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Implementing Smart Grid for IoT applications in Tourism:

Identifying Sustainable Design Interventions in the Tourism Industry with Future technology.

Tarkvõrgu rakendamine turismi IoT lahendustes:

säästva disaini võimalused turismiturul tuleviku tehnoloogiaid kasutades.

Key words : Tourism, IoT, Smart grid, Smart Cities, Value chain, Digitalization.

MASTER THESIS

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TABLE OF CONTENTS

Abstract

The tourism industry has always observed the changes and has been re-engineering its attire accordingly.This study centers on the impacts of Tourism and its solutions using future technology. The tourism industry influences the social, economic, and cultural development of the host destination. With the 2020 pandemic, there has been a halt in the travel industry. Correspondingly this research has enabled an opportunity to re-formulate the tourism ecosystem and structure it towards a self-sustainable system.

The thesis reflects upon issues caused by overcrowding and uneven distribution of tourist flow which creates negative effects on the local residents and impedes travelers, visitors, tourists from the true essence of their journey experience - the destination's localness. Commercialized tourist spots have caused a loss of the local culture and values of the destination. Resulting in the hike of fees, imposed fines, sound pollution, excessive waste accumulation, and staggered hours of entrance and exit times. There was a time when the Internet overcame the industry with numerous updates, and now the Internet of Things is going to have a vibrant impact on the industry and the tourism industry. The paper aims to recognize the effect of IoT on the tourism industry and proposes a model for streamlining the tourism industry in order to thoroughly examine the experience of tourism.The tourism industry is widespread and involves a range of stakeholders in the overall travel and tourist circuit. The industry is full of diversity and expertise in diversity. Trending IoT technology will serve as a common thread which would sew all processes, including experience, and to solve the problems of accurate real time data in the tourism industry.
The paper is divided into three parts on understanding the tourism industry and its stakeholders and their problems, frameworks on implementation, the analysis on the effect of the Internet of Things technology on the various fragments of the tourism industry and the impacts of IoT on the proposed model.

LIST OF ABBREVIATIONS

ICT - Information & Communication Technology.

IoT - Internet Of Things.

IIoT - Industrial Internet of Things.

BLE - Bluetooth Low Energy.

NFC- Near- Field Communication.

AIoT - Artificial Intelligence of Things.

UNWTO - United nations World Tourism Organization.

POI- Point of Interest.

EU - European Union.

A.I - Artificial Intelligence

LOS - Length of stay.

CRM - Customer Relationship Management.

Chapter 01 : INTRODUCTION

" Travel is fatal to prejudice, bigotry, and narrow-mindedness." - Mark Twain

1.1 Evolution of Tourism

With an almost incomprehensibly huge infrastructure, tourism is also seen as a global phenomenon. Its significance is evident from the fact that its presence penetrates society, politics, culture, and, above all, the economy. Indeed, this is the fastest-growing branch of the global economy: the World Tourism Organization (WTO) reports that 903 million visitors spent 625 billion US dollars in 2007. They have thus supported a global structure in the new leisure and experience industry with about 100 million employees. A dynamic, interwoven world-wide system exists dedicated to meeting the unique tourist needs of mobile people, groups and masses.

Tourism has polarized since its inception: it shows various opinions ranging from the absolute acceptance of its ability to enrich self-realization combined with leisure to critical rejection because of the perception that it causes damage through the systemic dumbing down of entertainment and preventable degradation of the environment.Tourism is indeed the world's largest industry as it has many branches and sub branches to social, cultural, technology, economy and it touches the populations of the world directly and evasively.

The World Tourism Organization[1] defines Tourism as a social, cultural and economic phenomenon which entails the movement of people to countries or places outside their usual environment for personal or business/professional purposes. These people are called visitors (which may be either tourists or excursionists; residents or non-residents) and tourism has to do with their activities, some of which involve tourism expenditure.

The paper attempts to broaden and unfold crucial elements in the development of tourism & its technology. It also maps down and categorizes external innovations that have had an impact on the tourism sector. Correspondingly, the paper addressed the derivative advancements that could take place in tourism with the progression in technological, institutional & other sectors(As seen In Figure 1.0).

[1] "Glossary of tourism terms | UNWTO." https://www.unwto.org/glossary-tourism-terms. Accessed 4 Dec. 2020.

