Assessing the Optimal Implementation of Artificial Intelligence Within the Hotel Industry for Generation Y

Bachelor Thesis

for Obtaining the Degree Bachelor of Business Administration

in Tourism & Hospitality Management

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Vienna, 27 February 2022

Abstract

The implementation of artificial intelligence has the potential to reshape the hotel industry. It makes use of massive amounts of accumulated data, called Big Data, and tries to identify latent patterns within it. Artificial intelligence has the ability to learn, and to potentially make decisions on its own, becoming ever more precise the more data it has at hand. Within the hotel industry, artificial intelligence increasingly gains ground and has a wide range of applications. While artificial intelligence can significantly contribute to the design of the guest experience it can have negative implications for employees. As artificial intelligence can learn, it might eventually outperform humans in their work. However, this is a very controversial topic in scientific literature and there is a significant number of researchers that argue artificial intelligence will only have limited impact on human employees. This thesis will examine to which extent the implementation of AI is desired by generation Y and attempts to reveal whether human employees might be replaced by artificial intelligence, or whether artificial intelligence and human employees will coexist.

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1 Introduction

The implementation of artificial intelligence has increased significantly within various industries, including the hotel sector. Statistically, the artificial intelligence software market is said to experience considerable growth within the next few years (Liu, 2020b). From the year 2021 to 2022, the respective market is envisioned to grow by almost 50% (Liu, 2020b). Even from 2024 to 2025, the growth of the AI software market is still immense, predicted to grow by another 26% (Liu, 2020b). By the year 2030, the consumer goods, accommodation sector – including the hotel industry – and food services are predicted to denote a 15% increase in GDP, solely attributed to artificial intelligence implementation along two dimensions: The impact that AI has on product development and the increase of productivity due to AI (Mlitz, 2021).

Major newspaper agencies have devoted an increasing number of articles towards AI implementation within the hotel industry. In 2019, Reuters published an article on "Alibaba's Hotel of the Future", the "Flyzoo Hotel" in Hangzhou, China (Cadell, 2019). From the hotel check-in, which works via facial recognition and a smartphone application, over in-room virtual agents controlling light intensity or water temperature, to robot waiters in the hotel restaurant – processes are majorly solved through artificial intelligence (Cadell, 2019). Another article published in 2019 by Forbes focused on in-room applications of artificial intelligence in hotels (Tiwari, 2019). Artificial intelligence is presented as a new technology that can overcome language barriers, personalize hotel experiences to individual guest preferences and overall influence the guest's loyalty towards the respective hotel (Tiwari, 2019).

The emphasis of this research will lie on investigating, whether or to which extent artificial intelligence is desired by millennial hotel guests. Key questions will include within which hotel areas, guests desire human employee interaction over artificial intelligence and where they find artificial intelligence deployment more useful.

There have been numerous studies conducted on whether artificial intelligence might replace or alter the need for or responsibilities of human employees among many industries (Rampersad, 2020; Koo et al., 2021, Mutascu, 2021). However, when turning to the hotel industry in particular, the number of research papers shrinks. Furthermore, only little research has been conducted on the guests' perspective

towards AI implementation within hotels. If research has been conducted within a hospitality setting, such as by Lee et al. (2021, p.1) then only a subsection of the whole AI implementation areas such as "Exploring the hotel guest's perception of using *robot assistants"* has been analysed.

Nowadays, generation Y is greatly represented in the hotel industry, representing "one third of all hotel guests" (Foris et al., 2020, p. 65). As described by Ordun (2015) generation Y comprises people born between 1981 and 2000. By understanding in which hotel areas generation Y would desire or welcome AI implementation and within which areas human interaction is irreplaceable, hotel managers could enhance the guest experience and in turn influence guest loyalty. It might also provide insights on the extent to which artificial intelligence is believed to threaten human jobs in the hotel industry. Therefore, this thesis' findings can provide hotel managers with considerable insights into the optimal hotel experience, using AI. The term generation Y will be used interchangeably with the term millennials, as justified by Ordun (2015).

The present research proposes that artificial intelligence will increasingly gain ground within the hotel industry, as its implementation is desired by generation Y (Foris et al., 2020). In accordance with current research, this research proposes that artificial intelligence has the potential to decrease the number of jobs held by human employees (Nguyen et al., 2020; Reis et al., 2020). Nevertheless, the hotel industry is built on human contact, indicating that artificial intelligence will primarily take on routine work, while complex, personal guest interactions will continue to be performed by human employees.

2 Literature Review

2.1 Artificial Intelligence

To find a clear definition of artificial intelligence (AI) is challenging, as the term *Intelligence* itself involves so many different aspects that no general definition has been agreed upon (Russell et al., 2020). However, if one agrees on the fact that humans do not always decide for the most favourable and mathematically correct solution, this already implies that there is more to Intelligence than solely rationality. During the past decade, *Intelligence* has become more of an umbrella term including emotional and physical intelligence (Russell et al., 2020). It also involves the human ability to adapt and fit into new environments and its ability to learn from past experiences, commonly referred to as behavioural intelligence (De Togni et al., 2021; Russell et al., 2020).

Now that a distinction between the final decision taken by humans and pure rationality has been introduced, there is a second dimension which is vital to consider: the subject matter (Russell et al., 2020). Intelligence is often described as a human's "internal thought process", while other researchers have concluded that intelligence is more of a behaviour, a rather external process (Russell et al., 2020, p. 19). According to these distinctions, there are four different approaches to artificial intelligence, which are namely:

- The Turing Test Approach

The Turing Test approach examines whether a computer can answer questions as precisely as a human can. A machine gets hold of written questions which it must answer, if the human cannot tell whether another human or machine has formulated the response, the test was successful (Russell et al., 2020).

- The Cognitive Modeling Approach

The Cognitive Modeling Approach is aimed at replicating the human mind. It is not about – in contradiction to what has been introduced so far – the best rational outcome, but to mimic what a human in a certain predefined scenario would decide for, even if it would not be the most favourable, rational outcome (Russell et al.,

2020). This field is referred to as cognitive science, which aims at understanding the human thinking process and incorporates a variety of different fields such as, among others: philosophy, psychology and anthropology (Barrett, 2020).

- The "Laws of Thought" Approach

The "Laws of Thought" approach tries to base decisions on logical reasoning and has the goal to achieve a rational, correct solution (Russell et al., 2020). It is designed to come to correct conclusions solely based on inferences, operating within its predefined and certain environment. The problem that arose was that it cannot operate in an environment that involves uncertainty (Russell et al., 2020). This issue has majorly been overcome by integrating probabilities.

- The Rational Agent Approach

The rational agent approach, similar to the "laws of thought" approach, aims at achieving rationality (Russell et al., 2020). However, not solely through correct thinking and based on inferences but within a much wider sphere. Its goal is to *act*, to operate independently and navigate through uncertain environments autonomously.

In accordance with several contemporary research papers, artificial intelligence within this thesis will be referred to as an "intelligent system", which is primarily aimed at "problem-solving" – finding the best possible solution to a given scenario (Fenech et al., 2018, p. 9; De Togni et al., 2021, p. 1; Van der Maas et al., 2021, p. 3). Put in other words, artificial intelligence has the goal to "do the right thing" and tries to replicate human intelligence through technological means – agents (Russell et al., 2020, p. 22). What exactly "the right thing" to do is, varies according to the desired outcome programmed within or given to the intelligent agent (Russell et al., 2020, p. 22). "Ultimately, AI is the training of machines via imitating the cognitive behaviour of humans" (Kakkar et al., 2021, p. 116).

2.1.1 Machine Learning

The term machine learning is applied when a computer is used as the agent and has the ability to enhance its own performance without the need for assistance (Russell et al., 2020). The machine makes its own observation of the environment and decides

on how to cope with a given situation. One could say that the machine makes its own experiences and learns from them (Russell et al., 2020).

Machine learning uses Big Data sources (which are massive datasets that go far beyond the capacity of traditional ones) in order to identify hidden patterns within them and immediately applies what it has learned (Kaplan & Haenlein, 2019). The more data machines have at hand, and the more variables are known, the more precise their decision-making or predictions can become (Bini, 2018). Machine learning is considered a subcategory of artificial intelligence, however, not all artificial intelligence systems are operated on the grounds of machine learning (Russell et al., 2020).

The problem with machine learning is that it can only learn from structured data, which refers to inputs that a computer can understand, such as numbers and values that stand in a relationship with its coherent columns and rows within a dataset (Bini, 2018). Furthermore, the programmer must pre-define certain features, which build the foundation of the machine's operations. Machine learning needs pre-defined inputs according to which it can then classify certain objects and start learning on its own (Bini, 2018). If the programmer makes a mistake in the first phase, the algorithm, and all outcomes that the machine infers will be inaccurate. Therefore, programming machine learning algorithms mostly involves several testing phases and a lot of time rebuilding the existing model (Bini, 2018).

There are three types of learning, which are:

- Supervised Learning

Supervised learning uses an underlying input dataset which already has the correct, desired outputs (IBM Cloud Education, 2020). When the agent is exposed to new inputs it tries to name the correct output, which is called label, according to what it has learned from its pre-defined dataset (Russell et al., 2020). Whenever it makes a mistake, it recognizes failure and further improves until the error rate is reduced to a minimum (IBM Cloud Education, 2020).

Supervised learning is used for classification and regression (IBM Cloud Education, 2020). Classification means that the algorithm tries to correctly assign the data which

it has at hand into its designated categories. Regression, on the other hand, aims at identifying a relationship between independent and dependent variables and in the best case, to derive predictions for the future.

- Unsupervised Learning

Unsupervised learning means that the agent learns autonomously and that it uses unlabelled data – there is no feedback provided to the agent (IBM Cloud Education, 2020; Russell et al., 2020). In unsupervised learning, the most frequently given task is called clustering, which refers to the agent independently trying to identify hidden patterns within a given input dataset (IBM Cloud Education, 2020).

- Reinforcement Learning

Reinforcement Learning makes an agent learn from its own success or failure (Russell et al., 2020). The agent performs a certain action and at the end it will either be notified of a success or a failure. If it has failed, it does not know exactly where the error occurred during the entire process and has to figure out when and where something went wrong. This means that it will go through the entire process repeatedly, changing its previous behaviour until it is successful (Russell et al., 2020).

2.1.2 Deep Learning

Deep learning, in contrast to machine learning is able to not only process structured data, but also unstructured data (Bini, 2018). Unstructured data means that the data which the algorithm has at hand follows no structure that would fit in traditional datasets, e.g., it could include textual formats or / and can be hundreds of layers deep – far too complex for machine learning algorithms. Also, deep learning algorithms do not need any pre-defined features within a given dataset (Bini, 2018). The respective algorithm manages to go through a given set of data autonomously and can define underlying patterns or specific features on its own. Therefore, deep learning models are much more efficient than machine learning algorithms, as they can handle greater amounts of data and work independently (Ji et al., 2021). Deep learning algorithms are not designed to operate within the already known but also have the task to identify and evaluate the unknown and provide new knowledge to the programmer. Visual object recognition, speech recognition, image synthesis and natural language processing have become ever more accurate and precise through the application of deep learning algorithms (Russell et al., 2020).

Natural Language Processing (NLP) is concerned with enabling machines to understand and interact with one another through the human language (Lauriola et al., 2021). NLP refers to the ability of a machine to process what it is told in human language (whether by a human or another machine) and to act upon it (Russell et al., 2020). It uses “artificial intelligence to process, organize, and extract embedded information from texts” (Chan et al., 2021, p. 1). The integration of Natural Language Processing in machines enables computers to communicate with humans (Russell et al., 2020). It makes it possible for humans to speak to a computer and to be understood. Also, NLP helps machines to learn and enables them to process much greater amounts of data than it could without. A substantial amount of the information brought to us is in natural, human language and not written in formal computational logic, which makes NLP in artificial intelligence – and especially robotics – so important (Russell et al., 2020).

Deep learning algorithms have significantly improved the performance of NLP when it comes to a machine answering questions, or summarizing information (Lauriola et al., 2021). To this date, deep learning (in particular deep neural networks) in natural

language processing has surpassed the human ability to detect deceiving content and can often answer questions more precisely than a human could (Lauriola et al., 2021).

