

Understanding how the utilisation of a private 5G network in hotels would optimise operating processes and refine customer-centric services.

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M.Sc. Strategic Management and Digital Marketing

2020

Abstract:

The purpose of this study is to understand how the utilisation of a private 5th generation communications network in hotels would optimise operating processes and refine customer-centric services. A qualitative approach to inquiry was adopted by the researcher in which online qualitative surveys were purposively distributed to the representative sample of 4-star and 5-star hotel general managers and interviews were conducted with the representative sample of information and communications technology professionals to strengthen the validity of the study. The results presented in this study were coded from the qualitative data gathered during the interviews and from the survey responses. This study concluded that enhanced service personalisation and optimised departmental process is possible through innovative 5G enabled Internet of Things devices. This research was limited to the opinions of selected samples since the technology is not available in Malta for observation. This study offers practical value since new technologies are required to improve hotel revenues and reduce costs for the long run, this would be possible if a private 5G network is set up to enable Internet of Things devices for the purpose of process automation and increased guest service personalisation. This study will discover how this process can be accomplished.

Keywords: Internet of Things, 5th Generation Radio Access Technology, Private Networks, Process Optimisation, Process Automation, Service Personalisation, 'Untact' Services.

Acknowledgements:

This dissertation would not be possible without the constant support and guidance of Dr. Godwin Caruana. I greatly appreciate his time and help throughout this study. Thank you.

I would like to also thank my mother Margaret, my father Walter and my sister Maria for the constant support throughout the years of my academic journey.

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Introduction.

Hotel management is facing significant challenges while operating in today's hospitality industry. The economic devastation brought by COVID-19, terrorist attacks making guests feel less secure while lodging, climate change and sustainability legislation, shifting demographics together with the advances in technology and the ever-increasing profitability targets, staying afloat is already a challenging feat for management. Now more than ever, hotel management must find innovative and sustainable ways of developing cost-effective operational processes and provide the guests with a unique and seamless hotel experience to withstand the competition of other hotels and adapt proactively to the external factors that influence hotel profitability.

To maximise profit, hotel management must cut down departmental costs and create new revenue opportunities. Denney G. Rutherford identifies seven hotel departments which would be found in a typical hotel and resort. These departments are the front office, food and beverage department, purchasing and accounting department, engineering department, marketing and sales departments, housekeeping and security departments. Each of these operational departments has processes and functions that are carried out by hotel staff and machinery that work synergistically to ultimately provide service to the guest. The best guests for any hotel are the ones who receive the most significant benefit from the services provided by the hotel. They are prepared to spend more, increase their frequency of purchasing services and products, and remain more loyal because services offered are satisfying their needs. Management now more than ever understand that focusing on providing customer-centric services is essential to serve their guests better and improve the hotel experience.

Personalisation of services and products offer the guests with the flexibility to suit their preferences and unlock further upselling and cross-selling opportunities for the hotel. Personalisation of services and streamlined processes are therefore essential for improving the financial performance of the business as this requires hotel management to look further than merely utilising the traditional cost-cutting techniques and relying solely on loyalty programmes. It is crucial for management to recognise the need for the utilisation of new technologies that facilitate the collection of valuable customer data that can contribute to additional revenue and reduce costs which would otherwise be spent on non-productive processes and resources. Therefore, investing in new technologies should be considered as a strategic investment from which the business will reap the benefits in the future years.

In the age of the fourth industrial revolution, disruptive technologies such as the Internet of Things, robotics, virtual reality, and artificial intelligence are reshaping the process of how hotels are managed. The required networking architecture, computing power and storage capacity must be in place for these technologies to be incorporated in the business effectively, as current hotel network infrastructure is commonly characterised by integration complexity, lack of design flow, lack of data control, security, and more increasingly, insufficient connectivity coverage for such technologies to be utilised. Private 5G networks are a crucial enabling technology for such technologies to generate sustainable and cost-effective growth for hotels. With the increased use of the Internet of Things throughout hotels, the integration of 5G networks will have an essential role in the future of the hotel industry.

A private local area network will enable 5G technologies to create a customised network of devices with dedicated connectivity, optimised latency, and a secure means of communication within the hotel area through hotel owned network infrastructure and using

its own spectrum. In this way, the network will improve the current interconnection of departments and the guests with the result of providing hotel management better control of hotel resources and the guest experience while having private access to data and connected devices within a hotel.

A private 5G network allows quicker data collection and in higher volume through connected devices on the network and therefore advanced personalisation will become easier to generate with the help of data analytics and could be used to determine more accurate predictions of what customers want. Together with the sheer amount of data that can be collected, the network also offers the possibility to automate and optimise departmental processes which can be done in real-time with 5G due to the low-latency and reliable connections to share and transfer this data. This results in eliminating costs which are associated with repetitive jobs and inefficiencies.

Research Objectives.

The scope of this research is to get a better understanding of how service personalisation and operational processes are affected by hotels when adopting the next-generation cellular network. Therefore, this study will answer the questions of how the utilisation of a private 5G network in hotels would:

1. Refine customer-centric services for additional revenue.
2. Optimise operating processes for cost reductions.

This study will provide a clear understanding of the changes that hotels would have to go through to remain competitive in this dynamic industry.

Practical Relevance.

The following are the research contributions of this study:

1. The researcher presents a comprehensive and systematic analysis of Internet of things device-driven departmental operations and service personalisation and discussed their potential for hotel applications.
2. This study analyses several applications for the incorporation of 5G-enabled Internet of Things peripherals into a hotel business model.

Outline of Report.

This research features the following sections, an Introduction to this study by outlining the research objectives and the study's practical relevance and significance and how it adds to the knowledge in the field. Then the following section is the literature review in which a thematic review of literature is presented discussing hospitality consumer-level trends, external environment trends, hotel operations and organisational structure, hotel service personalisation, hotel process automation and upgrading to 5G radio access technology. The next section is the methodology adopted for answering the research questions, this includes the philosophical perspectives of research starting from the ontological and epistemological assumptions considered, the adoption a research strategy reviewing the research gap for the qualitative approach and then formulating a research design. The research design highlights the steps taken by the researcher to understand information required for research objectives, defining the target respondents, the selection of data collection methods and the question selection for the survey and the interviews. The next sections are the ethical considerations considered by the researcher and the indication of any research imitations. The results and discussion section analyses the qualitative inquiry method for the presentation of the changes

required to the front office, food and beverage department, housekeeping department, engineering department, security department, sales and marketing department, procurement and finance department and the human resources department. The study concludes with a research conclusion and further remarks for further academic research.

Literature Review.

This section of this report consists of a review of the literature in areas of study related to customer relationship management, Internet of things technology adoption, hotel management, hotel process automation, the use of private 5th generation networks in organisations. The search for literature used for this study served as a basis for understanding what research has been attempted and discover what areas of research have been overlooked or not researched. The search for literature was conducted through the following online academic libraries: ScienceDirect, HyDi, Wiley Online Library, Academia and ResearchGate, a filter was applied to include literature which consisted of peer-reviewed journals and online reports, non-academic documents and published books.

Thematic Literature Review.

Current events such as terrorism, guest demographic changes, economic downturns and ever-increasing legislations are influencing the volume of hotel accommodations and are dynamically shaping guest demands, and these profound transformations in the industry are conditioning the decision-making processes of hotel businesses. (Juan Ignacio Pulido-Fernández, 2011) It is therefore essential to examine the two aspects of hospitality trends: the trends that are an outcome of the developments at customer-level and the trends that emerge from the external environment of the hotel industry. (Dimitrios, 2006)

In the following sub-sections of this report, a review of literature focusing on the topics of consumer-level trends and macro -environment trends within the hotel industry is provided. These sections would aid the reader to better understand the dynamics of the hotel industry and also lay out what the future trends hotel managers have to understand and proactively use their resources at their disposal to gain competitive advantage and maximise profitability.

Consumer-Level Trends.

Sustainability is now a priority; guests are becoming more concerned about their environmental footprint and now need to know that the hotel they decide to spend their time and money at, will act ethically and with respect to the environment when providing leisure activities and other services. Hotels are increasingly promoting their eco-friendliness through making use of smart lighting and smart heating whilst restaurants are now promoting their vegan and vegetarian options. Using more sustainable automated processes to cut down waste and wasted energy is also propelling hotels towards cost reductions and profitability. (Clarke, 1994)

Wellness is going mainstream, where in the past, the hospitality industry was characterised with hotels featuring fast-food eateries and pubs vending sugary alcoholic beverages, nowadays, there has been a cultural change with guests growing more aware of the quality of the food they are consuming, pointing to a healthy food and drinks trend. To hotels, this has meant to re-invent the restaurant, catering service and room service food menus by offering healthfuller options, comprising of gluten-free, dairy-free, low fat, vegetarian, vegan, and organic options as well as less sugary drinks sold in pubs. (Dixte, 2020)

Increased life expectancy, linked with better quality living, indicates that the world's population is ageing and, therefore, the senior population becomes an important segment

for the vacationist market (Berkup, 2014). A significant importance has been assigned to the study of the different generations, and the tourism sector has given special attention to generation Y, also known as millennials, considering investigating the behavioural traits of this generation now can assist to foretell how guests would act in the future. (Ruth N Bolton, 2013) Travelling preferences by millennials are increasingly complex; one emerging trend of 'Bleisure' could offer hotels additional revenue opportunities. The combination of business travel with leisure activities in which a guest may originally stay in a hotel to attend business meeting or conference, and later extend their visit to turn it into a vacation. This is one of the most important hospitality trends as 'Bleisure' travellers would be more likely to want unplanned services, fast communication, and present upselling opportunities for the hotel.

External Environment Trends.