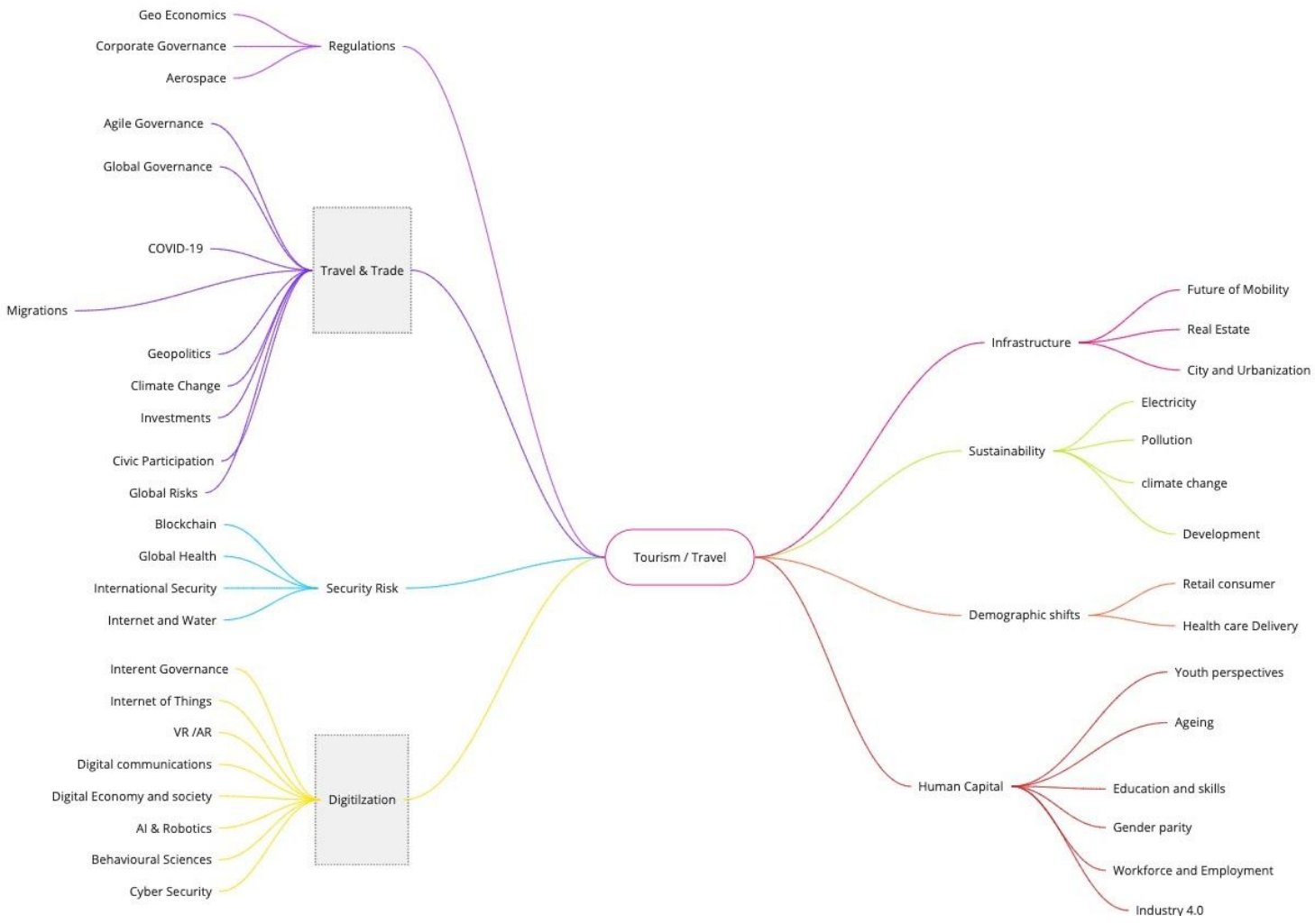

Figure 1.1 Mapping Tourism Sectors (Source :Author)

There has been unprecedented growth in tourism since the last decade due to easy accessibility and connectivity and even with major obstacles such as wars, natural calamities, and pandemics it shows promising growth. But with growth and ease of access it brings a fair share of challenges which are currently addressed to commercialized tourist spots and 'social media' influenced tourism resulting in uneven tourist flow. That has harmed the local communities and their culture resulting in the loss of authenticity and cultural erosion.

It calls for having a different vision for tourism. Multiple attempts have been made in tourism disciplines to switch from a traditional form of tourism towards a more sustainable form. Sustainable tourism calls for local communities to play a greater role and engage in its preparation, growth, and management. The ultimate purpose of the community and tourist participation is to aim for sustainable practices that balance the needs and desires of local economies with specific industrial needs.