Deep learning is often used in the combination with deep neural networks, which are artificial neural networks (ANN) with the goal to replicate human brain functions (Kakkar et al., 2021). Mathematical neurons (which are also referred to as perceptrons) build the core of artificial neural networks. ANN can consist of one or more layers – with each of the layers comprising of one or more perceptrons. As soon as artificial neural networks are built upon more than one layer the term deep neural networks is used (Kakkar et al., 2021). The perceptrons operate similarly to neurons in the human brain – they hold a mathematical function at their core which allows them to recognize inputs and exchange the derived information with one another. Perceptrons have the ability to learn, think and eventually perform an action – just like a human would (Kakkar et al., 2021).

Table 1 summarises the information mentioned above. It defines the terms artificial intelligence, machine learning and deep learning, emphasizing on the terms' interdependencies and differences. Artificial intelligence can be referred to as the umbrella term, comprising machine- and deep learning (Bini, 2018; Kaplan & Haenlein, 2019). While machine learning can only process structured data and needs pre-defined input sets, deep learning can autonomously identify underlying patterns and unique features, without the need for human assistance. The more data artificial intelligence has at hand, the more precise the results will become.

Artificial Intelligence	• Aims to replicate human intelligence • Uses information gained through Big Data sources to detect embedded, hidden patterns
Machine Learning	• Subcategory of artificial intelligence • Technology's ability to "learn" as the software can alter its own algorithm to make more accurate decisions • Needs existing, structured data and pre-defined characteristics provided by the programmer to operate • Enabled through the implementation of Big Data, which refers to a massive database, fed into the machine learning software. With an increasing amount of data, the machine's results or predictions become ever more accurate • Very time-consuming and often inaccurate as programmers do not always know which characteristics are of importance • Machine learning can be improved by providing constant feedback on whether it has taken a right or wrong decision
Deep Learning	• Subcategory of artificial intelligence and machine learning • Can handle an immense volume of structured and unstructured data • Relevant features and characteristics need not be pre-defined by the programmer. Deep learning algorithms can detect and categorize unique features on its own • Works through Artificial Neural Networks (ANN): Data processing by machines, operating similar to the human brain as it allocates a logical construct to gathered data

Table 1: Definition Artificial Intelligence, Machine Learning and Deep Learning (Bini, 2018; Kaplan & Haenlein, 2019)

2.2 Artificial Intelligence within the Hotel Industry

Over the past years, new technologies, which include artificial intelligence have denoted substantial growth within the hotel industry (Li et al., 2021). Within the year 2021, the artificial intelligence software market is expected to grow by another 54%, and in the following year 2022 growth is expected to continue rapidly with yet another 47% increase (Liu, 2020b).

Whether it be intelligent check-in processes, intelligent service desks, facial recognition, digital assistants, chatbots, or service robots – the implementation of artificial intelligence has become omnipresent and is associated with a great change in the way services are delivered (Li et al., 2021; Foris et al., 2020). In the near future, guests might not follow an employee to their designated room, but a service robot (Li et al., 2021). Questions about the stay might not be answered by humans, but by chatbots. The traditional reception might no longer be staffed with humans, but is built upon intelligent service desks, which use self-check-in facilities.

This indicates that the hospitality industry is just before, or already going through, a great change. As already mentioned, there a are multiple possible applications of artificial intelligence within the hotel industry. From booking the hotel to checking-out, guests will be exposed to the implementation of evermore artificial intelligence (Nguyen et al., 2020).

2.2.1 Chatbots

Especially within the past decade chatbots have gained massive attention and are widely implemented (Rouhiainen, 2018; Pizzi et al., 2021; Tran et al., 2021). In fact, the chatbot market size is expected to grow from roughly 2.5 billion dollars in 2019 to approximately 9.5 billion dollars in 2024 (Tran et al., 2021). Also, the outlook for market revenue generated by the implementation of chatbots seems promising (Liu, 2020a). While in the year 2021 the market revenue of the chatbot market will denote about 80 million US dollars, six years later in 2027 the market revenue is expected to expand to roughly 450 million US dollars (Liu, 2020a).

Essentially, chatbots are computer programs which take on and respond to questions that are asked in human language – using previously discussed Natural Language

Processing (Pantano & Pizzi, 2020). There are two types of chatbots, which are namely text-based and voice-based chatbots (Samala et al., 2020). The former is designed to reply to questions asked via text-message. The latter can answer guest queries by talking to them.

Chatbots are intended to help and assist hotel guests, to facilitate hotel room reservations, and to quickly respond to arising questions during the booking process (Rouhiainen, 2018). More of the substantial advantages offered through chatbot implementation is the 24-hours possibility to answer arising questions and to handle multiple conversations at the same time (Pizzi et al., 2020; Samala et al., 2020).

The advancements in chatbot design have gone so far that guests were often unable to tell whether they have been talking to a human or machine (Robinson et al., 2020). Chatbots have excelled human performance to such an extent that they needed to be programmed with little flaws, making them "perfectly imperfect" (Robinson et al., 2020, p. 366). These little integrated flaws have led every second person to believe that they have just talked to a human, although it was a machine. Nevertheless, there are still some scenarios that chatbots alone cannot overcome, which is why they usually operate with a second program (Tran et al., 2021). In case a chatbot cannot sufficiently answer questions, the guest will be redirected to a human employee (the second program) – so far, chatbots are not proficient enough to replace humans entirely but rather coexist with them (Tran et al., 2021).

Within the hotel industry chatbots have even gone beyond traditionally answering questions (Robinson et al., 2020). Chatbots can send text messages to a guest's mobile device, asking whether the check-in process was alright and whether there was anything it could do for them. Hotels which have implemented such services have denoted an overall increased guest satisfaction rating and nearly a third less calls to the front desk (Robinson et al., 2020). Even after check-out, chatbots can ask questions about the guest's stay, what could have been improved and whether they would like to remark anything further (Pillai et al., 2021). This data is then saved and can be matched to other guest responses. Through the ever-increasing amount of data collected, artificial intelligence can then suggest improvement opportunities and highlight which process have enjoyed great customer satisfaction, and which did not (Pillai et al., 2021). Therefore, chatbots play a crucial role when it comes to the

evaluation of on-site service offers (Li et al., 2021). Also, chatbots help in personalising the guest experience (Samala et al., 2020). Chatbots can assist the customer by providing a range of services, such as ordering food to the hotel room, scheduling appointments, setting alarms, or inform housekeeping when guests have left the hotel room. Hotel guests can simply tell the chatbot what they need, and it then will execute the given task – as if the guest had an own personal assistant during his stay (Samala et al., 2020).

2.2.2 Service Robots

Although artificial intelligence rapidly gains ground, the implementation of service robots used in the hotel industry is still rather in its infancy (Lin & Mattila, 2021). There are a range of different service robots, including robots meant for housekeeping, but also guest-facing robots such as concierges or receptionists, waiters, and guide robots (Lin & Mattila, 2021; Hu, 2021; Samala et al., 2020). The two most widely spread distinctions in the appearance of robots are *mechanoids* (or non-humanoids) and *humanoid* (or anthropomorphic) robots (Reis et al., 2020; Hu, 2021). While the former visually appears to be a machine, the latter tries to take on appearance characteristics similar to humans (Reis et al., 2020).

Wirtz et al. (2018, p. 909) refer to service robots as *"system-based autonomous and adaptable interfaces that interact, communicate and deliver service to an organization's customers"*. They are equipped with effectors and sensors (Russell et al., 2020, p. 932). Effectors refer to devices which are designed to interact with the physical environment. In the case of service robots – depending on their looks – this would include e.g., their legs, or wheels (Russell et al., 2020). Sensors, on the other hand are integrated within a robot to make it able to perceive its environment. Among others, sensors include cameras, microphones, or radars which enables the robot to identify objects or human within its environment (Russell et al., 2020; Podpora et al., 2019). While passive sensors such as cameras have the task to identify other physical object in the robot's surrounding, active sensors try to send out a signal into the physical environment and expect a response (Russell et al., 2020).

In a hotel, service robots operate in a partially observable environment (Russell et al., 2020). They are exposed to a lot of movement by hotel guests – which makes it

necessary for them to predict human movement, as they need to prevent colliding of any kind with the costumer. Therefore, in order to maximise the utility a service robot offers to the hotel itself, or hotel guests, its sensors and effectors need to be programmed to take the correct action (Russell et al., 2020).

Embedded machine learning, or deep learning empowers a service robot to analyse its behaviour and the outcome associated with it (Writz et al., 2018). Service robots learn from past experiences and try to forecast which of their decisions could lead to the most favourable result in a new encounter (Writz et al., 2018). Its intelligence component helps service robots to better adapt their behaviour to a given situation the next time they are confronted with it (Wirtz et al., 2018; Hu, 2021). Service robots have the ability to communicate with guests, to interact and to eventually deliver the desired service to them (Hu, 2021).

Major hotel chains work on implementing or have already implemented service robots within their processes. One prime example would be the Henn-na hotel in Japan, or the Flyzoo hotel in China. The Henn-na hotel was the first hotel worldwide to implement a range of digital technologies and handling most of their customer service through service robots (Henn-na Hotel Tokyo Ginza, 2021). The Flyzoo hotel in China has made similar efforts, while primarily employing robots at the bar and restaurant, delivering food, and mixing cocktails (Saiidi, 2019). Other major hotel chains also try to catch up, Marriott International has employed “Mario” a humanoid robot which manages tasks such as guest greeting and guarding the buffet (Neild, 2016) and Hilton (in cooperation with IBM) has introduced “Connie”, which is a robot concierge (Shadel, 2021; Luo et al., 2021). Connie is able to answer queries about the hotel and provide suggestions on local attractions, depending on what exactly the guests are looking for (Luo et al., 2021). As Connie is operated through AI, the more guest interaction it has, the better its next suggestions will become as it has greater access to data from which it learns.

Although there are many advantages to the implementation of service robots, there are studies which reveal that some guests will stay reluctant to interacting with them and refuse to use their provided services (Chi et al., 2020 cited in Chi et al., 2021). This objection is often due to associated uncertainty when it comes to the implications of

new technologies for the future and a lack of trust in service robots and underlying technologies (Chi et al., 2021).

2.2.3 The Internet of Things

The Internet of Things (IoT) connects physical objects and enables them to receive and send data to one another (Tzounis et al., 2017). Its goal is to interconnect billions of unique devices (which can all be very different in technological specification, such as compatibility, computing power, or environmental capability) within one central network. This means that those physical objects, which are equipped with computing power and networking capabilities can exchange information and accumulate vast amounts of data (Tzounis et al., 2017.). The data which those objects collect includes information such as its location, status, and identity (Tzafestas, 2018). Two important terms which are mostly used to define the IoT are connectivity and heterogeneity. The connectivity aspect enables heterogenic devices to access networks and makes them compatible with one another (Tzafestas, 2018).

The internet of things itself does not necessarily need artificial intelligence to collect data, but in order to make use of what it has collected, it does (Tzounis et al., 2017). The implementation of the IoT mostly incorporates artificial intelligence, such as machine learning algorithms which process the collected data and derive suggestions and actions to take. There is an ever-increasing number of businesses which have implemented the internet of things and combined it with the power of artificial intelligence (Tzafestas, 2018).

As already discussed, an increasing number of hotels have implemented artificial intelligence within their operational processes (Infante-Moro, 2021). The same accounts for the IoT within the hotel industry. Especially when it comes to in-room facilities, the combination of IoT and AI can become particularly useful.

There are glasses which can be worn by front desk employees that help identify certain guests (Infante-Moro, 2021). Combining this with AI, facial recognition may be able to highlight certain information about preferences gathered throughout the individual's last stay. Through the combination with AI, the facial recognition can be matched to data collected about this individual and highlight their preferences during their last stay.

Further, in-room, smart minibars can alert personnel when a drink has been taken out and needs to be replaced (Infante-Moro, 2021). However, AI cannot only alert the need for replacement; it can also automatically add the amount that has to be charged to the final receipt.

When enough data about the guest behaviour concerning room lighting, or ideal room temperature has been collected through IoT, artificial intelligence can adjust the room lighting, as well as air condition or heating according to the guest's needs (Infante-Moro, 2021; Tzafestas, 2018). When a guest enters the hotel room, lights could automatically turn on, adjusted to the time of the day and the lighting outside and their general preference of it to be very bright or rather dark (Infante-Moro, 2021; Samala et al., 2020).