Current digital technologies are creating new hotel experiences which are leading to more personalised expectations; this is fundamentally due to the acceleration of big data. Hotel guests now need to be treated as prized individuals, rather than just another unknown guest. This guest experience is being enabled through the rise of internet-enabled devices that generate data based on personal preferences that can be captured and transmitted to hotel analytical systems in real-time during the guest stay for a more customised experience. This new opportunity enables hotels to use the data to their advantage and create new services for upselling and cross-selling opportunities. (Zhou, 2019)

The General Data Protection Regulation (GDPR) of May 2018 stepped up the importance of protecting guest data since the hospitality sector is naturally an industry that handles a large number of personal customer details. There are several steps hotels must take to protect guests' personal data – from reviewing security policies to encrypting data. Data protection

needs to be prioritised and kept in mind throughout the designing any new service or process. Apart from data security, a hotel must also ensure to provide reassurance of physical security which is of significant importance and also which was the centre of controversy in the last couple of years due to the increase of terrorist attacks in public places. (Brian, 2018)

Globalisation is another factor influencing hotel services and processes. Now that it is easier for tourists to cross borders, guest culture differences have taken the hotel industry by storm and catering for such differences poses difficulties in matching hotel services and accommodation preferences to the guests' cultural normalities. Cultural and demographic shifts are pointed out as one of the main areas set to affect the tourism sector, where cultural diversity comprises of guest beliefs, customs, and traditions. (Larry Dwyer, 2009)

'Untact' services will dominate the service industry in the coming decades as business models have to be redesigned to cater for the shift in consumers' purchasing behaviours, that being from traditional service providing to more digital and mobile-enabled services. Smart digital devices and advanced technologies have enabled "Untact" services by facilitating customer service encounters without face-to-face contact with employees whilst providing easy access to the global market. (Sang Lee, 2019) This new concept which originated in South Korea promotes organisations in all industries to invest heavily in robotics, drones, self-driving vehicles, and other technologies that would reduce the need for human contact. Kim Rando, a professor of consumer science at Seoul National University, pointed out that due to the circumstances brought about by Covid-19, it will probably compel many countries to encourage their national organisations to take 'Untacting' technology trend seriously. (Kim, 2020)

Covid-19 now requires hotels to making the hotel experience safer. According to a McKinsey Consumer Leisure Travel Survey, frequent travellers were asked what it would take to get them to travel again. Most US leisure travellers want additional health and safety measures. (Vik Krishnan, 2020) This does not only apply only to US hotels as Covid-19 has effected every business in every country; hotels are taking the most substantial hit. The fear factor, especially if a second wave of Covid-19 commences, it will have a lasting impact on the inclination to travel.(Fabri, 2020) Corporate travel in Malta is likely to be back on track the soonest, with leisure travel the last, the Agile Report also shows the majority of respondents would also leave some time before going abroad after authorities declare it is safe. Tony Zahra, president of Malta Hotels and Restaurants Association, stated that in a post-COVID-19 world, hotels have to be ready to adapt and adjust their product in line with this new situation as the focus has to shift more on quality than quantity. (Fabri, 2020)

Hotel Operations and Organisational Structure.

Adapting traditional hotel business models to be more cost-effective and more profitable whilst anticipating and moving at pace with current trends is becoming increasingly important, which can be achieved through new or redesigned operational planning. In his book, Denney G. Rutherford identifies seven hotel departments which would be found in typical hotels and resorts, and these are presented below together with their respective processes.

Front office: the front office processes consist of guest reservation, guest reception and guest services which include bell service and concierge. Communication flows from the front office to all other divisions, which allows for coordination and efficient operations.

Food and beverage department: the food and beverage department processes consist of food production and supply for hotel restaurants, bars, banquets catering and room service.

Purchasing and accounting department: the purchasing and accounting department processes involve purchasing functions and accounting for financial transactions.

Engineering department: the engineering department functions include, civil engineering, which is concerned with areas such as the building, its renovation, new construction, drainage treatment and waterworks. Mechanical engineering which is concerned with areas such as heating, refrigeration, ventilation, generator and swimming pool maintenance and machinery installation. Electrical engineering is concerned with areas of testing electrical devices and equipment such as sensors and the upkeep of the hotel communication infrastructure.

Marketing and sales department: the department processes involve developing programmes to increase occupancy and make profitable use of the hotel's leisure facilities.

Housekeeping department: housekeeping department's main processes involve cleaning guest rooms, public spaces, and staff rooms.

Security department: the security department is responsible for guest and staff safety.

Denney G. Rutherford also points out that the ever-increasing improvement of information and communications technologies have enabled automation and efficiencies of these processes which could potentially lead to reducing costs and increasing accuracy through extensive data collection about each hotel guest and every departmental process. As a result, many hotels are turning to technology to improve customer services by implementing IT-enabled customer service and property management systems for service personalisation and hotel process optimisation. Hotel guests are becoming more and more sophisticated, demanding a high level of quality and value. (Harwood, 2009) Creating a unique and memorable customer experience requires personalisation, which is the ability to tailor products, services, and the transitional environment to individual guest's needs. Through a customer service system, the hotel can predict and identify guest needs and react to the needs immediately and effectively (Tan, 2013)

Hotel Service Personalisation.

Service personalisation requires two sub-processes, learning and a matching process (Murthi, 2003)

- The learning process requires a data gathering procedure whereby an organisation collects specific guest data related to differentiated preferences which are usually formed on the spot (Pantelic, 2017) through the interaction of devices that collect data and the guest making use of them.
- The second subprocess in service personalisation consists of matching guest preferences to hotel offerings, by modifying service delivery, service products and service environments based on data generated. (Glushko, 2013)

Developing guest profiles can help the hotel identify upselling and cross-selling opportunities as this allows the narrowing of the expectation and delivery gap. (King, 2016) Economic benefits, both incremental cashflows and cost reductions, are obtained from the creation of true service value, defined as the assessment of the utility of a service based on perceptions of what is received and what is paid. (Zeithaml, 1988) Customer retention management has become an essential element of a hotels marketing strategy to retain its loyal guests, who in turn increase the hotel's market share, promote its brand, and ultimately boost profit (Denney G. Rutherford, 2010) The wide usage of mobile devices integrated with enabling technologies such as 5th generation mobile networks, artificial intelligence and robotic process automation would create an opportunity to conduct more sophisticated data analytics and better service provision. Thus, hotels are beginning to explore the potential of mobile technology as part of their business strategy to improve service personalisation and process optimisation. (Ronanki, 2018)

Data capture enabled by IoT devices requires connectivity. A standard fixed cable network is only capable to support important applications of fixed devices rather than the typically complex and demanding processes of hotel departments that require wireless connection due to their constant mobility. The need for connectivity goes beyond the standard Wi-Fi connection, strong communication capabilities for mobile-based IoT applications is required to reliably satisfy time-critical communication over secure channels with carrier-grade data encryption and identity authentication. (Roberto Minerva, 2015) Thus, 5th generation cellular technology is an excellent enabling technology because future hotels will have an array of IoT devices deployed with different connectivity demands.

With the development of Internet of things, a hotel has the potential to create new guest experiences by leveraging real-time location data along with guest preferences and behavioural data through the delivery of highly personalised information that can be generated at every instance of the guests' journey. (Oracle Hospitality, 2018) It would be wiser for hotel management to redesign and plan business processes around an IoT based experience approach in which the application of data is used to improve the guests' experience. 5G mobile technology could transform the way people use their smartphones and, in turn, how hotels are run. In the future, smartphones will not be the only things requiring continuous data connectivity, the Internet of things and other devices will rely on wireless networks, requiring advanced connectivity solutions. US National Intelligence Council foresees that by 2025 disruptive civil technologies may be incorporated into everyday things such from food packages, furniture to paper documents. It also highlights future opportunities that will arise due to the increase in connected devices demand and technology advances could drive widespread diffusion of the Internet of things that could contribute invaluablely to a hotel's economic development (NIC, 2008)

[Hotel Process Automation.](#)

Automation of hotel processes is also another critical aspect of IoT. Nowadays, there is a preference for 'untact' technology over human interaction for several tasks which before required human interaction. Business process automation is a term used for the technology-enabled automation process for complex business processes. It can streamline a business process for simplification, to achieve digital transformation, enhance service quality, improve service delivery, and reduce costs. It consists of integrating applications, restructuring labour resources, and using software applications for all the organisations' processes. (Watson, 2009)

Hotels that can utilise enabling technologies and create automation solutions to become more human capital lean, reduce or eliminate non-value-adding processes and activities, increase revenue efficiently and effectively whilst improving environmental sustainability. With autonomous devices and software that perform the repetitive, undesirable, and non-value-adding work, hotel employees will become less caught up with 'work' and can be utilised to focus on interacting face to face with guests. (Oracle Hospitality, 2018)

Automated check-in at hotels, for instance, would be a much quicker process than standing in line to be checked-in by front office staff. Hotels are consequently increasing their investing in the fundamental technology to enable automated check-in and check-out for the guests' convenience. Online booking management systems supported by robotic process automation is also a feature of automation which enables the guests to book their room according to their preferences. This type of automation eliminates the need for any human intervention, and bookings and cancellations can be processed at any time of the day with no human error. (Lukanova Georgina, 2015)

Robotics is another feature of automation technology that is increasingly being adopted by the hotel industry. From concierge services to housekeeping services, robots are increasingly being deployed to perform repetitive tasks. A guestroom automation system enables guests' rooms to be equipped with occupancy sensors which can sense when a guest has entered the room and turn on the lights and temperature control autonomously. (Lukanova Georgina, 2015) Automation can also help reduce costs and increase revenue in various departments of a hotel.