1.2 Sustainable Tourism

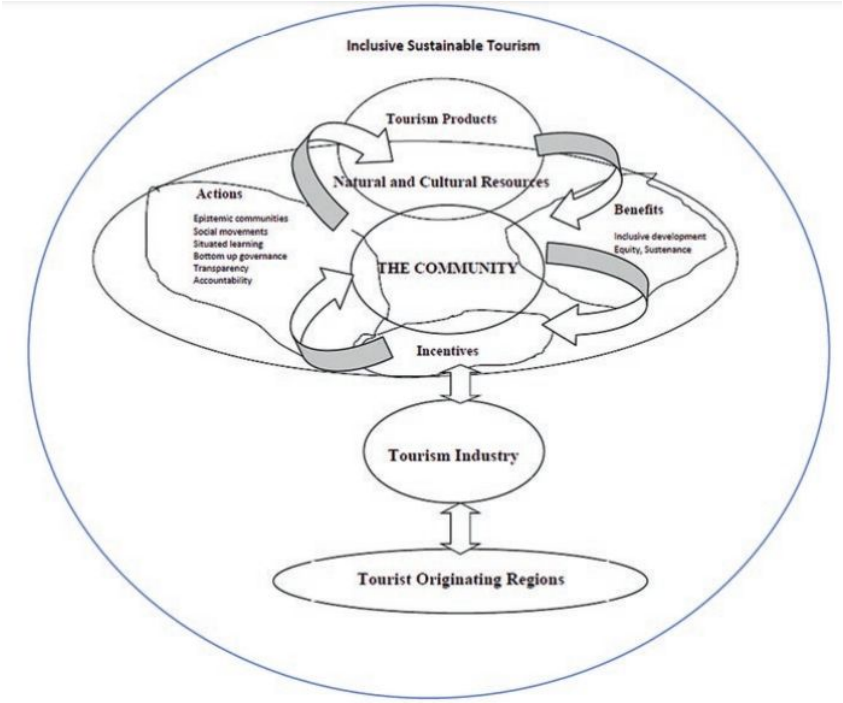

Figure 1.2 Inclusive Sustainable tourism

The World Tourism Organization defines sustainable tourism as - "Tourism that takes full account of its current and future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment, and host communities."(Sustainable development | UNWTO, 2020).

In Achieving sustainable tourism it is necessary to form an interdependent relationship between the local communities & visitors and deliver an authentic experience resulting in a minimal loss for all the parties involved. In order words to build a self-sustainable practice that balances the local economy with specific industrial needs. It also elucidates on new-age tourist fabrications integrated into the tourism ecosystem and it cannot be practiced

independently. The stakeholders have to be connected cohesively and need to collaborate together on building the relationship between the Locals and the visitors. Drastic measures are needed to overcome the 'over-tourism' impacts to society by highlighting the role of new technology and educational actions to its people. Thus this study centers on the impacts of Tourism and its solutions using future technology. Since the tourism industry influences the social, economic, and cultural development of the host destination. With the 2020 pandemic, there has been a halt in the travel industry. Correspondingly this research has enabled an opportunity to re-formulate the tourism ecosystem and structure it towards a self-sustainable system.

Chapter 02 : Technology & Tourism

2.1 Sociotechnical systems

Sociotechnical systems - Are systems in which people and technology (Including infrastructures) interact in a reciprocal relationship within an environment. It was first coined in the 1950s to describe the complexities of the modern workplace framework but has evolved to include a wide range of other environments such as cities.it further implies an optimization of this relationship through a joint design which considers both technical and human factors.[2]

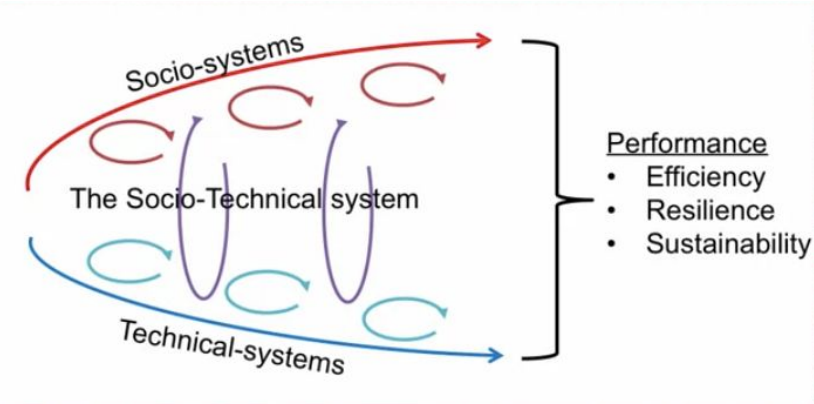

Figure 2.1 Relationship through non- human and human factors.(Source : IGLUS, EPFL)