Prime examples within the hotel industry are showcased by Marriott and Hilton hotels (Car et al., 2019). Both have given their guests the opportunity to control various room attributes via their mobile device. At the time of their next arrival, the previously collected data through IoT will be used by AI to already set up the room according to the guest's preference. This means that the desired TV channels were highlighted, and the lighting, temperature and position of the shades was adjusted according to their previous stay (Car et al., 2019).

Similarly, other hotel chains have incorporated voice-based agents, such as Amazon's Alexa (Car et al., 2019). Guests no longer need to search for restaurants on their own, neither go to the concierge – whatever question arises, they can simply ask Alexa, which is able to respond in human language and make accurate suggestions, based on the guests' preferences (Car et al., 2019).

This can result in a greater value delivery to the customer, which in turn increases guest satisfaction, while at the same time reduces unnecessary costs to the hotel (Infante-Moro, 2021; Car et al., 2019). The more data the internet of things can collect, the greater the efficiency of artificial intelligence. Hoteliers now have access to data, which before was nearly impossible to obtain. The combination of both (IoT and AI) gives hoteliers the possibility to go beyond traditional customer service.

2.3 The Impact of Artificial Intelligence on the Guest Experience

The implementation of artificial intelligence is said to enable hoteliers to offer high-quality experiences, tailored to individual needs and preferences, as artificial intelligence has access to immense datasets where e.g., information about different individuals can be stored (Foris et al., 2020; Chi et al., 2021). Chatbots are one example that can successfully collect customer data during support processes and later use it to design experiences more adequately (Hyken, 2017). AI gathers knowledge and offers the collected information to the hotel managers in an adequate, easily understandable way (Li et al., 2021). As artificial intelligence is easy to use and can be very interactive, AI is said to enhance the service value that is offered to a guest (Li et al., 2021; Robinson et al., 2020). Especially when it comes to targeting millennials, which is a generation characterized by looking for experiences, and desiring ever-more personalized services, hoteliers are well advised to implement new technologies (Foris et al., 2020).

However, the surge in AI implementation has been accompanied by a decrease in the face-to-face contact of hotel guests and hotel employees, which is reshaping an industry that had human-to-human interactions at its very core (Li et al., 2021). Hotel managers need to study the implications that AI has on the guest experience and on their overall satisfaction level during their stay.

One of the reasons why artificial intelligence implementation continuously increases within the hotel industry is attributed to changing customer needs (Kim et al., 2021). Kim et al. (2021) have found that the hotel guest's perception towards the use of robots in the service industry has changed especially during the covid-19 pandemic, leading to a more welcoming attitude towards interacting with robots. Especially during times of crisis, the implementation of artificial intelligence can foster the guest's confidence that *"*their safety and health will not be endangered during their stay*"* as AI can eliminate physical touchpoints from check-in to the check-out (Foris et al., 2020, pp. 72-73). Through the covid-19 outbreak, guests have understood the importance of physical distancing, which resulted in the desire to reduce human contact (Hu, 2021). This in turn lead to an increased acceptance towards service robot implementation (Hu, 2021).

Moreover, Prentice et al. (2020) have found that artificial intelligence influences customer engagement and overall customer satisfaction. High system and information quality offered through the implementation of artificial intelligence can enhance the customer experience leading to greater enjoyment during the hotel stay (Prentice et al., 2020). Furthermore, Foris et al. (2020) elaborated on the fact that the implementation of new technologies within hotel practices, providing guests with a feeling of increased safety, can result in greater loyalty.

Also, when it comes to guest entertainment, service robots can have a valuable contribution (Lu et al., 2019). In Marriott hotels, a range of different room deliveries is executed by service robots. Whenever one robot has made it to the designated room where it should, e.g., deliver coffee to, it tells the hotel guest "I am just chilin, please remove your items" (Lu et al., 2019, p. 46). This has resulted in hotel guests perceiving the service robot as adorable and entertaining – improving the guest experience.

Despite the anticipated increase in guests' acceptance towards robots, there are currently issues arising from implementing them due to the actual state of AI development. Reis et al. (2020) have revealed that robots nowadays lack the capability to perform tasks that involve greater interaction than standardized routine work. This could implicate that although gaining greater hotel guest acceptance, AI technology is not advanced enough yet. However, even if the technological state of artificial intelligence develops further, artificial intelligence will not be capable of showing emotions in the near future (Reis et al., 2020). Emotional exchanges are still desired by guests, and (currently) solely inherited by humans. Furthermore, the hospitality industry has human-to-human interactions at its core (Robinson et al., 2020). As the implementation of artificial intelligence is new, and utterly exciting, it continues to surge. However, the long-term effects might prove the current openness towards robots wrong (Robinson et al., 2020). Guest attitudes towards the implementation of new technologies might change, as in people's minds there is often the notion and fear that artificial intelligence, and robots in particular, depict a threat to humanity (Złotowski et al., 2017). This could result in reluctance of interacting with robots and might decrease satisfaction levels the more advanced service robots become.

Another issue which is often associated with the implementation of artificial intelligence are privacy concerns – especially, the safety and security of the collected data (Lee et al., 2021). In the European Union, the General Data Protection Regulation stipulates to which extent data can be collected and requires data protection of all collected data (Russell et al., 2020). This implies e.g., that companies (including hotels) need to get the guest's consent if data about their behaviour is collected and processed (Russell et al., 2020). Within the European Union, tools such as facial recognition are often banned (Zheng, 2020).

2.4 The Implications of Artificial Intelligence for Human Employees

As artificial intelligence can offer great benefits for hotels when it comes to customer satisfaction and is well advanced to perform routine tasks, it challenges to replace human employees (Nguyen et al., 2020).

Through the accumulation of vast amounts of data, artificial intelligence is said to successfully personalize experiences to individual guest needs (Koo et al., 2021). The greater degree of personalization comes with a reduction of human face-to-face interaction, as robots will increasingly execute the work previously provided by humans. Through the ability of artificial intelligence to replicate the human thinking process and learning from its own mistakes there is a prevalent notion that artificial intelligence could eventually eliminate jobs which are currently performed by humans (Koo et al., 2021). As artificial intelligence has access to large volumes of data, not processable by the human brain, it can eventually find solutions to a problem, which a human might not be capable of. Within the hotel industry, about one fourth of the tasks performed by human personnel can be automated through the implementation of artificial intelligence (Prentice et al., 2019).

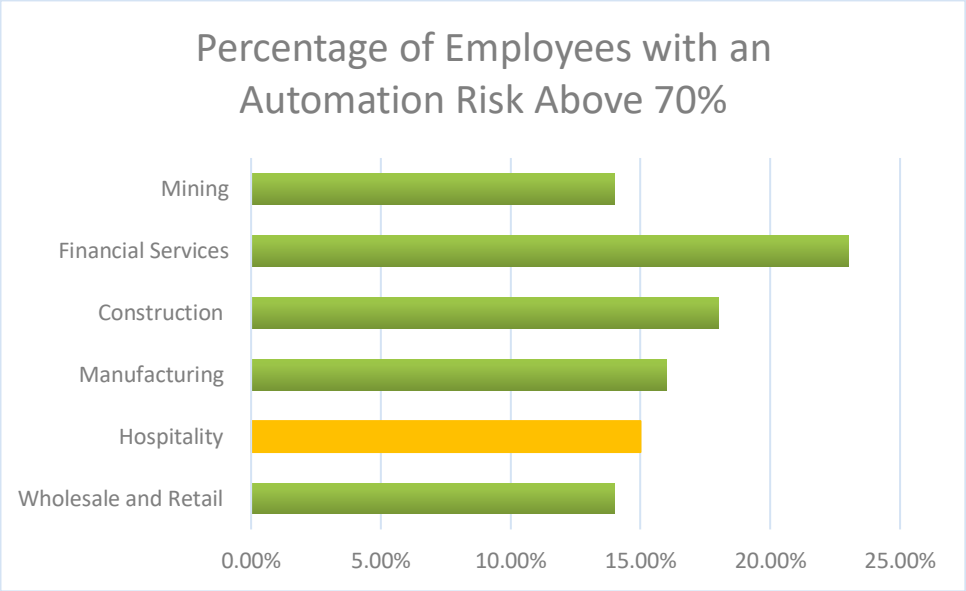

Figure 1: Percentage of Employees with an Automation Risk Above 70% (Federal Government Department Austria 2019: 48-49).

Figure 1 shows the fraction of Austrian employees along different economic sectors, which are at risk of losing their occupation to full automation by more than 70% (Federal Government Department Austria, 2019). Most vulnerable are occupations within the financial service industry with 23%. Jobs in the economic sectors mining, construction, manufacturing, *hospitality*, wholesale, and retail share similar risks, ranging from 14% to 18%. *Figure 1* underlines that service automation, including the implementation of artificial intelligence, threatens human held occupation, also within the hospitality industry.

Research conducted by Huang and Rust (2018, p. 157) measured the potential of AI to replace humans along different intelligence levels – namely *"mechanical, analytical, intuitive and empathetic"* and concluded that it can be possible to create an environment in which artificial intelligence as well as human employees work together and complement each other. However, Huang and Rust (2018) have also found that if human-machine cooperation fails, artificial intelligence can endanger human employment.

Koo et al. (2021, p. 8) have described the work environment within the hospitality industry as "*uncertain*" and investigated to which extent employees' fear of being

replaced by artificial intelligence impacts their job engagement and eventually a hotel's revenue. The researchers' findings showed that job insecurity (the threat to be replaced by artificial intelligence) has a negative effect on job involvement, which in turn can decrease hotel turnover (Koo et al., 2021). Nevertheless, they have witnessed a general willingness of employees to work with artificial intelligence and stressed the necessity of employees to be trained on how to best use and work with it (Koo et al., 2021).

Artificial intelligence implementation does not necessarily need to replace human workers, but may be implemented so as to free their time to provide even more interpersonal services where they are needed and to handle complex situations in which human assistance is desired (Paluch & Wirtz, 2021). While artificial intelligence has already proven to be able to perform mechanical, routine work, it is neither able to perform tasks which involve showing emotions, nor can it express empathy outside of what has been programmed. They often also fail to understand ironic sentences or humour, which is sometimes annoying for guests (Paluch & Wirtz, 2021) However, especially when it comes to the service industry, being empathetic and showing compassion is appreciated by guests. Complaints management for example is nearly impossible to perform without the ability to show understanding (Paluch & Wirtz, 2021). Therefore, these findings stress the importance of reshaping jobs in the hotel industry, preparing for a joint work effort of artificial intelligence and human employees.

3 Methodology

The methodology chapter for the presented research is divided into five subchapters. Firstly, different research methods are discussed, justifying the choice of quantitative research in this matter. Secondly, the design of the used online survey and respective questionnaire will be described, emphasizing on the objectives of the conducted research. Thirdly, data collection, and fourth, data analysis using hierarchical, agglomerative clustering with the Gower distance measure will be defined. Lastly, research ethics are discussed.

3.1 Research Method

In general, there are three different research designs, which can be applied: Qualitative research, quantitative research, and a mixed methods approach (Williams, 2007).

The objective of all three, qualitative, and quantitative research, as well as a mixed method approach is to get a deeper insight into a specific subject or phenomenon by collecting data, information, or facts thus analysing and interpreting it (Williams, 2007). Qualitative research is conducted to get a solid knowledge of the relationship or nature of respective variables (Black, 1994). While qualitative research focuses on answering "what" kind of an event occurs, quantitative research collects majorly numerical data to answer the question "how often" a certain event can be observed (Black, 1994, p. 425.). As quantitative data is concerned with event occurrence, it is mostly applied to gather numerical data, which can be quantified (Williams, 2007). A mixed method approach refers to data collection through both, qualitative and quantitative approaches (Willliams, 2007).

To investigate the presented content, the author decided to follow a quantitative research approach by developing and conducting an online survey. This choice is justified as this strategy is used to (dis)prove hypothesis testing and used for further statistical analysis which will be performed in *4 Findings* (Williams, 2007). Quantitative research is used to "objectively measure reality," plus following the descriptive approach with some causal attributes tries to describe a phenomenon as it currently exists – which lies at the heart of this thesis (Williams, 2007, p. 66).