As technology becomes cheaper, more powerful as well as easier to use, an increased effort is being made to enable these smart devices and machines to communicate with each other and enable hotels to make full use of their potential (Heppelmann, 2014) Hotels are already struggling to operate with basic Wi-Fi capabilities, so planning for the future can be an important strategic decision. Hotel managers should reflect carefully about spending any money on obsolete network infrastructure in their hotels today as what is required today will not be the same in forthcoming years

5G, or fifth-generation, technology represents a disruptive leap in performance over today's 4G networks, it will provide users with super-fast speeds, massive bandwidth or capacity and lower latency than today's 4G networks. (Alsharif, 2016) With all the moving devices and complex processes of a hotel, Internet of things sensors and equipment, such as computers and peripherals, attached to a network could dramatically help hotels become smarter and more automated, and 5G would make them that much easier to operate. (Lee, 2015)

[Upgrading to 5G Radio Access Technology.](#)

The increased use of IoT-enabled devices causes a need for a technology that can support this enormous amount of data transmissions efficiently and reliably. This data transmission process provides for the increase in the data exchanges from machine-to-machine, device-to-device and human-to-human interaction using machines and devices. (Kalyani, 2015) Many of the network capabilities that we have today are not fit for the future technological developments organisations often need to use a mix of fixed and wireless network technologies to enable massive connectivity of IoT devices that generate large amounts of data. To cope with the considerable amount of data being captured and generated, an

upgraded network architecture from the current 4G connectivity would be needed to be developed to improve hotel services and departmental processes. (Ted Saarikko, 2017)

The new 5G connection would allow for Massive-Input, Massive-Output (MIMO) which is a practical method for sending and receiving more than one data signal simultaneously over the same radio channel, which helps to achieve network capabilities than the current 4G LTE does not do effectively. With the help of small cells which are small wireless transmitters and receivers designed to provide network coverage to smaller and unreachable areas will allow a more condensed network to be part of the whole network infrastructure. Compared to the existing 4G technology, which uses frequencies below 6 GHz, 5G networks support a significantly higher frequency which ranges from 30 GHz to 300 GHz which would enable privatisation of frequency bands for organisations since 5G connectivity can enable new industrial applications which operate outside of the current mobile broadband range. (Habibi, 2019) This 5G technology a key enabler for IoT technology; thus, it complements IoT to provide higher data rates, reduced latencies, lower energy requirements, and higher scalability.

A connected hotel environment enables the generation of vast amounts of data, which can then be utilised with enabling technologies like artificial intelligence (AI) to gain deeper insights into the businesses' processes and allow for predictive decision making. The performance features of 5G communication are network reliability up to 99.999% with the latency of < 1mS and low power requirements will satisfy the shortcomings of the existing communication devices as newer devices are being manufactured to complement 5G connectivity. (Li, 2017) 5G connectivity promises larger bandwidth capacity, improved data-rate, and low latencies for IoT devices, to make departmental processes flexible by enabling

the addition or changing of existing machines and sensors with different connectivity requirements easier.

The 5th generation of wireless communication (5G) is a driver for the 5G-enabled IoT applications which would be changing the aforementioned scenarios using appropriate infrastructure, in which real-time interaction between machines, data, and people would become possible. (Malta Communications Authority, 2019) Another aspect of 5G networks is that it allows the possibility for organisations to acquire a wireless local area network that utilises 5G connection to create a network with dedicated bandwidth and infrastructure that provides the organisation with connectivity needs. The release of unlicensed spectrum for all industries will allow organisations to deploy their own private 5G network infrastructure, without having to work with an operator and thus, private 5G networks will be characterised by increased security and privacy enabled by network slicing which will be next in line after national rollout for public use. (3GPP, 2020)

Methodology.

This section presents a review of the research problem being investigated together with the evaluation of the suitability of different research methodologies to best answer the research questions.

This study aims to understand how the utilisation of a private 5G network in hotels would optimise operating processes and refine customer-centric services. This research problem was constructed after several failed attempts to find literature to understand how in a fourth industrial revolution, hotels would benefit from the adoption of a new technology that allows for increased capacity of connected devices and data transmission rate. This new technology has already been deployed in technologically advanced countries and has begun to explore industry verticals that could be enhanced through 5G radio communications. Malta's mobile service operators already started the process for a nation-wide deployment of public 5G mobile communication at the beginning of 2020. As research suggests, technologies often are adopted by industry players within a year of the public rollout. Therefore, it is very opportune to investigate how the utilisation of a private 5G network in hotels would refine customer-centric services for additional revenue and optimise operating processes for cost reductions.

This study required a design framework for the adoption of a research methodology. This process consists of understanding the philosophical perspectives of research so that the researcher can adopt a research strategy to collect primary data from selected samples. This section also presents an analysis of the features of the different types of qualitative research methodologies that best fit the research questions and the qualitative fieldwork necessary to obtain the data required. The analysis and treatment of qualitative data and the reliability and validity tests carried out for this study are also discussed.

Philosophical Perspectives of Research:

Ontology.

Research design is a critical component that is essential to research studies, particularly to the disciplines of social science. Currently, there is an abundance of literature presenting multiple approaches to the formulation of research design. Although the existence of various approaches could be beneficial in the development of research design, it could also be a source of confusion because of the lack of clarity about the strategies to research design, research methods, and research methodology in the social sciences. (Abutabenjeh, 2018) After having identified the research topic, and the research questions were formulated, selecting the appropriate design was the next important step. To ensure that the quality of the research is not compromised, it was essential to understand and think through the philosophical positions that underlie the design of the study.

Social scientists draw from different ontological and epistemological assumptions to formulate their methodologies. Awareness of philosophical assumptions can both enhance the quality of the research and contribute to the creativity of the researcher. Understanding the philosophical perspectives underlying management research would, therefore, aid the researcher to effectively draw the best combination of assumptions from both schools of thought. Ontology is the philosophical assumptions about the nature of reality, whilst epistemology is the broad set of assumptions about ways of inquiring into the nature of the truth. We can view epistemology as the traditional assumptions and procedures formed from ontology whilst ontology is the discovery and formulation of new perspectives and assumptions.

The four different ontologies are presented in a table below:

Table 1: Ontologies

| Ontology | Realism | Internal Realism | Relativism | Nominalism |
|----------|---------------------------------|--|---|----------------------------|
| Truth | Single truth | Truth exists but is obscure. | There are many truths. | There is no truth |
| Facts | Facts exist and can be revealed | Facts are concrete but cannot be accessed directly | Facts depend on the viewpoint of the observer | Facts are human creations. |

Source: Easterby-Smith, M., Thorpe, R., & Jackson, P. R. (2012). Management research (4th Edn)

Philosophers of natural sciences debate on several varieties of realist positions stemming from the traditional position that emphasises that the world is concrete and external and that science can be only progress through observations that have a direct correspondence to the phenomena being investigated. In this study, the researcher drew assumptions from the combination of the realism and the internal realism standpoints in which the epistemological perspectives adapted to this research question assumes that without gathering direct evidence of the effects on departmental hotel processes and hotel services due to the adoption of a 5G cellular network, it would not be possible to ascertain the reality of its effects on departmental processes and personalised services since the effects are real and can be unearthed through the analysis of the opinions of the individuals within the sample targeted by the researcher.

Epistemology.

Social Science research can be conducted by using two contrasting paradigms for inquiring into the physical world. Positivism and Social Constructionism positions are characterised by different philosophical assumptions and methodological implications from which the researcher can combine to formulate the research design.

The philosophical position of positivism assumes that the social world exists externally and should be measured through objective methods rather than being analysed subjectively through sensation, reflection or intuition, meaning that true knowledge comes from analysing the observable traits and actions of the subjects rather than through reasoning or speculating. On the other hand, the philosophical assumptions of social constructionism are that reality is determined by people rather than by objective and external factors. Therefore, it focuses on the ways that people make sense of the world through the sharing of their experiences with others via the medium of language. This philosophical position requires the researcher to appreciate the different constructions and meaning that people place upon their experience. Positivism fits the realist ontologies whilst the constructionism fits the nominalist ontologies, stronger and normal versions of positivism and constructionism positions are analysed in the table in the next page:

Table 2: Four Main Epistemological Positions

| | | | | |
|------------------------------|--------------------------------|----------------------------------|---------------------------------|-----------------------------------|
| Ontology | Realism | Internal Realism | Relativism | Nominalism |
| Epistemology/ Methodology | Strong Positivism | Positivism | Constructionism | Strong Constructionism |
| Aims | Discovery | Exposure | Convergence | Invention |
| Starting Points | Hypothesis | Propositions | Questions | Critique |
| Designs | Experiment | Large survey, Multi Cases | Cases and Survey | Engagement |
| Data Types | Numbers and Facts | Numbers and Words | Words and Numbers | Discourse and Experiences |
| Analysis | Verification/ Falsification | Correlation and Regression | Triangulation and Comparison | Sense-Making and Understanding |
| Outcomes | Confirmation of Theories | Theory Testing and Generation | Theory Generation | New Insights and Actions |

Source: Easterby-Smith, M., Thorpe, R., & Jackson, P. R. (2012). Management research (4th Edn).

The researcher analysed every epistemological position and came into conclusion that combination of methodologies derived from both social constructionism and positivism epistemologies is needed to conduct this research since neither standpoint are adequate to answer the research question of this study. Critical realism, the Frankfurt school, which originated as an intellectual movement, sought to critique the effects of modern society and technology on human development is the most appropriate school of thought for this research. The main objective of critical realism is the focus upon critiquing the changing society; on the other hand, the traditional theory is oriented to understanding or explaining the changing modern society.

Adopting a Research Strategy.

A research strategy describes the approach with which the research question will be answered. Critical realist research methods are primarily focused on understanding, rather than merely describing social reality. Despite critical realism's explanatory advantages, there is limited literature available on how methods of data collection, interpretation, and analysis are appropriate for critical realism research (Yeung, 1997) (Deshpande, 1983) criticised researchers for discarding theory generation; the methods science researchers had developed are those to confirming theories rather than uncover them. Wells (1993) presented other criticisms for the methodologies, which are traditionally adopted in consumer research. These include the researchers' dependence on quantitative methods, the lack of originality in theorising and the over-reliance of sophisticated correlational methods to imply causality. (Blaikie, 2009) suggests that there are four main categories of research strategies to seek understanding, these are 'inductive', 'deductive', 'retroductive', and 'abductive' research strategies.