When applying future technology in a new ecosystem which has no non-human intervention until now, the theory of the Sociotechnical system can be applied. Considering an opportunity to develop a smart city with the context of Tourism, one must understand what a city is. Cities can be understood as sociotechnical systems, a place where people live and

[2] "PHILOSOPHY OF SOCIO-TECHNICAL SYSTEMS." http://www.uvm.edu/pdodds/files/papers/others/1999/ropolh1999a.pdf. Accessed 4 Jan. 2021.

work together. Cities can further be understood through different dimensions, it can be an economic system, a place where wealth and a location in which the jobs are generated. Due to the nature of concentration of tourist crowd and business in cities, there is an increase in efficiency of production and thus competitiveness of tourist organizations. Additionally, this concentration results in the necessity of knowledge and innovation to tackle social issues using existing services and infrastructure of the city.

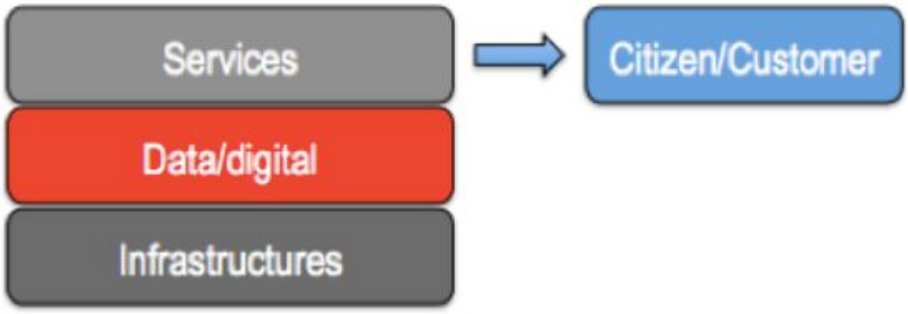

Figure 2.2 The data layer: The layer which defines smart City grid (Source :Author)

In a city system there are two main layers, an infrastructure and a service layer. The main point that differentiates a smart city is the addition of a third layer in between the original two namely a digital or data layer. This layer grows through the increasing number of sources for data generation in the cities, such as sensors, cameras, gps, smart phones and many other digital devices. These are data generation devices that can be found at increasingly lower costs and sizes, making their use very convenient. Additionally, their storage capacity had been growing exponentially, which means that the future cities would be generating unprecedented amounts of data.

This technological leap in urban systems is enabled by different technologies. The base data layer is a legacy system, namely telecommunications infrastructure (both cables and wireless), which allows for the physical transmission and storage of information. The second enabler is the network layer. This means the connection of all devices through the telecommunications infrastructure is done using protocols and systems such as the internet. However, it is necessary to identify and exchange the data generated, which is done through the world wide web. This is the communications dimension that connects all the data. Finally at the top of the pyramid, we have the individual devices that generate and store data.

When you combine all the systems above, you get the Internet Of Things (IoT): the connections of different devices through the internet and world-wide web. The evolution of this phenomena is exponentially growing, since we already have connected devices with the vast amount of data being generated and transmitted at real time with zero or minimal latency. However, this amount of data poses a new challenge, such as the new data generated must be analysed for it to be useful. This has led to the development of our capacity and ability to not only analyze this data but also visualize it in a way that it can be read and learn from the data. Some tools used are machine learning or Artificial intelligence. This process of analysis of large amounts of data is known as 'Big Data'.
We would learn further in the chapter how IoT is influenced in the tourism Industry and why there is an emergence of using the technology.

2.2 Technological Trends in Tourism

Technology is a core component of the tourism and travel industry, helping organizations with day-to-day tasks, while also enhancing the customer experience. It is critical that hotels, airlines, restaurants and other businesses keep up with the latest technological developments in the travel industry for this reason. In the era of COVID, with consumer preferences changing, this is particularly vital to make technological interventions now to tackle these challenges. The listed are 2020 technological trends.

2.2.1 Contactless Technology

Reducing points of mutual touch and face-to-face encounters is a key concern for travelers and tourism providers. To minimize these problems, many companies are looking for ways to implement contactless technology. For instance post covid, during check-in and boarding, some airports are exploring alternatives to handling tickets, passports, and other travel documents.

The use of biometrics is considered by a number, such as the ONE ID of IATA[3]. Biometrics can include contactless fingerprinting, scanning iris, or recognition of facials. Touchless entry, including motion controls, document scanning, or voice commands, are other options.

The use of mobile apps is another field that is gaining popularity, particularly for hotels and accommodation. Such programs may allow visitors to check in or out of rooms, open doors, or pay for facilities. Applications may also be used to replace room service menus, remote

[3] "One ID - IATA." https://www.iata.org/en/programs/passenger/one-id/. Accessed 09 Nov. 2020.

or environmental control information cards, all of which have the ability to transmit the virus across their surfaces.