The objective of the developed survey is to outline whether, or to which extent hotel guests desire the implementation of artificial intelligence along different hotel areas. The survey will investigate whether hotel guests are willing to opt for artificial intelligence implementation, even though this would imply that human employees are replaced. Also, the survey aims to understand a respondent's decision making through in-depth questions, why a certain choice has been made.

3.2 Online Survey Development

As mentioned in *3.1 Research Design*, the objective of this survey was to investigate the extent to which artificial intelligence implementation is desired in hospitality. The survey was developed in accordance with the comprehensive literature review. For its creation, the online survey application LimeSurvey was used.

Prior to filling out the actual survey, participants had to watch a short video. The video was taken from youtube.com and can be found under the name "Go Inside Alibaba's FlyZoo Hotel" published by the Alibaba Group. It follows a reporter walk through the Flyzoo hotel premises, which is a hotel operating mainly through artificial intelligence. It was shortened by the author, as some information was not relevant to the questionnaire and thus, the video was speeded up to equal 1 minute and 15 seconds. The aim of showing this video was for participants that were unfamiliar with artificial intelligence in the hotel industry to get a better understanding of what they will be asked and to make their answers more truthful. It was shown to avoid potential unclarity or confusion.

The survey questions covered four major categories:
First, participants were asked whether a certain aspect of artificial intelligence implementation within a hotel is generally desired by them. This has been investigated using a "Yes / No" question, plus using a 10-point Likert scale if the answer was "Yes". This helped assess the extent to which this implementation would enhance the guest experience (10 referring to a significant increase in the guest's experience). The investigated fields were namely:

- Robot Receptionists
- Facial Recognition

- Smart Assistants
- Robots used for Room Deliveries
- Robot Concierges
- Service Robots (Operating in the Hotel Restaurant)

Second, participants were asked if they would desire a mentioned aspect of artificial intelligence even if this technology would entirely replace human labour force. Again, this question has been asked using "Yes / No."
As "Facial Recognition" and "Smart Assistants" do not directly threaten human jobs, this question was only asked in fields that included AI technology in robotics as it is said to impose a direct threat on human employees.

Third, in-depth questions were designed to better understand *why* a certain artificial intelligence application was or was not desired by a respondent. Regardless, if the proceeding questions (explained in *First* and *Second*) have been answered with "Yes" or "No," the survey showed designated individual follow-up question, depending on previous answers. As very different implementation fields have been covered in the survey, there was no standard answer set that participants could choose from, but each was designed for one specific question.
The answers that were provided ranged from two to five options, depending on the question. Participants had the possibility to select only one out of all given answer options to investigate which of the issues was the most severe one to a participant. Usually, those options covered central issues such as e.g.: Privacy concerns, a general favour for human or artificial intelligence in a respective hotel field, or service quality and performance. To better understand this section, one example will be given for the question "If robot receptionists would completely replace human receptionists, would you like their implementation?"

If participants answered "Yes," the following answer options were to choose from:

- Because I enjoy the interaction with a robot.
- Because I believe the check-in process will be faster.
- Because I think human contact is not necessary at the reception.
- Because I believe fewer errors will occur.
- Because I believe the protection of my data is safer with robots.

If participants answered “No”, the following answer options were to choose from:

- Because I enjoy the interaction with humans.
- Because I believe the check-in process will take longer.
- Because I think human contact is vital at the reception.
- Because I believe more errors will occur.
- Because I believe the protection of my data is safer with human receptionists.

Fourth, the survey was ended with three major questions that aimed at summing up previous answers. The first one asked, whether a participant would book a hotel majorly operated through artificial intelligence only as a one-time experience. Second, participants had to complete a sentence saying: “Overall, I believe artificial intelligence will replace …. jobs in the hotel industry” and could choose from “all,” “most,” “some,” “a few,” and “no.” Third, participants had to answer whether they would enjoy human interaction, artificial intelligence, or a joint workforce most in the hotel industry for designing their optimal guest experience.

3.3 Data Collection

As briefly touched upon, the conducted survey was solely performed online due to the ongoing covid-19 pandemic and nationwide lockdowns, which made it impossible to interview people in-person. This thesis solely analyses primary data which has been gathered through the survey.

Online surveys have several advantages, especially in times of a worldwide pandemic. Participants can take the survey at any time of the day, whichever is most convenient to them (Chang & Vowles, 2013). Also, online surveys can be answered worldwide, there is no constraint on the participant’s geographic location. Another advantage of web-based surveys is that they do not need an interviewer, hence eliminating the possibility of an interviewer bias and participant’s giving answers that they believe the interviewer wants to hear (Chang & Vowles, 2013). LimeSurvey offered a link to the online survey, which enabled recipients of it to take part in it. The link to the survey has been published on several Instagram profiles.

As the core of this thesis was to investigate the interests and desires of millennials / generation Y this survey has majorly asked people between 20 to 40 years of age. The

respective target audience has been selected as, on average, currently every third hotel guest falls into this age range (Foris et al., 2020).

In total, 172 people have taken part in this survey. However, 65 people have not completed the survey, which is why those were eliminated from the data to be analysed. 100 participants have been in the age range between 20 to 40 years, 7 participants claimed to be beneath 19 years old – nevertheless, they have been included in the data analysis. The respective survey accepted answers for one month and five days and it was possible for participants to save their answers and resume at a later point in time. All answers were anonymised and therefore the participants cannot be traced back. Multiple responses from the same device were not allowed to avoid the same person filling it out more than once.

3.4 Data Analysis

As it has been described in the sections above, the data to be analysed consisted of very different measures. Most commonly, Yes / No questions were asked, as well as 10-point Likert scales, and single-choice questions to better understand why a certain answer was given by the participant.

Cluster analysis is an exploratory statistical technique with the aim to compress a given dataset and is majorly used for summarisation. To analyse the given dataset, hierarchical clustering was applied to explore and identify groups within it. In general, clusters refer to quite homogenous groupings that share similar characteristics compared to the rest of the dataset (Reutterer & Dan, 2020).

There are two approaches to identify clusters, which are model- and distance-based clustering. The former inherently assumes that a certain observation occurs with a probability distribution that comprises two or more elements, while the latter “is more exploratory by nature” (Reutterer and Dan, 2020, p. 3). Therefore, it is especially useful if a dataset proves to be rather complex.

There are five steps involved in cluster analysis. The first one is to select an objective for the performed analysis. In this case, the objective was to assess whether artificial intelligence implementation in the hotel industry is desired by generation Y. Thus, to

investigate whether certain AI implementations are still desired, if they impose a threat to humans performing a certain job.

Secondly, an appropriate proximity measure must be chosen. For this research, the Gower distance measure has been selected. It is used since 1960 and proved to be capable of coping with many different forms of characters, irrespective of whether numeric, non-numeric (e.g., categorical data) or a combination of both values is analysed. Also, Gower distance can usually be applied without the need for any further recoding (Gower, 1971). These factors made the Gower distance measure most suitable to be applied on the respective dataset and to compute the "average of partial dissimilarities across individuals" (Anand, 2020).

Third, a cluster algorithm had to be chosen. For this research, hierarchical, agglomerative clustering was applied. As the presented thesis aims to define a certain target audience and agglomerative clustering is more widely used in market research, this application made most sense (Reutterer & Dan, 2020). In this case, market segmentation was the goal – identifying groups of people that share similar characteristics concerning their desire to implement specific AI technologies in the hotel industry.

Agglomerative clustering is an unsupervised machine learning algorithm that assigns each object into an own cluster, depending on the selected proximity measure and linking criterion. For this research, Ward's method was selected as linking criterion, computing a minimum in-cluster variance. Agglomerative clustering merges the ever-more similar clusters until all datapoints are combined in a single one. Using Ward's method, in each progressing step, clusters that lead to a minimum increase in its in-cluster variance are combined.

This leads to the fourth steps, which is for the researcher to identify a number of clusters at which the agglomeration process stops. For this research, a total number of three clusters has been decided on.

In the fifth and last step of conducting cluster analysis, the respective clusters must be analysed and interpreted, which will follow in chapter *4.2 Cluster Analysis*.

3.5 Research Ethics

Designing a survey, or questionnaire, needs to follow certain guidelines to yield data of high quality, which is suitable for further analysis (Marshall, 2005).

An important step during survey development was to design it in accordance with current literature. To comply with research ethics, novice researchers are advised to investigate whether the research topic of interest has already got validated questionnaires designed by experts (ibid.). Research conducted by Wu and Cheng (2018), Lin and Mattila (2021), and Lee et al., (2021) have developed questionnaires, which are similar to the conducted one. Each of those investigating the use of artificial intelligence in hospitality, often focusing on robotics and the guest's perspective. In particular, they have investigated the guest behaviour when interacting with robots (Lee et al., 2021; Lin & Mattila, 2021), and further evaluated the dimensions of technology attachment in smart hotels (Wu & Cheng, 2018).

Of course, the developed questionnaire does not entirely follow the mentioned literature, as the purpose of the online survey was different to those conducted by experts. The aim was to assess whether millennial hotel guests enjoy interacting with artificial intelligence or not. The goal is to derive managerial implications for hotel managers to design and enhance the optimal guest experience for millennials.

Moreover, the landing page for participants should mention the purpose and aim of the conducted survey, explain the participant's role in it, and guarantee that all responses are anonymised – If it is the case (Marshall, 2005). In this research's survey development, all the above mentioned has been considered. The cover page included a short greeting, the thesis title, the purpose of the research and briefly provided information on generation Y. Also, within the description it said that participants will be shown a short video about artificial intelligence in the hotel industry, which should eliminate fears of lacking knowledge concerning this topic.

When participants start the survey, sequencing of the questions plays a crucial role in whether they will finish the survey or not (Marshall, 2005). The presented survey follows the cycle of a typical guest experience starting with robot receptionists at their arrival, over facial recognition to enter the hotel room, a smart assistant that helps guests with basic enquiries, room service robots delivering food to your room, robot concierges for recommendations on e.g., sight-seeing and eventually, service robots in the hotel restaurant.

At the end of the survey, participants were thanked for their participation, informed that the questionnaire has now ended, and encouraged to close the browser window, as it is suggested by Marshall (2005). The survey did not include names of participants, nor contact information. Each respondent was solely numbered consecutively. Demographics collected about respondents were gender – male, female, or non-binary – and age, as it is necessary to identify their belonging to generation Y. Also, participants were asked for their level of education, the field they work in, and which nationality they identify with. All data will be destroyed after the data analysis and cluster interpretation has been performed.

4 Findings

This section is devoted to outline the findings of the before mentioned survey and presented cluster analysis. This part of the thesis will first analyse the sample, and later describe the three clusters that have been found using hierarchical, agglomerative clustering using the Gower distance measure and Ward's method as linking criterion. The (dis)similarities of those will be outlined and statistical tests will be performed to identify significant differences. The Kruskal-Wallis Test has been applied to compare the three independent, non-parametric cluster groups. To correct for the multiple testing problem, Bonferroni correction has been applied in the post-hoc Mann-Whitney-U Tests.

Also, the main aim of *4 Findings* is to answer the thesis' research questions, namely:

- In which hotel areas – if in any – is the implementation of artificial intelligence desired most frequently by generation Y?
- If the implementation of artificial intelligence would directly threaten, or replace the respective jobs held by human employees, would the implementation still be desired by generation Y?
- What are the reasons behind deciding for or against artificial intelligence in the hotel industry for generation Y?

4.1 The Sample

The online survey has been viewed by 172 people. However, 65 of them have not completed the survey – therefore, they cannot be included for the data analysis. Out of the remaining 107 participants, 97 respondents fall in the age range of 20 to 40 years, while 7 participants are beneath 19 years old, and 3 participants above 31 years old. This indicates that more than 90% fall directly in the predefined age range of generation Y, while only approximately 10% do not. Although this survey focusses on millennials, all respondents that have completed the survey were included in the data analysis.