Table 3: Four Main Research Strategies

| | Inductive | Deductive | Retroductive | Abductive |
|---|--|--|---|---|
| Aim | To establish universal generalisations to be used as pattern explanations | To test theories, eliminate false ones and corroborate the survivor | To discover underlying mechanisms to explain observed regularities | To describe and understand social life in terms of social actors' motives and understanding |
| Ontology | Cautious, depth or subtle realist | Cautious or subtle realist | Depth or subtle realist | Idealist or subtle realist |
| The starting point of research strategy | Start aggregating observations of data and produce generalisations | Identify a regularity to be explained and construct a theory and deduce a hypothesis | Document and model a regularity and construct a hypothetical model of a mechanism | Discover everyday lay concepts, meanings, and motives and produce a technical account from lay accounts |
| The finishing point of strategy | Finish by using these principles as patterns to explain further observations | Test the hypotheses by matching them with data | Find the real mechanism through observation or experiment | Develop a theory and test it iteratively. |

Therefore, the use of an inductive approach to data collection, data interpretation and data analysis which is consistent with critical realism ontology is adopted for this study. The use of existing literature and participants' knowledge and experience will be utilised and converged together for the conclusion towards the probable effects of a private 5G network in hotels on operating processes and customer-centric services.

Research Gap.

Although several research papers cover Internet of Things adoption in the hotel industry, few had considered the researching the potential of the enabling opportunities offered through the adoption of 5G communication for connecting the IoT devices that have the possibility to be applied to all departmental hotel processes. In this paper, we investigated the role of 5G connectivity for service personalisation and process optimisation with 5G-enabled IoT devices.

In a scenario where services are complex, and personalisation remains a strategy, the tourism industry is one of the sectors in which the rise of IoT applications through 5G connectivity is expected to change hotel processes and services as we currently know them, yet there is no empirical research on what technologies would be enabled for better departmental process optimisation and service personalisation if a hotel adopts such technology.

Through an inductive approach to inquiry, a conclusion to how the utilisation of a private 5G network in hotels would refine customer-centric services for additional revenue and optimise operating processes for cost reductions would be made.

Qualitative Approach to Inquiry.

An inductive research strategy for qualitative research design would allow the researcher to generate new theories emerging from the data collected by focusing on the exploration of a phenomenon from different perspectives and come to a generalised conclusion. A qualitative research framework would be necessary to answer how the utilisation of a private 5G network would optimise operating processes and refine customer-centric services within a hotel. There are four qualitative research designs to consider when defining research designs and research methodologies and these are analysed below.

Ethnographic research is the study of the life of ethnic groups' culture. The researcher examines the group's observable and learned patterns of behaviour, customs, and ways of life. The researcher leaves his customs and seeks to understand the behaviour of the group's members.

Phenomenological research is the analysis of the subjects' experiences and point of views of reality which is characterised by the interaction of inanimate objects with the subject and event occurrences which are perceived differently or understood differently by human consciousness. The subjects' experiences include imagination, thought, emotion, desire, and action.

Hermeneutic research is a philosophical discipline concerned with the analysis of the conditions for understanding the changes in the world through cultural texts. Preconceptions can affect our interpretation of what is being communicated through a text. Over time, people change, and so does the world and the ways we interpret things, different time periods have a different culture and will interpret texts differently. If interpretation is based on the present

culture rather than the culture of the author of the text, the interpretation will be different from the author's original intent.

Grounded theory approach provides answers to questions like what, how and why, with the aim of gaining familiarity with an existing phenomenon or acquiring new insight into the phenomenon to form a more precise conclusion. It begins based on a generic research idea, and the results from the research are then used to find out associated issues with the topic of the research. This type of exploratory research is usually conducted to have a better understanding of the existing problem but usually does not lead to a conclusive result.

Case Study research is an exploration of a case over time through in-depth data collection involving multiple sources of information. The qualitative case study can either be composed to illustrate a unique case that has an unusual interest and needs to be described, detailed or to understand a specific issue, problem or concern, selected with the intention of better understanding the problem. Case study methods should determine if a case study will answer your research question by gaining an in-depth understanding of a case or cases within a clearly identified bounded system. Researchers should identify the case or cases to be researched so that the appropriate type method of conducting case studies can be utilised. The researcher collects many forms of qualitative data, ranging from interviews, surveys, observations, and documents. Relying on one type of data is not enough to develop this in-depth understanding, Yin 2009 suggests that the multiple cases show different perspectives on the issues being studied.

Case study research method was the most appropriate methodology to answer the research question presented in this study since the researcher is required to understand how utilising a private 5G network would effect hotel operating processes and customer-centric services

through in-depth surveys with hotel industry professionals for the management and marketing factors and also with professionals who have extensive work experience and knowledge within the information and communications technology academic disciplines to analyse the technological factors that contribute to the causality and change in this study.

Research Design.

A case study research design was adopted by the researcher, it was essential to making sure the data to be collected is relevant, valid, reliable and all the necessary data is collected. Therefore, the researcher considered the following:

Information Required for Research Objectives.

A detailed list of the required information and the concepts to be understood in this study was developed. The scientific explanation for our research questions can be defined by the terms 'dependent' and 'independent' variables. The changes to the dependent variable are what the researcher is aiming to understand whilst the independent variable is the variable to affect the dependent variable.

The independent variable for this study is the adoption of a private 5G network in a hotel. Whilst the dependent variables of the study are the departmental process and consumer services offered by hotels. Therefore, the study will analyse the effect brought by the adoption of a private 5G network in hotels on organisational processes and services. The researcher's aim is to identify through individual participants' opinions on what new technologies would be enabled brought by the utilisation of 5G networks in hotels and their effects on departmental processes and customer-oriented services.

Defining Target Respondents.

The selection of the representative sample was conducted using the following sampling methodology:

First, the researcher defined the target population. The target population which the researcher deemed to be useful for this study would be knowledgeable and experienced on the topics being discussed in this study. These areas of focus are customer relationship management, IoT technology adoption, hotel management, hotel process automation, private 5th generation networks and 5G network architecture. Therefore, the most appropriate populations from which a representative sample could have been drawn where professionals with an academic background in hospitality and information and communications technology.

One of the two populations included in the study is general hotel managers who have the responsibility of directing 5-star and 4-star hotels. It is assumed that these types of hotels have significant use of technology in their operations and will be at the forefront of adopting new technologies. The other population to be included for data collection are technology and engineering industry professionals who would contribute to this study with their expertise on the effects of technology to be studied.

Then the researcher drafted the sampling frame to find the representative sample. A list of candidates was drawn up, having in total twenty-nine hotel general managers who currently hold a position as hotel management which were found from Linked-in and a total of twenty information and communication technology professionals who are knowledgeable about the technologies and who work at a reputable leading company to discuss the topics in this study. The researcher then selected the sampling method. The sampling method selected depending

on various factors such as the knowledge of the areas discussed, the experience in the field concerned and the time required to conduct the data collection. The researcher resorted to utilising purposive sampling and convenience sampling which is a judgement sample which would include people who are knowledgeable about hotel management and 5G technology and Internet of Things and exclude other people who are not knowledgeable about the technology, or it is not their field of expertise.

The researcher then determined the sampling size. Minimum non-probability sample size determined for a qualitative survey for a homogeneous population of general managers working in 5-star and 4-star hotels are 4-12 individuals (Guest et al., 2006) whilst for the interviews which would be done for the technology professionals who would be knowledgeable on 5G enabled technologies are 5-25 individuals (Kvale & Brinkmann, 2009)

Ultimately the researcher implemented the sampling frame by distributing online surveys to the whole general manager representative sample in Malta, that of twenty-nine individuals and held interviews for the representative sample of information and communications technology professionals. The response rate of the surveys from the representative sample of general managers was 24.13%, and five of the contacted individuals from the fields of information and communications technology and engineering professionals agreed for an interview.

Data Collection Methods.

The qualitative data collection required in case studies are usually extensive, and thus the methods used for this study are surveys and interviews. Qualitative data collection is the suitable type of data collection method since it would increase the understanding of context and content derived from the opinions of the interviewees on the effects on the marketing of services and the optimisation of management of operations. It also increases the in-depth knowledge of what technologies that are enabled the adoption of 5G communication throughout hotels and their effect with the possibility of better analysis of how particular impacts are occurring through interviewee participation.

Triangulation refers to the application of various methods or data sources in qualitative inquiry to produce an accurate conclusion of events (Patton, 1999). Triangulation has many benefits, such as strengthening the validity of the result if the different techniques of data collection point to comparable findings. It is more to raise the level of understanding about the change in variables and to confirm the researcher's viewpoint from multiple aspects. It is advantageous in confirming events, providing more complete data, improved validity, and enhanced opinion of studied events.

The survey was distributed to the 4-star and 5-star hotel general manager representative sample in Malta (twenty-nine individuals) the sample representing the information and communications technology professionals was interviewed to fill in the gaps and support any claims and clarify any uncertainties that were made through the surveys by general hotel managers. The survey was conducted using Google Forms for flexibility and convenience for the representative sample, and the presentation of the questions was done in sections

according to each hotel department to be analysed. The interviews were done over voice call on Google Meet for the convenience of the interviewees due to Covid-19.

Question Selection for the Survey and Interviews.

The questions to be asked in the survey and during the voice interview was made sure that they provide valid and reliable responses. The questions were made sure to be straightforward and easy to understand by the sample and set into a logical manner that flows naturally to keep the respondent interested to continue to cooperate and increase the response rate. The questions seek to understand how departmental processes can be optimised and how customer services can be improved using 5G enabled technologies.

Ethics.

