benefit from VA functionality and scalability to reduce costs and improve profitability.

From a customer perspective, understanding the enablers and inhibitors of VA-based customer service supports value cocreation and experience development. VAs should be part of the value cocreation process and enhance customer service by facilitating personalisation. Service examples include selecting the interaction language; improving efficiency through reducing waiting times and avoiding queuing by scaling of services. They can add value through accessing content and services for consumers and initiate processes through voice commands. Figure 4 illustrates the advantages and disadvantages of speech-enabled VA interactions between hotels and guests.

**Figure 4.** Advantages and disadvantages of hotel VAs interactions



The future of VAs is linked with the development of AI and the adoption of a smart tourism and hospitality ecosystem. The rapid deployment of VAs across various business domains improves efficiency. In hospitality, where a high level of communication and interactivity is required between hotels and guests by the means of voice, VAs are becoming central to service provision. VAs can scale service provision and support multiple users simultaneously and cost effectively. VAs boost the efficiency of business operations and revolutionise customer service delivery. However, VAs require heavy initial investment; interconnectivity with existing systems; reengineering of processes to facilitate VA-enabled customer care. Privacy concerns, especially for in-room VAs, is a major issue for consumers. These factors should be taken into account when considering complex integrations of hotel VAs. Voice activated human-computer interaction will drive user experience and customer service in the ambient intelligence era. Further research is required in the development of voice activated interfaces and in portability of user profiles to support a “plug and play” functionality, where the new technological equipment adjust all settings based on the user profile.

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