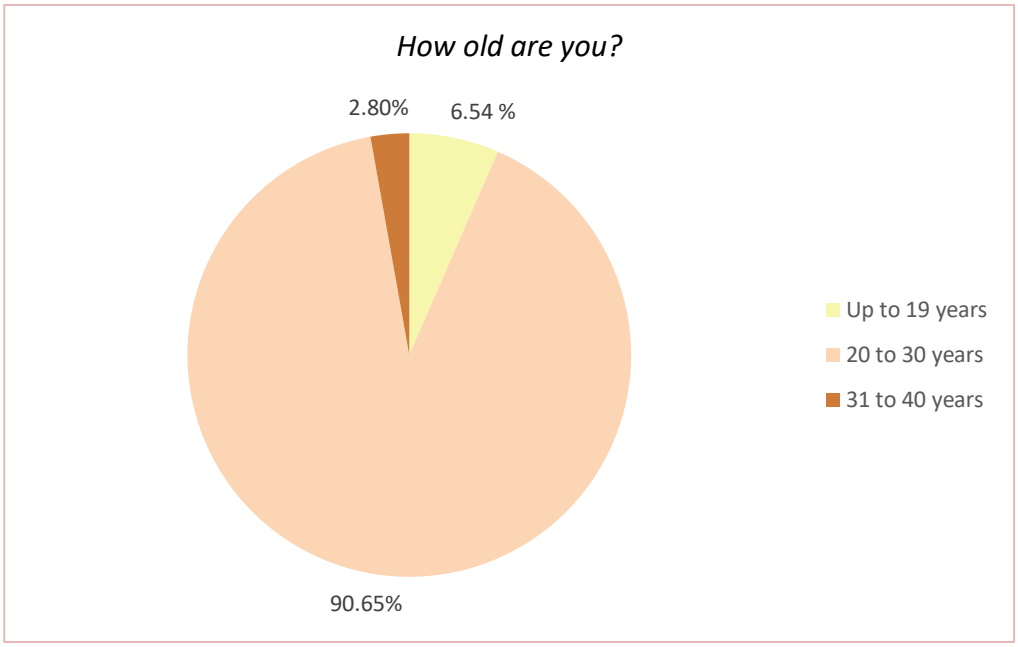

Figure 2: Age Distribution of Respondents (own illustration)

Out of the respondents, 37% identified themselves to be male, while 63% answered to be female. None of the respondents claimed to be non-binary.

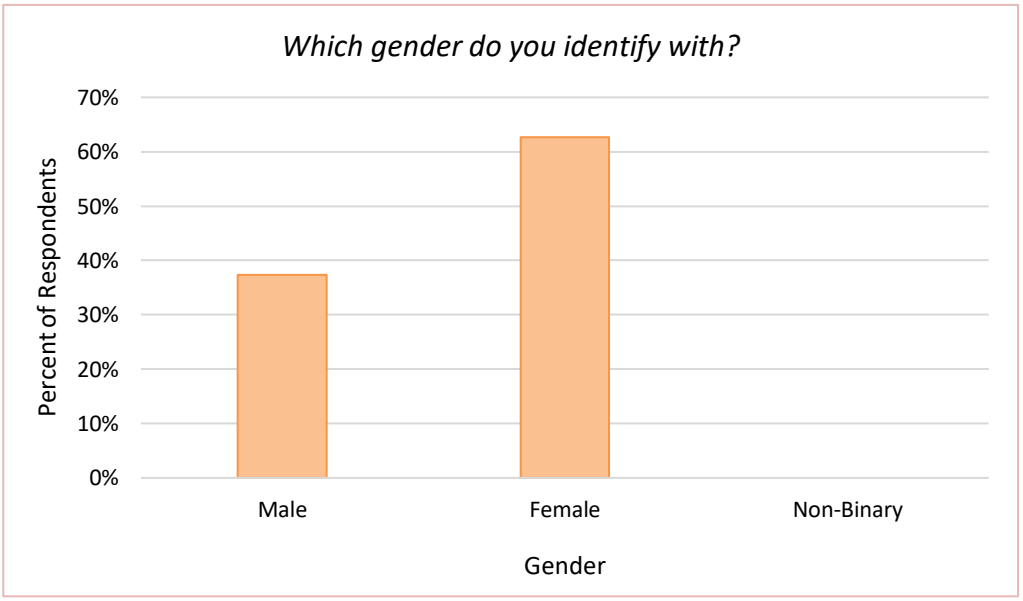

Figure 3: Gender Distribution of Respondents (own illustration)

When it comes to educational background, more than half of the respondents are currently enrolled in a bachelor programme, followed by nearly 20% that have graduated from high school. 14% of the respondents have already finished their bachelor's degree. 8.6% are currently enrolled in a master's degree. The rest splits up

into 3.3% that have completed their master studies, 3% that have not completed high school yet and 1.15% that are enrolled in high school.

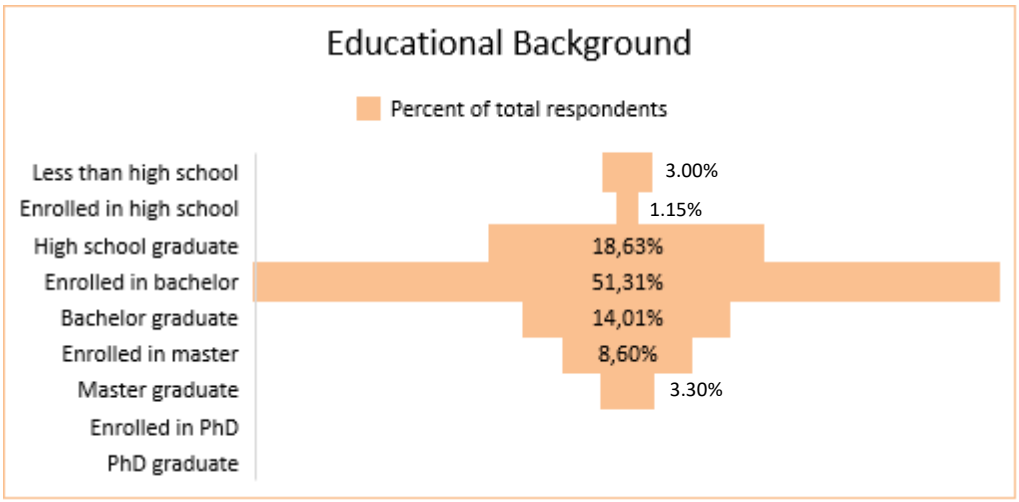

Figure 5: Educational Background of Respondents (own illustration)

As for the field of occupation, most participants work in Business and Finance (22%), followed by people that did not find their occupation under the selection criteria (21%), or are currently unemployed (17%). As most people fell in the age cohort of 20 to 30 years, it could be assumed that a considerable proportion of respondents is still in their studies and therefore currently unemployed. Respondents working in the respective field, tourism and hospitality, accounted for 9% of total participants, right behind 10% of respondents that said to be employed in engineering and manufacturing.

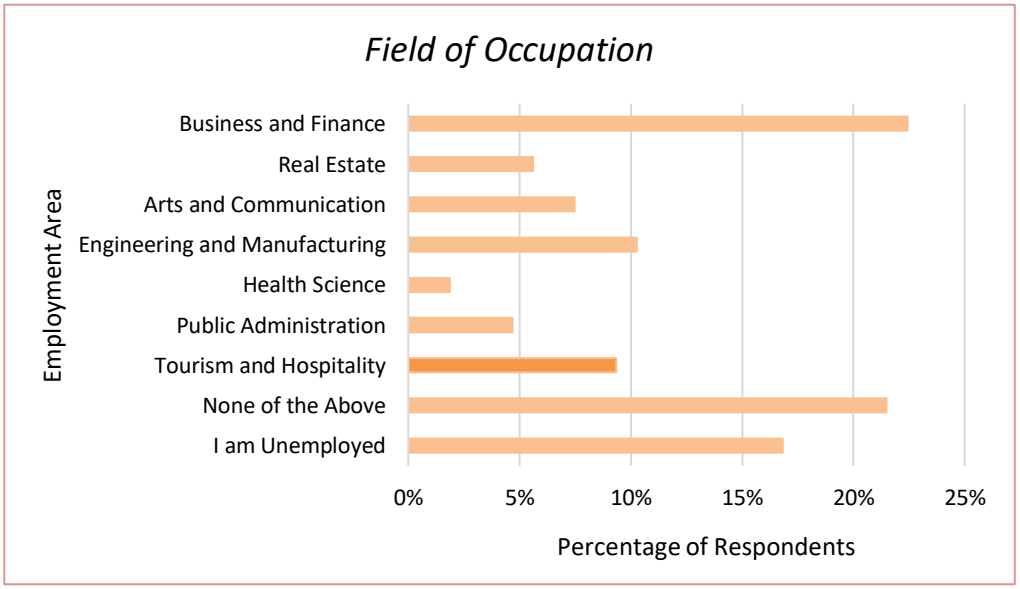

Figure 4: Field of Occupation of Respondents (own illustration)

As for the respondents' nationalities, nearly 80% were Austrians. The remaining percent split up into 4% each of German and Israeli respondents. 3% of the participants identified with Italy, followed by Bulgaria, America, and Poland with 2% each. Also, Russia, Bosnia, Serbia, Great Britain, and Chile are represented in the sample with roughly 1% each. The rest splits up to be undefinable, as inaccurate answers were given.

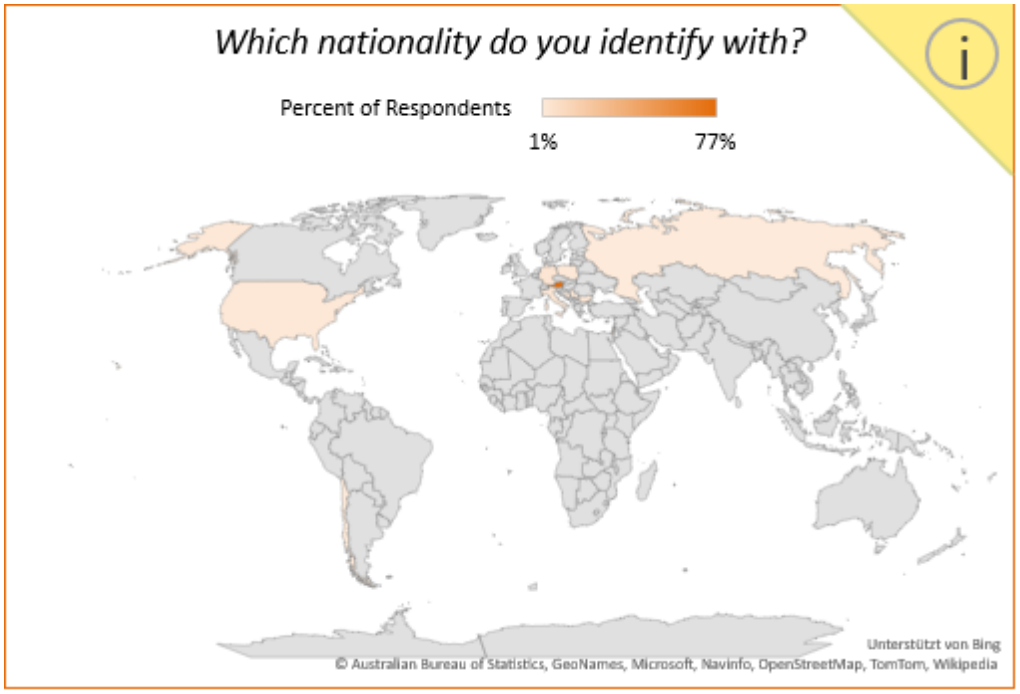

Figure 6: Nationality of Respondents (own illustration)

4.2 The Clusters

Through hierarchical, agglomerative clustering using the Gower distance measure and Ward's method as linking criterion, three distinctive clusters were found. This subsection is devoted to outline the differences between the before mentioned three clusters. They show differences in attitudes towards the optimal implementation of artificial intelligence in the hotel industry. Those differences refer to the desire of guests to implement artificial intelligence concerning: Robot Receptionists, Facial Recognition, Smart Assistants, Robots used for Room Deliveries, Robot Concierges and Service Robots operating in the hotel restaurant.

Each of the three following clusters will be thoroughly analysed by assessing and evaluating in which areas a certain cluster would (not) desire AI implementation, by how much it would enhance the guest experience, whether the application of AI would still be desired if it imposes a direct threat on human labour force and provide reasons for their responses.