There were several ethical principles that had to be considered when conducting this research. The Researcher had to abide by ethical principles that stress the need to do good and do no harm. These ethical principles meant that as a researcher, it was essential to obtain informed consent from the sample of participants; minimise the risk of harm to participants; protect their anonymity and confidentiality; avoid using deceptive practices; and give participants the right to withdraw from the research.

Limitations.

Nature of case studies would impact the depth of this study since generalisation from responses gathered from the general managers' sample and the information, and communications technologies sample would be needed when conducting a multi-case case study.

The lack of awareness and technological expertise of general managers about 5G technology limited the rigour the researcher was expecting, mitigating this shortfall, the researcher interviewed information and communication technologies experts to fill the gaps in the data.

Due to time restrictions, the qualitative survey and interviews had to be done in a short period of time, not allowing for increased pursuing of more respondents to be included in the study.

Another limitation of this research is that the conclusion is based off the opinions of industry professionals and facts cannot be certain since the technology is not available yet to be observed and studied, therefore the reliance on a generalised conclusion is another drawback of this study.

The qualitative data gathering methodology used is another limitation of this study since the researcher pushed for interviews for the hotel general managers though it proved futile since they preferred filling out a survey on the contrary the Information and communications technology experts were more open to being interviewed rather than conducting a survey.

Results and Discussion.

Qualitative Analysis Process.

The main goal of this qualitative study was to understand the effects on hotel operational processes and services brought by the adoption of a private 5G network through a thorough analysis of the opinion of industry specialists. The researcher conducted a content analysis process of the data gathered to increase the understanding of content gathered, increase the understanding of what is affected & how, to analyse the particular impact of effects that were occurring and understand how the variables under investigation, operational processes and services can be improved.

The data was collected through two research methods. Hotel general managers were surveyed through an online platform Google Forms, and ICT professionals were interviewed through an audio interview. This approach was taken since hotel managers were more committed to conducting a survey rather than being interviewed, and ICT professionals preferred to be interviewed rather than conducting an online survey when contacted and presented with options.

The online survey was sent to all the representative sample representing 4-star hotel and 5-star hotels having a response rate of 24.13%. The survey is the prioritised method of data collection; on the other hand, the interviews conducted with ICT professionals was carried out with the intention to validate the data through cross verification from the two sources. The data gathered from the online survey on google forms were downloaded on an Excel sheet, and all the survey questions were individually separated on Word documents for better analysis. The audio of the interviews was transcribed to word document for analysis.

The first step that was taken to analyse the data was categorisation, the data was thoroughly read and analysed line by line. The next step was data reduction, it was essential to reduce data to a manageable form, and therefore the data was labelled into four categories, technology used, the effects on processes optimisation and personalisation of services and the overall hotel benefits, the data that was labelled consisted of repeated words, concepts and ideas. Data display was the next important step; the data was organised into tables which enabled the compressed assembly of information that permitted the drawing of conclusions. Conclusions were drawn by exploring the differences and similarities across data categories through an interpretation of the data so to make sense through more abstract conceptualisation.

The following section is a presentation of the results of the opinions of industry professionals drawn up to understanding how the utilisation of a private 5G network in hotels would optimise operating processes and refine customer-centric services. The sections are organised by hotel departments, and every process of the department is analysed through the data collected. The results presented in the following sections will be discussed in detail and compared with insights from the literature.

Front Office.

The front office is often the first and last points of contact with the guests with our organisation during their stay, according to a study issued by Cornell's Centre for Hospitality Research, guest satisfaction could decrease by 47% at times when check-in takes more than 5 minutes. The front office must, therefore, find ways to provide a seamless experience for guests by improving our front office's processes and services to increase the probability of positive first and last impressions and obtaining the possibility of converting them into loyal customers.

In this section, the participants were asked to give their opinion on how 5G IoT enabled technologies are to affect front-office processes and customer service personalisation. From Table 4: Front Office Department Processes, the categorising and coding of data were grouped according to the process being analysed.

The future state of operations of the front office according to hotel general managers and information and communications technology professionals will evolve to provide an increased service personalisation and have the processes streamlined through the adoption of new technologies that the current hotel do not utilise. The 5G network will allow devices such as 'smart cameras with facial-recognition', 'guests' mobiles', 'autonomous carts', 'AI-enabled chat-bots' and 'mobile app' to transmit large volumes of data with reduced lag time in order to be of service to the customer. These new technologies which would be useful for day to day operation of hotels would not be possible to be adopted since as devices get smarter and other devices than smartphones are connected to the hotel's communication network, the network would not have the capacity of transmitting all the data required and communicated with the connected devices.

Besides improving service personalisation and process efficiency, the adoption of the network would add several other benefits that hotels currently forego. Some of these benefits forfeited

are 'increased revenues', 'automation of processes that do not add value', 'efficient target marketing' and enhance 'customer satisfaction'.

Table 4: Front Office Department Processes

| Front Office Processes | Focus Area | 5G Enabled Process | Benefits Enabled by 5G | Effect on Factors |
|----------------------------|-----------------------------|---|--|---|
| Checking In & Checking Out | Check-in Process | <ul style="list-style-type: none"> Smart cameras with facial-recognition capabilities to recognise guest from mobile check-in before to arrival Guests' mobile device app is activated automatically allowing them to bypass the front office. | <ul style="list-style-type: none"> Drive revenues efficiently and effectively. | <ul style="list-style-type: none"> Increase in guest personalisation Increase in process optimisation |
| Physical Check-out Process | Physical Check-out Process | <ul style="list-style-type: none"> When guests check out via mobile app, robotic process automation software will automatically update the room status in real-time so staff can prepare for the next arrival. | <ul style="list-style-type: none"> Be able to automate activities that do not add value. | <ul style="list-style-type: none"> Increase in process optimisation |
| Loyalty Programme | Recognising Loyalty Members | <ul style="list-style-type: none"> A smart camera integrated with the customer management systems. The facial-recognition capabilities also help identify loyal members when they enter the hotel entrance, informing staff to greet them in a personalised and timely manner. | <ul style="list-style-type: none"> Assist staff with targeted marketing, increasing revenue. | <ul style="list-style-type: none"> Increase in guest personalisation |
| Bell Service & Concierge | Bell service | <ul style="list-style-type: none"> Luggage can be loaded onto an autonomous cart integrated with the lifts that will deliver them securely to the rooms. | <ul style="list-style-type: none"> Be able to automate activities that do not add value. Luggage loaded efficiently and effectively. | <ul style="list-style-type: none"> Increase in process optimisation |
| | Concierge | <ul style="list-style-type: none"> Ai-enabled chat-bots can provide guests with up-to-date, real-time itineraries, as well as recommendations to enhance their stay. | <ul style="list-style-type: none"> Enhances guest satisfaction by creating for them customised recommendations. | <ul style="list-style-type: none"> Increase in guest personalisation |

Food and Beverage Department.

The Food and Beverage Department is one of the most revenue-generating departments for most hotels. Increasingly, guests are not just looking for a place to stay. They are also willing to spend more on food and beverage options, giving hotels opportunities to net extra revenue. With both restaurant and in-room dining functions becoming significant contributors to a hotel's revenue streams, hotels should not overlook their ability to provide high-quality food and efficient dining.

In this section, the participants were asked to give their opinion on how 5G IoT enabled technologies are to affect department processes and customer service personalisation. From Table 5: Food and Beverage Department Processes, the categorising and coding of data were grouped according to the process being analysed.

The future state of operations within the food and beverage department is envisioned to be improved in terms of service personalisation and optimising departmental processes through the utilisation of technologies that are enabled with the adoption of 5G communication networks. According to hotel general managers, and information and communications technology professionals the food and beverage department will evolve to make 'efficient use of tables and guests', generate better 'promotion to entice spending', have a better 'ordering system', 'reduce non-productive activities', 'Cutting unnecessary processes', 'Easing manpower pressure' and staff will be encouraged to only handle the 'customer interaction and any exceptions'.

This future state of operations in the food and beverage department would be only possible if hotels would adopt a 5G network to connect effectively 'facial-recognition cameras', 'mobile devices', 'sensors', property information systems, and 'food robots'. The sheer amount of data for these devices to operate seamlessly and in coordination with other departments need real-time, reliable, and safe connection throughout the hotel.

Table 5: Food and Beverage Department Processes

| Food and Beverage Processes | Focus Area | 5G Enabled Process | Benefits Enabled by 5G | Effect on Factors |
|-----------------------------|---------------------------|--|---|---|
| Foodservice | Table Management | <ul style="list-style-type: none"> Facial-recognition cameras aided by CRM systems placed at outlet entrances will help staff recognise and greet loyalty members. Smart cameras can identify vacant tables and notify staff to clean them and flags it as open in the system. | <ul style="list-style-type: none"> Drives potential for promotions to entice spending and offer giveaways to enhance their experience. More efficient use of tables and guests are hosted in a cleaner environment. | <ul style="list-style-type: none"> Increase in service personalisation Increase in process optimisation |
| | Ordering | <ul style="list-style-type: none"> Orders can be placed via mobile devices instantly. Menus can also be updated in real-time depending on availability of ingredients. | <ul style="list-style-type: none"> Staff do not need to physically share orders with the kitchen and create a billing invoice in the point of sale. | <ul style="list-style-type: none"> Increase in process optimisation Increase in service personalisation |
| | Payment | <ul style="list-style-type: none"> Guests pay via facial recognition since the point of sale will create the bill seamlessly. | <ul style="list-style-type: none"> Staff need only manage customer interaction and any exceptions. | <ul style="list-style-type: none"> Increase in process optimisation |
| In-room Dining | Ordering | <ul style="list-style-type: none"> Guests place their orders via mobile device and kitchen management system, which will send orders and billing directly to the point of sale and kitchen, respectively. | <ul style="list-style-type: none"> Guests do not have to wait for the staff to input the order and bill manually. | <ul style="list-style-type: none"> Increase in process optimisation |
| | In-Room Delivery | <ul style="list-style-type: none"> Staff will place the order in a secure autonomous in-room dining robot for delivery to the rooms. Guests unlock the robot via facial recognition or their keys to retrieve the food. | <ul style="list-style-type: none"> The reduction of staff to carry out repetitive and non-productive activities will result in process optimisation and cost reduction. | <ul style="list-style-type: none"> Increase in process optimisation |
| Kitchen & Food Management | Food Inventory Management | <ul style="list-style-type: none"> Smart IoT sensors in the food and beverage stores can automatically count the quantity of each stock in real-time. Robotic process automation software will automatically generate purchase orders and prompt supervisors for approval. | <ul style="list-style-type: none"> Cutting unnecessary processes for calculating inventory levels. Simplifying the procurement process. | <ul style="list-style-type: none"> Increase in process optimisation |
| | Food Hygiene and Safety | <ul style="list-style-type: none"> IoT sensors installed in the freezers and kitchen equipment can automatically capture the data and present them on a dashboard. Smart cameras embedded in refrigerators digitally tag expiration dates on different food items, helping staff keep track of fresh and expiring items. | <ul style="list-style-type: none"> All data is uploaded in real-time onto the platform so supervisors can monitor performance on the go, alert staff to rectify issues and help minimise overall food wastage. | <ul style="list-style-type: none"> Increase in process optimisation |
| | Food Preparation | <ul style="list-style-type: none"> Food is prepared and cooked alongside automated food robots. | <ul style="list-style-type: none"> Easing workforce pressure and shortening guests' waiting time. | <ul style="list-style-type: none"> Increase in process optimisation |
| | Food Waste Management | <ul style="list-style-type: none"> Bin with smart AI capability automatically weighs, detects, and records the type and amount of food items discarded. Chefs and department managers analyse data to tweak their menus, food quantity and types of ingredients for procurement. | <ul style="list-style-type: none"> Reducing food waste and generating more cost savings. | <ul style="list-style-type: none"> Increase in process optimisation |

Housekeeping Department.

House Keeping department is an essential department in any hotel. A hotel's ability to turn over rooms quickly has a direct impact on guest satisfaction and revenue. However, tight human resources challenges and the lack of communication between hotel systems regularly affect the work efficiency of the Housekeeping team, making the physically demanding tasks even more laborious and time-consuming.

In this section, the future state of the housekeeping processes is analysed, the participants were asked to give their opinion on how 5G IoT enabled technologies are to affect the department processes. From Table 6: Housekeeping Department Processes, the categorising and coding of data from the survey and the interviews were grouped according to the process being analysed.

'Better efficiency of processes' can be achieved by connecting staff devices to a hotels network capable of enabling 'automation of repetitive processes' with technologies such as 'mobile devices' and 'apps' 'housekeeping cart' and 'IoT Sensors'. These optimised processes would lead to 'Saving housekeeping staff time', 'Better room cleaning planning', 'Better deployment of human capital' and 'Reduce the risk of theft'.

Some optimised processes such as the Minibar inventory control can also lead to increased guest satisfaction and 'personalisation' due to the timeliness of the service provision and could lead to 'further spending' when the guest is provided with replenishments of their choice.

Table 6:Housekeeping Department Processes

| Housekeeping | Focus Area | 5G Enabled Process | Benefits Enabled by 5G | Effect on Factors |
|----------------------|----------------------------------|--|---|--|
| Room Cleaning | Room Assignment to Attendants | <ul style="list-style-type: none"> Mobile app auto-assigns rooms to each attendant, taking into consideration the priority rooms, special requests and each attendant's availability and performance. | <ul style="list-style-type: none"> Better efficiency of processes carried out by staff. Better deployment of human capital | <ul style="list-style-type: none"> Increase in Process optimisation |
| | Room Cleaning | <ul style="list-style-type: none"> A robotic cart aids the attendant with room requirements, while a vacuum robot cleans the floor on its own. | <ul style="list-style-type: none"> Automation of repetitive and non-productive processes | <ul style="list-style-type: none"> Increase in process optimisation |
| | Minibar Tracking | <ul style="list-style-type: none"> The minibar is installed with IoT sensors and alerts the front office and teams of the items consumed and bills them to the guest. A mobile app will also inform the room attendant of the items that require replenishing in each room. | <ul style="list-style-type: none"> Saving housekeeping staff time from continuously checking the minibar Encourage further spending by replenishment. | <ul style="list-style-type: none"> Increase in process optimisation Increase in customer personalisation |
| | Reporting of Room Status | <ul style="list-style-type: none"> After cleaning a room, the attendant updates the room status on the mobile app. | <ul style="list-style-type: none"> This allows the staff to check a guest into a clean room quickly. | <ul style="list-style-type: none"> Increases process optimisation |
| | Tracking Attendants' Performance | <ul style="list-style-type: none"> Supervisors can monitor the performance of each room attendant and better plan housekeeping operations. | <ul style="list-style-type: none"> Better room cleaning planning by management, resulting in efficient and cost-effective operations. | <ul style="list-style-type: none"> Increase in process optimisation |
| | Amenity & Linen Delivery | <ul style="list-style-type: none"> Upon receiving guest requests, housekeeping staff can help distribute the requested items by autonomous delivery robots. Staff places the dirty linen at a collection point on each floor, where an autonomous linen robotic cart travelling from floor to floor will collect the soiled linen. | <ul style="list-style-type: none"> Better efficiency of processes carried out by staff. Machinery would be carrying out strenuous work instead of the staff. Better deployment of human capital | <ul style="list-style-type: none"> Increase in process optimisation |
| Inventory | Stock Taking | <ul style="list-style-type: none"> Inventories are tracked in real-time with the installation of IoT Smart sensors in the housekeeping floor pantries and central store. The software automatically notifies staff to restock the floor pantries and send a procurement notice. | <ul style="list-style-type: none"> Automation of repetitive processes. Reduce the risk of theft Less risk of human error when ordering and purchasing. Better forecasting using AI and ML | <ul style="list-style-type: none"> Increase in process optimisation |
| Public Area Cleaning | Reporting Cleaning Status | <ul style="list-style-type: none"> Housekeeping staff indicate the cleaning status of each area in the e-housekeeping app when they begin and end their duties, allowing supervisors to keep track of work completed. Staff activate the autonomous vacuum robot to clean public areas, leaving staff with sufficient time for more complex duties like the wiping of glass windows. | <ul style="list-style-type: none"> Better efficiency of processes carried out by staff. Better deployment of human capital | <ul style="list-style-type: none"> Increase in process optimisation |
| | Replenishing Checks | <ul style="list-style-type: none"> Smart IoT sensors on soap and toilet paper dispensers will send urgent mobile notifications to the housekeeping staff to top up supplies when they run low. | <ul style="list-style-type: none"> Saving housekeeping staff time from continuously checking the restrooms Ensuring all guests are provided with all amenities needed | <ul style="list-style-type: none"> Increases process optimisation |

Engineering Department.

The hotel's Engineering team is critical to its functionality and ability to remain in business. Management must ensure that building facilities and critical equipment such as the heating, ventilation and air conditioning system are functioning smoothly while tending to all repair assignments swiftly. However, the team is often overburdened with daily manual tasks and is always under pressure to complete assignments quickly to maintain guest satisfaction. With an increased focus on sustainability, the Engineering team is also tasked to find ways to reduce the hotel's energy and water consumption, minimise the carbon footprint, and save on operating costs.

This department is one of the central process-intensive departments within a hotel, therefore finding ways to increase in process optimisation is paramount, therefore through the use of technologies such as 'mobile app', 'smart IoT sensors', 'IoT devices' could help to 'Reducing breakdowns', 'Prioritise tasks efficiently', 'minimising wasted trips', 'becoming more sustainable' and ultimately 'ensuring safety and standards are always kept'. Table 7: Engineering Department Processes presents the data collected from industry specialists which clearly indicates that the engineering department would benefit immensely if a 5G network would be adopted on-premises. This type of network would offer management with more incredible speed in the transmissions, a more significant number of connected devices than current infrastructure allows and the possibility of implementing virtual network slicing to providing more robust connectivity to connected devices.

Table 7: Engineering Department Processes

| Engineering | Focus Area | 5G Enabled Process | Benefits Enabled by 5G | Effect on Factors Analysed |
|---------------------------------------|------------------------------|--|--|---|
| Outdoor Controls | Job Allocation | <ul style="list-style-type: none"> Staff receive alerts via the mobile app on defects and repairs requests made by guests and staff members. Smart IoT sensors throughout the property allow monitoring and analysis of security, fire safety, power, kitchenware, and other critical equipment in real-time. When abnormalities arise, the mobile app automatically assigns the urgent task to the most qualified staff. The team and supervisors can monitor the real-time status of every task through the app. | <ul style="list-style-type: none"> Staff can monitor issues and prioritise tasks efficiently. They can pinpoint issues and prepare necessary tools to rectify them, minimising wasted trips. No tasks will fall through the cracks. | <ul style="list-style-type: none"> Increase in process optimisation |
| In-room Controls | Preventive Room Improvements | <ul style="list-style-type: none"> With IoT sensors, engineering staff can now quickly: pinpoint problematic areas instantly, remotely control IoT devices and conduct preventive maintenance. | <ul style="list-style-type: none"> Reducing breakdowns and costs. | <ul style="list-style-type: none"> Increase in process optimisation |
| Facilities, Energy & Water Management | In-room Management | <ul style="list-style-type: none"> In-room IoT sensors detect when a room is unoccupied after some time, or the balcony door is open, and automatically switch the in-room systems to energy-saving mode. | <ul style="list-style-type: none"> Reduction of costs and becoming more sustainable | <ul style="list-style-type: none"> Increase in process optimisation |
| | Lighting Management | <ul style="list-style-type: none"> IoT sensors sense the level of ambient light and automatically turn lights on/off at a pre-set level. The lighting management system also regulates energy consumption and alerts the engineering team should a bulb fail. | <ul style="list-style-type: none"> Automating processes for guests and becoming more sustainable Immediate action to address faults, ensuring guest satisfaction. | <ul style="list-style-type: none"> Increase in service personalisation Increase in process optimisation |
| | Water Management | <ul style="list-style-type: none"> The engineering team can monitor and control the water flow throughout the hotel, generating savings while not compromising on the guest experience. | <ul style="list-style-type: none"> Reduction of costs and becoming more sustainable | <ul style="list-style-type: none"> Increase in process optimisation |
| | Swimming Pool Management | <ul style="list-style-type: none"> Embedded pool sensors capture and send data to the engineering team need not travel to the pool to track water quality. If water quality does not meet the pre-set level, an integrated pump will automatically dose the pool with the required chemicals. | <ul style="list-style-type: none"> Reducing staff processes Ensuring safety and standards are always kept. | <ul style="list-style-type: none"> Increase in process optimisation |

Security Department.