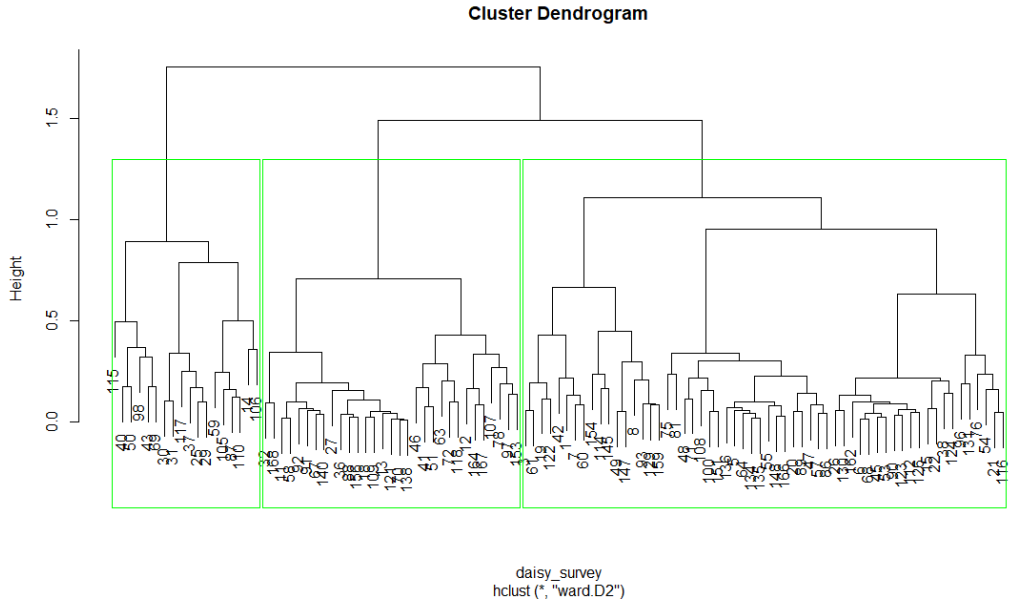

Figure 7: Dendrogram

Dendrograms are frequently used to visualise clusters and to gain a better understanding of their structure (Reutterer & Dan, 2020). *Figure 7* shows the dendrogram for this research. *Daisy* was a command used in RStudio to apply the Gower distance measure, *hclust* indicates that hierarchical clustering has been performed, thus *ward.D2* stands for using Ward's method as linking criterion. As it is observable there are three clusters to be analysed, each marked with a green frame. ***Cluster One*** will refer to the largest one on the right, ***Cluster Two*** will refer to the one in the centre and ***Cluster Three*** will comprise information about the smallest cluster on the left side of the dendrogram. Each cluster will be given a name that summarises its characteristics. In *Table 2* all information about the clusters can be found, based on which each of the clusters will be described. As "No Answers" have been replaced by zero in RStudio, the mode was used for Likert scale questions whenever it deviated from the median, (Questions asking "Why?") as results might be erroneously interpreted otherwise.

Table 2: Respondents' Answers by Cluster

3 Clusters		Cluster 1	Cluster 2	Cluster 3
		n = 58	n = 31	n = 18
Would you like to be welcomed by a robot receptionist?	Median	2	2	2
If robot receptionists would completely replace human receptionists, would you desire their implementation?	Median	2	2	2
If no - Why?	Median	1	1	1
Would you like to use facial recognition as a room key?	Median	2	1	1
By how much would this enrich your experience?	Median		6	5
If yes - Why?	Median		1	1
If no - Why?	Median	3		
Would you like to have a smart assistant in your room?	Median	2	1	1
By how much would this enrich your experience?	Median		7	5
If yes - Why?	Median / Mode		1	Median 1 / Mode 3
If no - Why?	Median / Mode	Median 1 / Mode 2		
Would you like to have robots in room service?	Median	2	2	1
By how much would this enrich your experience?	Median			6,5
If robots in room service would completely replace humans bringing food etc. - would you like their implementation?	Median	2	2	1

If yes - Why?	Median / Mode			Median 1 / Mode 3
If no - Why?	Median	2	2	
Would you like to talk to a robot concierge / chatbot for recommendations?	Median	2	2	1
By how much would this enrich your experience?	Median			6,5
If robot concierges would completely replace human concierges, would you like their implementation?	Median	2	2	1
If yes - Why?	Median / Mode			Median 2 / Mode 1
If no - Why?	Median / Mode	3	3	
In the hotel restaurant: Would you like to be served by service robots?	Median	2	2	2
By how much would this enrich your experience?	Median			
If service robots would completely replace human waiters, would you still like their implementation?	Median	2	2	2
If yes - Why?	Median / Mode			
If no - Why?	Median / Mode	4	4	4
Overall, I would enjoy staying in a hotel fully operated through artificial intelligence with no human staff only as a one-time experience.	Median / Mode	2	1	1
Overall, I believe artificial intelligence will replace (Insert: all, most, some, a few, no) jobs in the hotel industry.	Median / Mode	3	3	Median 2,5 / Mode 3
With which statement do you agree most?	Median / Mode	2	Median 2 / Mode 2 and 3	3

Table 3: Respondents' Demographics by Cluster

Demographics	Indicator	Cluster 1	Cluster 2	Cluster 3
		n=58	n=31	n=18
Gender				
Female	Percent	65.52%	64.52%	50.00%
Male	Percent	34.48%	35.48%	50.00%
Age				
Beneath 19 years	Percent	6.90%	3.23%	11.11%
Between 20 and 30 years	Percent	87.93%	96.77%	88.89%
31 to 40 years	Percent	5.17%	0.00%	0.00%
Level of education				
Less than high school	Percent	3.45%	0.00%	5.56%
Enrolled in high school	Percent	3.45%	0.00%	0.00%
High school graduate	Percent	18.97%	25.81%	11.11%
Enrolled in bachelor	Percent	50.00%	48.39%	55.56%
Bachelor graduate	Percent	6.90%	12.90%	22.22%
Enrolled in master	Percent	13.79%	6.45%	5.56%
Master graduate	Percent	3.45%	6.45%	0.00%
Enrolled in PhD	Percent	0.00%	0.00%	0.00%
PhD graduate	Percent	0.00%	0.00%	0.00%
Field of Employment				
Agriculture	Percent	0.00%	0.00%	0.00%
Business and Finance	Percent	22.41%	25.81%	16.67%
Real Estate	Percent	8.62%	3.23%	0.00%
Arts and Communication	Percent	10.34%	3.23%	5.56%
Engineering and Manufacturing	Percent	13.79%	0.00%	16.67%
Health Sciences	Percent	3.45%	0.00%	0.00%
Public Administration	Percent	1.72%	12.90%	0.00%
Tourism and Hospitality	Percent	3.45%	16.13%	16.67%
None of the above	Percent	15.52%	22.58%	38.89%
I am not employed currently	Percent	20.69%	16.13%	5.56%
Identified Nationality				
Austria	Percent	75.86%	77.42%	77.78%
Germany	Percent	1.72%	6.45%	5.56%
Italy	Percent	0.00%	3.23%	11.11%
Russia	Percent	1.72%	0.00%	0.00%
Bosnia	Percent	1.72%	0.00%	0.00%
Anglo-Saxon	Percent	1.72%	0.00%	0.00%
Bulgaria	Percent	1.72%	3.23%	0.00%
Serbia	Percent	1.72%	0.00%	0.00%
Israel	Percent	3.45%	3.23%	5.56%
Great Britain	Percent	0.00%	3.23%	0.00%

America	Percent	3.45%	0.00%	0.00%
Poland	Percent	1.72%	3.23%	0.00%
Chile	Percent	1.72%	0.00%	0.00%
Undefinable	Percent	3.45%	0.00%	0.00%

4.2.1 Cluster One: "The Traditional"

Cluster one comprises 58 respondents out of 107 in total, which equals 54.21% of all participants. Cluster One has been named "The Traditional" as it does not desire the AI within the hotel industry and wants to stick to traditional aspects of this industry. "The traditional" comprises 65.52% female (n=38) and 34.48% male (n=20) respondents. 93.10% of the respective cluster are between 20 and 40 years old, while only 6.9% are 19 years old and younger. Out of this cluster's respondents, 3.45% each dispose of less than a high school degree or are enrolled in high school. About 19% have graduated from high-school, 50% are currently enrolled in a bachelor programme, followed by 7% that have completed their bachelor's degree. 14% are currently enrolled in a master's degree, 3.45% have completed their master studies. As for their field of occupation, 22.4% work in business and finance while 20.7% are currently unemployed (probably due to them studying).

"The Traditional" wants to stick to the way the hospitality industry used to be. Cluster one refuses the implementation of robot receptionists, regardless of whether it imposes a direct threat on human labour force or not. Reasons for their choice are that they "enjoy interaction with humans more" than with artificial intelligence.

Also, facial recognition and smart assistants are not desired by "the traditional." The former and the latter have been denied due to "privacy concerns" associated with artificial intelligence. When it comes to the implementation of robots in room service and robot concierges, cluster one also opts against their implementation and decides for human interaction. The answers provided for rejecting robots in room service were that "human contact is vital in room service." The reason for not implementing robot concierges was similar, as "the traditional" claims that they "prefer human contact". Also, the following question which investigated whether robots were desired to be implemented in the hotel restaurant has been rejected, with respondents selecting "because I think human contact is necessary in the restaurant."

Moreover, “The traditional” denies the desire for AI implementation in the last section of the survey, consisting of questions that were asked for summarisation. When asked whether they would stay in a hotel fully operated through artificial intelligence as a one-time experience, the respondents answered “No.” However, cluster one believes that some jobs will be replaced by AI in the future of the hotel industry. Overall, “the traditional” claimed that they “would desire human employees more than artificial intelligence in the hotel industry” which aligns with answers described previously.

To summarise, “the traditional” values human exchange and interaction more than the implementation of artificial intelligence. From a range of answer options, cluster one majorly opted for answers that had to do with human contact and their affection towards human exchange. Regardless of which hotel area or application of AI has been asked, Cluster One denied any implementation and wants to maintain what lies at the heart of hospitality – human interactions and social exchange.

4.2.2 Cluster Two: “The Innovator”

In total, Cluster Two consists of 31 respondents which are 29% of the whole dataset. Therefore, it is the second largest cluster. Cluster Two comprises 20 female (64.5%) respondents and 11 males (35.5%), with 97% between 20 to 30 years old and 3% 19 years old or younger. 12.9% of “the innovator” are currently enrolled in a master’s degree (6.45%) or have finished their master’s degree (6.45%). Another 12.9% have completed their bachelor’s degree. Most respondents are high-school graduates (25.8%), or currently enrolled in bachelors (48.4%). One fourth of the respective respondents are working in Business and Finance which represents the largest field of employment.

“The innovator” refuses to be welcomed by robot receptionists instead of humans as cluster two “enjoys the interaction with humans” more than the exchange with robots. When it comes to the implementation of facial recognition to access the room, “the innovator” seems to be curious and answers “Yes,” as they believe that “accessing the room will be faster.” Moreover, this implementation would positively contribute to their overall guest experience (Likert Scale ranking: 6 out of 10). When it comes to using in-room smart assistants “the innovator” is also open to change, as they think that having a smart assistant in one’s room would be “more entertaining”

than a traditional key-card experience. To implement smart assistants would contribute to a greater guest experience, even more than facial recognition (Likert Scale ranking: 7 out of 10). However, cluster two answered with "No" to any subsequent question. This cluster neither wanted robots in room service, nor robot concierges as "human contact is vital in room service" and because they "prefer human contact" and receiving human recommendations over those of a robot. When it comes to service robots in the hotel restaurant, "the innovator" argues that "human contact is necessary in a restaurant" and therefore does not desire this kind of implementation.

"The innovator" would enjoy staying in a hotel fully operated through artificial intelligence as a one-time experience. Moreover, they believe that some human jobs will eventually be replaced by the implementation of artificial intelligence. "The innovator" seems to be on crossroads concerning the last question as an equal number of respondents claim to desire human employees more than artificial intelligence in the hotel industry while the other half answered that a joint and balanced workforce of AI and humans is preferred.

To summarise, "the innovator" has expressed interest in AI implementation only in areas that do not directly threaten human employees. Implementing facial recognition to unlock a hotel room, as well as using in-room smart assistants does not directly threaten human labour force within a hotel. Whenever a question was asked concerning AI in the form of robotics implementation and the associated potential of it to replace human labour, "the innovator" claimed that it is not desired. For "the innovator", staying in a hotel operated majorly through AI seems to be more of a one-time experience, rather than their desired norm. They are especially hesitant when it comes to deciding whether human labour force or a joint workforce of AI and human labour is desired.

4.2.3 Cluster Three: "The Challenger"

The third and therefore last cluster to be analysed is the smallest one, comprising 18 respondents, which equals 16.2% of all participants. Exactly half of the respondents allocated to this cluster are female and male. About 89% fall in the age range of 20 to 30 years old, while 11% are 19 years old or beneath that age. As for the educational

background, most respondents (55.56%) are currently enrolled in a bachelor's degree, followed by 22.22% that have completed their bachelor's degree, approximately 11% who have graduated from high-school and 5.5% each that do not have graduated from high-school yet or are master students. When it comes to their occupation, 16.67% each work in business and finance, engineering and manufacturing, as well as tourism and hospitality.

The implementation of robot receptionists is not desired by cluster three, as they enjoy the interaction with humans. However, "the challenger" desires a wide range of artificial intelligence implementations within the hotel industry. When it comes to facial recognition, "the challenger" would desire this facet of artificial intelligence, and it would increase their hotel experience by 50%. The reason for the interest in using facial recognition comes from their belief that "accessing the room will be faster." Moreover, also smart assistants are a tool which "the challenger" would like to encounter in the hotel industry, increasing the guest experience by another 50%. "The challenger" believes that "service will be faster as commands are taken immediately".

As for robotics, "the challenger" is open to change and would desire to have robots in room service. When asked by how much this would enrich their overall experience, respondents answered 65%. Even if room service robots would entirely replace human employees delivering food or other articles to a guest's hotel room, "the challenger" would desire the implementation. The reason for their choice is that, for them, "human contact is not necessary in room service." Robot concierges are another application of AI that cluster three would like to have included in their hotel experience – it would increase their stay considerably, by 65%. If robot concierges would completely replace human concierges, "the challenger" would still desire their implementation, because they "expect better recommendations based on my data". A robotic technology, apart from robot receptionists that "the challenger" does not want to have implemented are service robots in the hotel restaurant. The reason behind their choice is that "human contact is necessary in a restaurant" and therefore cannot be replicated by AI.

Overall, "the challenger" would enjoy staying in a hotel fully operated using AI technologies as a one-time experience. When asked about the potential of artificial intelligence to replace human-held jobs in the future, "the challenger" believes that

"some" might be endangered. If cluster three had to choose, they would desire to experience a hotel which is composed of a joint and balanced workforce, including AI and human employees.

To summarise, "the challenger" is open to a wide range of artificial intelligence implementations along their hotel experience. Out of the clusters that have been analysed, "the challenger" is the most welcoming when it comes to the use of AI in the hotel industry. Facial recognition and smart assistants are desired as the service quality is believed to increase (to be faster). Robotic technologies are partially desired – room service robots as well as robot concierges are welcome in "the challenger's" hotel experience. In room service, "the challenger" does not see a necessity for human contact, while the use of guest data is promising to "the challenger" to receive better recommendations by a robot concierge. Out of the questions asked in the survey, the hotel reception and the hotel restaurant comprehend most human interactions, compared to other areas. This might also be the reason for "the challenger's" desire to maintain human interaction in those labour-intense environments, and to replace employees where social exchange is not greatly present.

4.2.4 Cluster Summary

As discussed, "the traditional" is the largest cluster (n=58), followed by "the innovator" (n=31). "The challenger" is the smallest cluster with a total of 18 out of 107 participants. Those three clusters seem to show significant differences when it comes to their optimal hotel experience concerning artificial intelligence implementation. Although generation Y grew up with digital technologies, are familiar with handling those and open to new experiences and encounters (Kaifi et al., 2012), most respondents cherish the traditional style of hospitality and associated human exchange. "The traditional" denied any application of artificial intelligence, as this group desires human interaction and social exchange. For them, human contact lies at the heart of their experience in a hotel. Overall, they would desire human employees in hospitality more than artificial intelligence.

While "the traditional" wants to hold on to the current state of hospitality, "the innovator" seemed to be more excited about artificial intelligence. Facial recognition and smart assistants would enhance their hotel experience. Those two AI

implementations do not directly threaten human jobs, as entering the room or ordering articles to a room does not involve any, or a minimum of, human employee interactions. “The innovator” associates facial recognition with faster room access, and smart assistants are perceived as entertaining to use.

“The challenger” is excited for a variety of artificial intelligence solutions in the hotel industry. Not only facial recognition and smart assistants are of interest to them, but also robotics in room service and robot concierges would enrich their experience. “The challenger” favours robotics in those areas over human employees as they expect improved service quality.

As the described clusters seem to differ significantly from each other concerning their characteristics and opinions towards the implementation of artificial intelligence, statistical tests will be performed to encounter similarities and differences.

4.3 Statistical Tests: Similarities and Differences between Clusters

As previously discussed, statistical tests will be applied to test for significant differences and similarities among the clusters one, two, and three. To investigate whether the analysed variables follow a normal distribution, the Kolmogorov-Smirnov test was applied. If the p-value of the Kolmogorov-Smirnov test falls beneath 0.05, the data does meet the normality assumption and non-parametric testing needs to be applied. *Table 4* summarises the results.

Table 4: Kolmogorov-Smirnov Test Results

Kolmogorov Smirnov Test	P-value
Would you like to be welcomed by a robot receptionist?	0.00000000000000022
Would you like to use facial recognition as a room key?	0.00000000000000022
Would you like to have a smart assistant in your room?	0.00000000000000022
Would you like to have robots in room service?	0.00000000000000022
Would you like to talk to a robot concierge / chatbot for recommendations?	0.00000000000000022

In the hotel restaurant: Would you like to be served by service robots?	0.00000000000000022
Overall, I would enjoy staying in a hotel fully operated through artificial intelligence with no human staff only as a one-time experience.	0.00000000000000022
Overall, I believe artificial intelligence will replace (Insert: all, most, some, a few, no) jobs in the hotel industry.	0.00000000000000022
With which statement do you agree most?	0.00000000000000022

Table 4 visualises that all Kolmogorov-Smirnov tests were significant, indicating that the data does not follow normal distribution. As three non-parametric and independent groups will be compared, the Kruskal-Wallis test has been applied. *Table 5* summarises the results of the Kruskal-Wallis Test. The light orange indicates that no significant difference between the clusters has been found, while the light green indicates significant differences between the three clusters with a p-value smaller than 0.05. The questions asking whether a certain AI implementation is desired even if it completely replaces human employees has been left out as those answers were identical to the respective proceeding questions displayed in *table 5.*

Table 5: Kruskal-Wallis Test

Kruskal-Wallis Test	P-value
Would you like to be welcomed by a robot receptionist?	0.06226
Would you like to use facial recognition as a room key?	0.00000000000000129
Would you like to have a smart assistant in your room?	0.000006192
Would you like to have robots in room service?	0.006524
Would you like to talk to a robot concierge / chatbot for recommendations?	0.00000000002065
In the hotel restaurant: Would you like to be served by service robots?	0.05876

Overall, I would enjoy staying in a hotel fully operated through artificial intelligence with no human staff only as a one-time experience.	0.2511
Overall, I believe artificial intelligence will replace (Insert: all, most, some, a few, no) jobs in the hotel industry.	0.0006773
With which statement do you agree most?	0.3091

Significant differences in the respective cluster groups have been found for the implementation of facial recognition, smart assistants, robots in room service, and robot concierges. When it comes to assessing how many jobs in the hotel industry will be threatened by AI in the future, the cluster groups also show significant differences. This was to be expected as “the traditional”, “the innovator” and “the challenger” revealed different desires during the cluster analysis. The three clusters show similarities (non-significant differences) when it comes to the implementation of robot receptionists, and robots in the hotel restaurant. As all clusters denied the implementation of robot receptionists and robots in the hotel restaurant, a non-significant result was to be expected.

4.3.1 Post-Hoc Test for Significant Results

As some of the results of the Kruskal-Wallis test have been significant, the adequate post-hoc tests: Mann-Whitney-U tests were performed. Bonferroni correction was applied to eliminate the multiple-testing problem and to adjust the respective p-values. In *table 6* the results of the respective tests are summarised.

Table 6: Mann-Whitney-U Test with Bonferroni Correction for Significant Results

Mann-Whitney-U Test with Bonferroni Correction	**P-values**
Would you like to use facial recognition as a room key?	
Cluster One compared to Cluster Two	0.0000000000000013
Cluster One compared to Cluster Three	0.0000034
Cluster Two compared to Cluster Three	0.0022

Would you like to have a smart assistant in your room?	
Cluster One compared to Cluster Two	0.0000031
Cluster One compared to Cluster Three	0.5319
Cluster Two compared to Cluster Three	0.0022
Would you like to have robots in room service?	
Cluster One compared to Cluster Two	1
Cluster One compared to Cluster Three	0.0225
Cluster Two compared to Cluster Three	0.0074
Would you like to talk to a robot concierge / chatbot for recommendations?	
Cluster One compared to Cluster Two	0.91
Cluster One compared to Cluster Three	0.0000000085
Cluster Two compared to Cluster Three	0.000000036
Overall, I believe artificial intelligence will replace (Insert: all, most, some, a few, no) jobs in the hotel industry.	
Cluster One compared to Cluster Two	1
Cluster One compared to Cluster Three	0.0011
Cluster Two compared to Cluster Three	0.002

All three clusters show significant differences to one another when it comes to facial recognition. The strongest differences were encountered between “the traditional” and “the innovator”, followed by “the traditional” and “the challenger”. Although “the innovator” and “the challenger” both desired to implement facial recognition, significant differences have been found.

For the next question, the Mann-Whitney-U Test with Bonferroni correction identified significant differences between cluster one and two as well as two and three when it comes to the desire to implement smart assistants in hotel rooms. Cluster one and three show non-significant differences in this matter. Although it could have been assumed that “the traditional” and “the challenger” would show the most significant result here, the Mann-Whitney-U test could not find sufficient statistical differences.

Implementing robots in room service shows significant differences between cluster one and three, as well as two and three. A non-significant result was found when comparing cluster one and two in this instance. This follows the results obtained in

the cluster analysis, as “the traditional” and “the innovator” did not desire room service robots, while “the challenger” did.

Moving on to the next robotic implementation, robot concierges, significant differences have, again, been found comparing cluster one and three plus two and three. The same explanation as for robots in room service can be applied here. While cluster one and two denied the desire to interact with robot concierges in the cluster analysis, cluster three welcomed it.

Nearly the same goes for the assessment of how many jobs might be replaced by AI in the future, only the comparison between cluster one and two is non-significant. Given that “the traditional” opted for the desire to have more human held jobs in the hotel industry and “the innovator” also showed a tendency to this answer, these results were to be expected.

In all analysed aspects, cluster two “the innovator” compared to cluster three “the challenger” show a significant p-value beneath 0.05, which means that their viewpoints and desires concerning AI implementation in the hotel industry show significant differences. Almost the same goes for the comparison of cluster one “the traditional” and cluster three “the challenger” as the computed p-values fall beneath 0.05 except for the desire to implement smart assistants. This indicates that cluster one and three statistically show non-significant differences in their attitudes towards the implementation of smart assistants, which might be surprising given the cluster analysis. When it comes to the comparison of cluster one “the traditional” and cluster two “the innovator” quite a few similarities as well as significant differences were computed. While the respective clusters show unsimilar attitudes towards the implementation of facial recognition and smart assistants, they seem to be rather alike when it comes to their views on room service robots and robot concierges. Also, they had similar opinions on the jobs that might be replaced through artificial intelligence in the future, which was all supported by the cluster analysis.

5 Managerial Implications, Research Limitations and Potential Future Research

5.1 Recommendations to Hoteliers

The three identified clusters, namely “the traditional,” “the innovator,” and “the challenger,” can be used to provide managerial advice for hoteliers.

To create a suitable and desired guest experience for “the traditional,” hoteliers should not implement artificial intelligence in the service encounter. “The traditional,” as the name implicates, enjoys human contact and interaction – a hotel experience without social exchange would not be of their interest. As “the traditional” claimed to desire human labour more than artificial intelligence, investing in employees rather than replacing them would make them most satisfied.