Safety and security are always the top service priorities for hotels, especially in recent years. Guests have an expectation that they and their belongings will be safe and secure during their stay. The security team's goal is to provide protection to guests discreetly without interrupting day-to-day hotel operations and guest activities. However, inefficient workflows and manual administrative tasks hinder the team in reacting promptly to any potential crisis. Therefore, an analysis of how the utilisation of a 5G network in hotels would aid this department in carrying out the security processes more efficiently and more precisely.

General managers and information and communications technology specialists outlined the possible 5G enabled technologies that hotels might adopt to upgrade current security systems. Through the use of 'Intelligent video surveillance' and 'IoT sensors' used throughout the property, dedicated systems can be utilised to 'detect suspicious behaviour' and 'alert security' staff immediately. Besides the highlighting of suspicious behaviour and the minimising of theft and unauthorised intrusion, general managers also pointed out that detection of early fires or probable sources of flammable objects can be detected using smart cameras.

Table 8: Security Department Processes

| Physical Security | 5G Enabled Process | Benefits Enabled by 5G | Effect on Factors |
|---------------------------|---|---|--|
| Indoor & Outdoor Security | <ul style="list-style-type: none">Video surveillance technology helps aggregate and analyse data captured from Smart cameras and IoT sensors installed around the hotel and highlights suspicious events to the security staff | <ul style="list-style-type: none">Stops crime before it happens.Helps staff to act swiftly on the alert.Preventing a fire with immediate attention. | <ul style="list-style-type: none">Increase of Process Optimisation |
| Reporting Suspicion | <ul style="list-style-type: none">Video surveillance can accurately count the number of people entering, leaving, or remaining within the premises to prevent overcrowding.Alerting security staff when unauthorised people cross certain boundaries and identify suspicious people and behaviours via facial recognition analytics. | <ul style="list-style-type: none">Safety and health precautions are enforced.Ensuring that guests are given peace of mind that the premises are equipped with heavy security | <ul style="list-style-type: none">Increase of Process Optimisation |

Sales and Marketing Department.

In the ever-competitive hotel industry, sales and marketing tactics have changed dramatically in recent years, while revenue management has become more critical. When competition may literally be right next door, the pressure is always on to get room rates right – from both a guest and a revenue perspective. Hoteliers need to proactively develop an effective pricing and distribution strategy to maximise revenue. Tracking and analysing data is now a necessity to help hotels develop successful sales strategies, customise marketing tactics, and discover any unrecognised revenue opportunities. It is now nearly impossible to do this effectively, and error-free, without the adoption of technology and automation.

In this section, general managers and information and communications technology professionals were asked to give their opinion on how 5G IoT enabled technologies are to affect sales and marketing practices within a hotel and how it would affect customer personalisation and satisfaction.

With the capabilities that are enabled using 5G communication networks in hotels, technologies such as 'IoT devices', 'robotic process automation software', 'Beacons' and 'Smart cameras' would make it possible for sales and marketing teams to analyse 'data collected by IoT devices' which could be 'automatically consolidated via robotic process automation' and when 'beacons will sense the location of guests' throughout the property would precisely target the guests with tailored packages and services to unlock 'opportunities to upsell and enhance guest experiences'. 'Forecast real-time optimal pricing' can be another 5G enabled benefit so that hotels can 'maximise occupancy and profits'. All of these optimised processes also aid with the personalisation of hotel services which would earn the hotel 'additional loyal customers'.

Table 9: Sales and Marketing Department

| Sales & Marketing | Focus Area | 5G Enabled Process | Benefits Enabled by 5G | Effect on Factors |
|-------------------------|---------------------------------------|---|---|---|
| Hotel Pricing Strategy | Generating Optimal Room Prices | <ul style="list-style-type: none"> Leveraging data collected by IoT devices can be automatically consolidated via robotic process automation without having to pull reports from the property systems manually. | <ul style="list-style-type: none"> Helps management to forecast optimal real-time pricing to maximise occupancy and profits. The revenue team now has time to focus on broader strategic objectives and generate more revenue: | <ul style="list-style-type: none"> Increase in process optimisation Increase in guest personalisation |
| Event and Group Booking | Event/Group Sales Bookings | <ul style="list-style-type: none"> All client proposal data is captured and using Robotic process automation, automated yet personalised follow-up emails for each stage in the sales process are sent. | <ul style="list-style-type: none"> Simplified processes to allow the sales team to manage client enquiries and relations effectively and secure more sales. Sales staff can now spend more time connecting with guests and clients and upsell to them on a more personalised level. | <ul style="list-style-type: none"> Increase in process optimisation |
| Marketing & Upselling | Location-Based and Targeted Marketing | <ul style="list-style-type: none"> Beacons will sense the location of guests and push contextually relevant promotions to their mobile devices. Smart cameras with facial-recognition capabilities integrated with CRM, placed around the hotel, can also assist staff to recognise loyalty members and repeated guests and customise promotions. | <ul style="list-style-type: none"> Opportunities to upsell and enhance guest experiences. Unlock the potential for additional loyal customers | <ul style="list-style-type: none"> Increase in guest personalisation |

Procurement and Finance Department.

Procurement and Finance Department is not only responsible for the delivery of supplies in the hotel efficiently but also produces value through the optimal quality of goods and services as a function of customer service and sustainability, at the lowest possible cost. As a hotel provides 24/7 service, floods of transactions are recorded daily. Every trade, from purchasing a drink at the hotel bar to reserving a room online, results in a sale for the company, which ultimately requires validation checks by the Finance and Accounting team. Many processes handled by the Procurement and Finance teams are still done manually and time-consuming, and thus prone to human intervention errors, which could be detrimental to a hotel's reputation. The teams need automated solutions that can enhance real-time visibility, control, and efficiency across their processes.

In this section, the participants were asked to give their opinion on how 5G IoT enabled technologies are to affect procurement and accounting processes and customer service personalisation. From Table 6: Procurement and Accounting Department Processes, the categorising and coding of data were grouped according to the process being analysed. It resulted that 'Automating purchase order processing' can possibly contribute to 'cutting downtime in the ordering cycle' and 'eliminating the need for stressful month-end closing' which would 'increase in process optimisation'. This is possible if the adoption of a 5G network is adopted due to the capabilities of transferring large amounts of data simultaneously from other departmental processes all day long, which would not be possible with current technological infrastructure present in most hotels given the sheer amount of connected devices communicate with each other.

Table 10: Purchasing and Accounting Department Processes

| Purchasing and Accounting | Focus Area | 5G Enabled Process | Benefits Enabled by 5G | Effect on Factors Analysed |
|---------------------------|------------------------------|--|--|---|
| Procurement Functions | Purchase order Processing | <ul style="list-style-type: none"> Automating purchase order processing will help enable quick placing and tracking of orders. | <ul style="list-style-type: none"> Removing redundant processes and cutting downtime in the ordering cycle. | <ul style="list-style-type: none"> Increase in process optimisation. |
| | Overseeing Procurement Cycle | <ul style="list-style-type: none"> Automated procurement system with robotic process automation rules, the team now can have a consolidated view of historical and real-time expenses, as the system automatically pulls data from documents saved. | <ul style="list-style-type: none"> It can now detect reckless spending by management, identifying gaps to reducing costs, and making well-informed decisions when making new purchases. | <ul style="list-style-type: none"> Increase in process optimisation. |
| Accounting and Reporting | Financial Reconciliation | <ul style="list-style-type: none"> Financial data can be extracted and reconcile the transactions automatically. It will then identify data anomalies and notify finance staff to resolve the situation in real-time. | <ul style="list-style-type: none"> Increases the finance team's real-time visibility of accounts, eliminating the need for stressful month-end closing of accounts. | <ul style="list-style-type: none"> Increase in process optimisation. |

Human Resources Department.

Hotels are often met with tight workforce and high turnover rates. Human resources teams in hotels may struggle to attain suitable employees, keep current them satisfied and retain high-performing ones. Human Resources department must, therefore, battle these workforce trends by relying on tools and technology to help them search for new employees in a more productive manner, as well as retaining employees by giving them ample career development opportunities.

In this section, the participants were asked to give their opinion on how 5G IoT enabled technologies are to affect human resources department processes. From Table 9: Human Resources Processes, the categorising and coding of data were grouped according to the process being analysed. The future state of operations of the human resources according to hotel general managers and information and communications technology professionals is envisioned to evolve to provide an increased process simplification whilst improving the current ones.

Some improved processes as pointed out by the research respondents, human resources can be notified 'on the skill sets that are currently lacking' on various jobs allocation on the premises, these could appear across various labour intensive departments within the hotel such as engineering department, food and beverage department and housekeeping so that human resources managers can appropriately 'allocate training to unskilled workers' and 'replace with skilled workers'. Additional benefits besides the ones reaped through the adoption of 5G enabled technologies that can make the aforementioned processes possible are the reduction of costs associated with job inefficiencies and poor prioritisation.