A quite similar approach should be followed when dealing with “the innovator.” While they enjoy human contact, they do not reject the implementation of artificial intelligence in general. In hotel areas where artificial intelligence can be implemented without imposing a direct threat on human employees, its application is desired. Facial recognition and smart assistants use artificial intelligence technologies but at the same time do not threaten human labour. For the optimal service encounter, “the innovator” needs a lot of traditional, human interaction in areas that are typically associated with it. While half of “the innovators” would favour human labour over AI, the other half could imagine staying in hotels that offer a joint and balanced workforce composed of both, AI and human employees.

“The challenger” is different to the before-mentioned clusters. Hoteliers are well-advised to implement a wide range of artificial intelligence to enhance their hotel experience. Apart from facial recognition and smart assistants, “the challenger” would also welcome the replacement of human employees in room delivery and concierge services. Although human jobs would be endangered, those implementations are desired and would enhance the overall hotel experience of “the challenger,” as it is associated with elevated levels of entertainment and improved service quality.

As “the traditional” and “the innovator” represent the largest clusters, adding up to a total of 83% of the respondents, hoteliers would be best advised to stick to traditional, human interactions in their experience design. If hoteliers think of implementing AI it is important to apply the respective technology in areas that does not interfere with the beloved social exchange between guests and employees. As “the challenger” represents merely 17% of total respondents, hoteliers should only implement their desired AI solutions to position themselves in a niche market and advertise their hotel as a “brand-new artificial intelligence experience”, with reduced human contact. As revealed by the data, areas in which artificial intelligence is not beneficial to be implemented are the reception and the hotel restaurant. This means, even if a hotel operates in a niche market to target “the challenger” and implements different artificial intelligence technologies as a unique selling proposition, they are well advised to not replace traditional receptionists and employees in a restaurant.

5.2 Limitations

This research shows a few limitations. First, generalising the data extracted from the presented sample needs to be done with caution. The sample size of 107 respondents is rather small, also generation Y comprises people born between the 1980s up to the year 2000 (Ordun, 2015). However, roughly 90% of respondents fell into the age range of 20 to 30 years and therefore do not represent the whole generation. As the majority of participants claimed to be Austrian, the obtained results are unlikely to be valid in other parts of the world, due to regional differences in guest needs, desires and technological progress concerning artificial intelligence.

This thesis’ survey was developed and published during the covid-19 pandemic, accompanied by nationwide lockdowns around the world. The survey has been promoted on the author’s social media channels; thus, help was provided by friends and other followers. As this practice falls under convenience sampling, the obtained data might be biased. Moreover, although it was an online survey, the response rate could have been increased and randomised by additionally promoting it on the streets and asking pedestrians. Further reasons for merely 107 people that completed the survey out of 172 people that had a look at it, could be due to the survey design. Watching a 1 minute and 15 seconds video prior to answering between 24-30 questions (depending on given answers) might be overwhelming for respondents.

Also, the shown video plus the survey itself were solely available in English – people without the required language skills were unable to complete it.

5.3 Potential Future Research

Future research potential is given by overcoming the current research limitations. To conduct a representative study of generation Y, more people need to be asked randomly that fall into the entire respective age range, equally distributed.

As for the research objective, it might be of interest to investigate distinct desires and viewpoints on this topic within different countries. While Austria might not be too excited about implementing artificial intelligence, other parts within Europe could be. To investigate local differences concerning this matter can be especially useful to hotel chains which own property around the globe. As for assessing the optimal implementation of AI in the hotel industry, it makes sense to investigate and conduct research into different age ranges, especially in Generation Z which is born after generation Y and the next generation that becomes increasingly present within the hotel industry.

6 Conclusion

Artificial intelligence is a technology which is said to alter the traditional way of hospitality. Due to its potential to personalise hotel services, AI can impact the loyalty of a respective hotel guest (Tiwari, 2019). This thesis' purpose was to investigate the "Optimal Implementation of Artificial Intelligence within the Hotel Industry for generation Y." By conducting an online survey, primary data on this topic has been collected, questioning millennials. Consequently, three clusters with significantly different viewpoints were identified. "The traditional," "the innovator," and "the challenger" differ in their attitudes towards the implementation of robot receptionists, facial recognition, smart assistants, robot concierges, robots in room service, and robots in the hotel restaurant.

The following research questions have been investigated and answered within this thesis' research:

- In which hotel areas – if in any – is the implementation of artificial intelligence desired most frequently by generation Y?
- If the implementation of artificial intelligence would directly threaten, or replace the respective jobs held by human employees, would the implementation still be desired by generation Y?
- What are the reasons behind deciding for or against artificial intelligence in the hotel industry for generation Y?

"The traditional" refuses any aspect of artificial intelligence throughout their experience, as they desire social exchange with human employees. "The innovator" denied any implementation of robotics, however, facial recognition to enter the room and smart assistants to solve basic queries are desired by them. "The challenger" has revealed to be most open towards artificial intelligence in the hotel industry. Facial recognition, smart assistants, robot concierges, and robots in room service are all desired applications of AI in their hotel experience. Moreover, "the challenger" favoured the chosen robotic technologies over human employees in these respective areas.

Therefore, the implementation of artificial intelligence has been desired by two clusters: “The innovator” would desire to use facial recognition and smart assistants. “The challenger” agrees to the former thus would welcome robot concierges and robots in room service. Only “the challenger” has agreed to the implementation of robotics as a concierge and in room service, even if it would entirely replace human jobs in the respective areas. “The challenger” argued to opt for artificial intelligence instead of human employees as “human contact is not necessary in room service” and through robot concierges “better recommendations based on my data” is expected.

Initially, it was proposed that AI will denote a significant increase in its implementation as it is desired by millennials. However, the research has revealed that roughly 55% of the respondents deny the desire to implement AI. Nguyen et al. (2020) and Reis et al. (2020) have outlined the potential of artificial intelligence to endanger human held occupations in the hotel industry. Koo et al. (2021) have outlined the ability of robots to perform work traditionally executed by humans. The presented literature has been acknowledged and this thesis proposed that AI will reduce the number of jobs executed by humans in the hotel industry as it is desired by generation Y. However, over 83% of respondents did not opt for artificial intelligence implementation, when it is associated with threatening human jobs.

While AI is well-advanced to take on routine tasks (Nguyen et al., 2020), one reason for generation Y to favour human contact over the implementation of AI might be that artificial intelligence is yet unable to show emotions (Paluch & Wirtz, 2021). As described by Paluch and Wirtz (2021) the hotel industry is built on social exchange, especially showing empathy, and expressing compassion is central to a well-designed hotel experience. As long as artificial intelligence is not able to replicate feelings, it might take some time until generation Y is fond of its implementation.

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Appendix

Section A: Artificial Intelligence within the Hotel Industry

A1. Would you like to be welcomed by a robot receptionist?

- Yes ☐
- No ☐

A2. By how much would this enrich your experience?

1: Not at all - 10: Significantly

1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐

A3. If robot receptionists would completely replace human receptionists, would you like their implementation?

- Yes ☐
- No ☐

A4. Why?

- Because I enjoy the interaction with a robot ☐
- Because I believe the check-in process will be faster ☐
- Because I think human contact is not necessary at the reception ☐
- Because I believe fewer errors will occur ☐
- Because I believe the protection of my data is safer with robots ☐

A5. Why?

- Because I enjoy the interaction with humans ☐
- Because I believe the check-in process will take longer ☐
- Because I think human contact is vital at the reception ☐
- Because I believe more errors will occur ☐
- Because I believe the protection of my data is safer with human receptionists ☐

A6. Would you like to use facial recognition as a room key?

- Yes ☐
- No ☐

A7. By how much would this enrich your experience?

1: Not at all - 10: Significantly

1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐

A8. Why?

Because I believe accessing the room will be faster ☐

Because I believe fewer errors will occur ☐

A9. Why?

Because I believe accessing the room will take longer ☐

Because I believe more errors will occur ☐

Because of privacy concerns ☐

A10. Would you like to have a smart assistant in your room?

Yes ☐

No ☐

A11. By how much would this enrich your experience?

1: Not at all - 10: Significantly

1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐

A12. Why?

Because I think it is entertaining ☐

Because I believe fewer errors will occur ☐

Because I believe service will be faster as commands are taken immediately ☐

A13. Why?

Because I believe errors might occur ☐

Because of privacy concerns ☐

A14. Would you like to have robots in room service?

Yes ☐

No ☐

A15. By how much would this enrich your experience?

1: Not at all - 10: Significantly

1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐

A16. **If room service robots would completely replace humans bringing food or other articles to your room, would you like their implementation?**

- ☐ Yes
- ☐ No

A17. **Why?**

- ☐ Because I find robots more entertaining
- ☐ Because I believe the delivery of articles will be faster
- ☐ Because I think human contact is not necessary in room service
- ☐ Because I believe service will be flawless

A18. **Why?**

- ☐ Because I believe the delivery of articles will take longer
- ☐ Because I think human contact is vital in room service
- ☐ Because I believe more errors will occur
- ☐ Because of privacy concerns

A19. **Would you like to talk to a robots concierge (chatbot) for recommendations?**

- ☐ Yes
- ☐ No

A20. **By how much would this enrich your experience?**

1: Not at all - 10: Significantly

1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐

A21. **If robot concierges (chatbots) would completely replace human concierges, would you like their implementation?**

- ☐ Yes
- ☐ No

A22. **Why?**

- ☐ Because I expect better recommendations based on my data
- ☐ Because I find robot concierges more entertaining
- ☐ Because I believe recommendations will be faster
- ☐ Because I think human contact is not necessary
- ☐ Because I believe fewer errors will occur

A23. Why?

- Because I find human concierges more entertaining ☐
- Because I believe receiving recommendations will take longer ☐
- Because I prefer human contact ☐
- Because I believe more errors will occur ☐
- Because of privacy concerns ☐

A24. Would you like to be served by service robots in the hotel restaurant?

- Yes ☐
- No ☐

A25. By how much would this enrich your experience?

1: Not at all - 10: Significantly

1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐

A26. If service robots would completely replace human waiters, would you like their implementation?

- Yes ☐
- No ☐

A27. Why?

- Because I do not have to tip ☐
- Because I find service robots more entertaining ☐
- Because I believe the service will be faster ☐
- Because I think human contact is not necessary in a restaurant ☐
- Because I believe fewer errors will occur ☐

A28. Why?

- Because I do not feel social pressure to tip ☐
- Because I find human waiters more entertaining ☐
- Because I believe the service will take longer ☐
- Because I think human contact is necessary in a restaurant ☐
- Because I believe more errors will occur ☐

A29. **Overall, I would enjoy staying in a hotel fully operated through artificial intelligence with no human staff only as a one-time experience.**

- Yes ☐
- No ☐

A30. **Overall, I believe artificial intelligence will replace ..... jobs in the hotel industry.**

- all ☐
- most ☐
- some ☐
- a few ☐
- no ☐

A31. **With which statement do you agree most?**

- Overall, I would desire artificial intelligence more than human employees in the hotel industry. ☐
- Overall, I would desire human employees more than artificial intelligence in the hotel industry. ☐
- Overall, I would desire a joint and balanced workforce of artificial intelligence and human employees in the hotel industry. ☐

Section B: Demographics

B1. **Which gender do you identify with?**

- Female ☐
- Male ☐
- Non-binary ☐

B2. **How old are you?**

- 0-19 ☐
- 20-30 ☐
- 31-40 ☐
- 41-50 ☐
- 51-60 ☐
- 61-70 ☐
- 71 and older ☐

B3. **Mark your most recent level of education.**

- Less than high school ☐
- Enrolled in high school ☐
- High school graduate ☐
- Enrolled in bachelor ☐
- Bachelor graduate ☐
- Enrolled in master ☐
- Master graduate ☐
- Enrolled in PhD ☐
- PhD graduate ☐

B4. **If you are currently employeed, choose the field you are working in.**

- Agriculture ☐
- Business and Finance ☐
- Real Estate ☐
- Arts and Communication ☐
- Engineering and Manufacturing ☐
- Health Sciences ☐
- Public Administration ☐
- Tourism and Hospitality ☐
- None of the above ☐
- I am not employed currently ☐

B5. **Which nationality do you identify with?**

Thank you very much for your participation!