Table 11: Human Resources Department Processes

| Human Resources | Focus Area | 5G Enabled Process | Benefits Enabled by 5G | Effect on Factors Analysed |
|----------------------------------|---|--|---|---|
| Training & Development | Identify each Employee's Training Needs | <ul style="list-style-type: none"> The system will also analyse the workforce scheduling pattern and notify human resources on the skill sets that are currently lacking among the existing human capital. | <ul style="list-style-type: none"> Human resources managers can allocate training to unskilled workers and replace with skilled workers to fill the gap. Reduction of expenditure Increase in profits. | <ul style="list-style-type: none"> Increase in process optimisation. |
| Scheduling, Attendance & Payroll | Manpower Scheduling | <ul style="list-style-type: none"> By determining the required tasks, specific skills and duration required, staff can be cross deployed across hotel functions based on their skill sets, departmental budgets, and other priority settings. | <ul style="list-style-type: none"> Better management of human capital, together with optimising, returns on the costs incurred. Effective human capital allocation. Reducing inefficiencies, therefore, improvement of profit. | <ul style="list-style-type: none"> Increase in process optimisation. |

Conclusion.

The scope of this study was to get a better understanding of how service personalisation and operational processes are affected when adopting the next-generation cellular network into a hotels business model. Therefore, this study attempted to answer the questions of how the utilisation of a private 5G network in hotels would:

1. Refine customer-centric services for additional revenue.
2. Optimise operating processes for cost reductions.

This study also attempted to provide a clear understanding of the changes that hotels would have to go through to remain competitive in this dynamic industry.

Through the analysis of the responses, it is clear that the adoption of 5G network communications has an endorsement of both general managers with years of experience in the hotel industry and also ICT professionals who envision that there are numerous benefits reaped from introducing such technology will enable hotels to improve their services and their operations. Labour intensive departments are more likely to benefit from process automation, and optimisation whilst consumer-centric departments are more likely to increase their provision of personalised services. Hence this would boost revenues whilst streamlining hotel processes making the organisation more profitable.

Results show that service personalisation could be achieved through technology. Data which could be generated by guests can be utilised intelligently so that management can make optimal use of it and during the stay of the guest, the services provided can be tweaked to the preferences of the guest whilst offering possible optional services which the guest might be inclined to purchase. Personalisation is not limited to the end consumer only, data can be generated by staff devices

and can be utilised to make their job more tailored to their skills and their abilities and can provide information to human resource department to make the best use of the hotels human capital.

Results also show that process optimisation can be achieved through the utilisation of 5G enabled Internet of Things devices which can range from sensors to mobile devices and autonomous robots. The benefits of using such devices would lead to cutting inefficient and non-productive, leaving repetitive processes to software or robotics and help hotel staff with their current duties. The benefits would be reaped by all members of the organisation within every department. The facilitation of tasks would result in less workforce time consumed, less workforce required, and less funding needed. Considering the results of this study it also be a great opportunity for further research on how this digital transformation would affect management involvement in hotels and understand whether it is best to plan organisational processes around technology rather than implementing technology. Other research suggestions are what are the tolerance levels of hotel staff with regards to machines aided processes and how can technology increase work satisfaction within hotels.

The fourth industrial revolution is happening; data and connected devices are essential. Hotels thrive on consumer data, and now technology facilitated the process of the generation and collection of data through the excessive use of personal mobile devices. Besides the use of mobile devices, it is envisioned by technology entrepreneurs that in the next ten years, all physical objects will have some sort of digital capability. The increased use of IoT-enabled devices causes a need for a technology that can support this enormous amount of data transmissions efficiently. To cope with the considerable amount of data being captured and generated, an upgraded network architecture would be needed to be developed to improve hotel services and departmental processes. Hotels must prepare for the inevitable, the adoption of 5G technologies within organisations would be the result of looking beyond the short-term factors and predicting what

will happen in the next decade or two. Taking this approach would put hotel organisations at the forefront of technological adoption, which in turn would make them less susceptible to remaining immobile in the face of digital transformation.

References.

- 3GPP, 2020. *3GPP.org*. [Online]
Available at: <https://www.3gpp.org/release-17>
- Abutabenjeh, S., 2018. Clarification of research design, research methods, and research methodology: A guide for public administration researchers and practitioners. *Sage Journals*.
- Alsharif, M. & N. R., 2016. Evolution towards fifth generation (5G) wireless networks: Current trends and challenges in the deployment of millimetre wave, massive MIMO, and small cells.. *Telecommunication Systems*.
- Berkup, S. B., 2014. *Working With Generations X And Y In Generation Z Period: Management Of Different Generations In Business Life*.
- Brian, R., 2018. *hostelmanagement*. [Online]
Available at: <https://hostelmanagement.com/industry-news/gdpr-what-new-data-protection-regulations-mean-your-hostel>
- Clarke, R. A., 1994. *Harvard Business Review*. [Online]
Available at: <https://hbr.org/1994/07/the-challenge-of-going-green>
- Denney G. Rutherford, D. G. R., 2010. *Hotel Management and Operations*. s.l.:s.n.
- Dimitrios, C., 2006. In: *Tourism Management Dynamics*. s.l.:s.n.
- Dixte, J.-M., 2020. *hospitalitynet*. [Online]
Available at: <https://www.hospitalitynet.org/opinion/4099769.html>
- Fabri, S. C. V. F. J. F. G. S. J., 2020. *Agile. Perspectives on Malta's economy post COVID-19,,* s.l.: Seed.
- Glushko, R. & N. K., 2013. Substituting Information for Interaction A Framework for Personalization in Service Encounters and Service Systems. *Journal of Service Research*.
- Habibi, M. A., 2019. A Comprehensive Survey of RAN Architectures Toward 5G Mobile Communication System.
- Harwood, S. A., 2009 . The Domestication of ICTs - the case of the online practices of Scottish serviced accommodation providers.
- Heppelmann, M. E. P. a. J. E., 2014. *Harvard Business Report*. [Online]
Available at: <https://hbr.org/2014/11/how-smart-connected-products-are-transforming-competition>
- Juan Ignacio Pulido-Fernández, A. S.-C. C. F., 2011. *Critical external factors behind hotels' investments in innovation and technology in emerging urban destinations*.
- Kalyani, V. & S. D., 2015. IoT: Machine to Machine (M2M), Device to Device (D2D) Internet of Everything (IoE) and Human to Human (H2H). *Future of Comm*.
- Kim, S., 2020. *South Korea Bets on 'Untact' for the Post-Pandemic Economy*. [Online]
Available at: <https://www.bloombergquint.com/businessweek/south-korea-untact-plans-for-the-post-pandemic-economy>
- King, N. & F. J., 2016. Data analytics and consumer profiling: Finding appropriate privacy principles for discovered data. *Computer Law & Security Review*.

- KPMG, n.d. *KPMG*. [Online]
Available at: <https://home.kpmg/xx/en/home/campaigns/2019/06/converging-5g-and-iot.html>
- Larry Dwyer, D. E. E. A. M., 2009. Destination and Enterprise Management for a Tourism Future.
- Lee, I. & L. K., 2015. The Internet of Things (IoT): Applications, investments, and challenges for enterprises.. *Business Horizons*..
- Li, R. & Z. Z. & Z. X. & D. G. & C. Y. & Z. W. & Z. H., 2017. Intelligent 5G: When Cellular Networks Meet Artificial Intelligence. *IEEE Wireless Communications*.
- Lukanova Georgina, I. G., 2015. *Robots, Artificial Intelligence and Service Automation in Hotels*.. s.l.:Emerald Publishing Limited.
- Malta Communications Authority, 2019. *Malta Communications Authority*. [Online]
Available at:
<https://www.mca.org.mt/sites/default/files/5G%20discussion%20paper%20and%20survey.pdf>
- Murthi, B. & S. S., 2003. The Role of the Management Sciences in Research on Personalization.. *Management Science*.
- NIC, 2008. *Disruptive Civil Technologies*, s.l.: s.n.
- Oracle Hospitality, 2018. *Oracle.com*. [Online]
Available at: <https://www.oracle.com/a/ocom/docs/dc/using-ai-enhance-hotel-guest-exp.pdf>
- Pantelic, V., 2017. Factors influencing hotel selection: Decision making process... *International Hospitality Management*.
- Roberto Minerva, A. B. D. R., 2015. *Towards a definition of the Internet of Things (IoT)*. [Online]
Available at:
https://iot.ieee.org/images/files/pdf/IEEE_IoT_Towards_Definition_Internet_of_Things_Issue1_14MAY15.pdf
- Ronanki, T. H. D. a. R., 2018. *Harvard Business Review*. [Online]
Available at: <https://hbr.org/2018/01/artificial-intelligence-for-the-real-world>
- Ruth N Bolton, A. P. P. H. M., 2013. *Understanding Generation Y and Their Use of Social Media: A Review and Research Agenda*.
- Sang Lee, D. L., 2019. *"Untact": a new customer service strategy in the digital age*.
- Tan, C.-W. & B. I. & C. R., 2013. IT-Mediated Customer Service Content and Delivery in Electronic Governments: An Empirical Investigation of the Antecedents of Service Quality. *MIS Quarterly*.
- Ted Saarikko, U. H. W. T. B., 2017. The Internet of Things: Are you ready for what's coming?.. *Business Horizons*.
- Vik Krishnan, R. M. N. S. a. N. W., 2020. *Hospitality and COVID-19: How long until 'no vacancy' for US hotels?*. [Online].
- Watson, E. & H. K., 2009. Business Process Automation.
- Zeithaml, V., 1988. Consumer Perceptions of Price, Quality and Value: A Means-End Model and Synthesis of Evidence. *Journal of Marketing*.

Zhou, W., 2019. *towardsdatascience*. [Online]

Available at: <https://towardsdatascience.com/the-impact-of-ai-on-the-hospitality-industry-8ba7adb66be>