2.2.2 Enhanced cleaning technologies

For both travel suppliers and clients, cleaning and sanitation are another primary concern. In order to ensure clean environments, tourists expect businesses to take care and workers want to be told that they can function safely.

Providers are introducing tighter requirements to overcome these issues. For instance, the Marriott Global Cleanliness Council was recently established by the Marriott hotel chain. This council focuses on developing a norm for global hospitality, including best practices for guests and employees to reduce risk. It requires the use of hospital-grade disinfectant electrostatic sprayers, allowing for more thorough disinfection of hard-to-clean surfaces such as lobbies or gyms.

To help make sterilization more effective, it also incorporates ultraviolet light technologies. This article on how hotels should get ready for post-COVID-19 business offers valuable instructions on measures to better fulfill consumer demands alongside the new requirements[4]. In order to improve sterilization, airports also use a variety of technologies. This involves full-body disinfection booths in Hong Kong, antimicrobial high-touch surface coatings, and cleaning robots. The booths can disinfect a person and their clothes in 40 seconds, according to reports, and incorporate photocatalysts or "nano needle" technology, intended to kill pathogens. Meanwhile with ultraviolet light and air sterilizers, the robots are equipped to make cleaning efforts more efficient.

2.2.3 Automated processes

With several vendors struggling to achieve sales targets or costs, firms are likely to have fewer workers willing to assist clients. In order to get around this, automation integration is a potential solution. In addition to the self-service that consumers may access via the previously mentioned mobile apps, some stores can begin to incorporate automated checkout processes for easier shopping and free of any human interaction[5].

For example, airports and hotels might turn to self-service gift shops or cafeterias through the introduction of Amazon's Just Walk Out technology. Additional automation processes are

[4] "How to Prepare Your Hotel for the Day After COVID-19." 22 Jun. 2020, https://blog.mobility.here.com/how-to-prepare-your-hotel-day-after-covid. Accessed 09 Nov. 2020

[5] "How to Prepare Your Hotel for the Day After COVID-19." 22 Jun. 2020, https://blog.mobility.here.com/how-to-prepare-your-hotel-day-after-covid. Accessed 23 Nov. 2020.

also likely to be used at airports. For example, to detect fevers, incorporate thermal cameras into security monitoring. Or to help screen travelers, incorporate data from touch or symptom tracing databases.

Another alternative, such as that suggested by the Known Traveller Digital Identity initiative [6], is to introduce universal identity documents. This initiative proposes the creation of a partnership between individuals, governments, authorities and the travel industry to enable data and resources to be shared by providers. This will dramatically speed up screening times and health tests.[7]

2.2.4 Smart door-to-door transportation

Another development expected to increase popularity is door-to-door transport services. They are searching for better ways to get around, with many travellers concerned about the safety of public transport. In terms of protection, budget, and convenience, smart transportation services enable travelers to find the transport solution that best meets their needs.

For example smart transport services can be incorporated into the website of a hotel or online travel agency. As in the latest collaboration with HERE Mobility and Booking.com, HERE Mobility's[8] smart transport technology has been incorporated into the Booking.com platform. By partnership, Booking.com users have more chances to order their journeys from the airport or their hotel at the same time as making travel reservations.

[6] "KTDI." https://ktdi.org/. Accessed 23 Nov. 2020.
[7] "Known Traveller Digital Identity Specifications Guidance ...." 26 Mar. 2020, https://www.weforum.org/whitepapers/known-traveller-digital-identity-specifications-guidance. Accessed 23 Nov. 2020.
[8] "HERE Mobility & Booking.com Partnership: What it Means for ...." 14 Jul. 2020, https://blog.mobility.here.com/here-mobility-bookingcom-partnership-what-it-means-travel-industry. Accessed 23 Nov. 2020.

2.3 Influence of Iot in Toursim

2.3.1 IoT for Industry

The abbreviation 'IoT', is trending and detecting possible disruptions in the tourism and hospitality industries. The industry is a diverse interaction with a variety of stakeholders and ancillaries working together on the experience of tourism. It involves the host government, the local community, attractions, transportation, lodging, food, beverages, etc.Tourist is the absolute owner in finding experiences and justifying his/hers wishlist or a vision of a trip. The Imagescape could be different in different people's minds for the same destination. Destination management firms are working to continue, refine or change the existing destination picture in order to increase the tourist traffic (Verma and Shukla, 2019)[9].

With IoT, Big Data, blockchain technology, the destination will become a closely monitored environment for the activities of tourists, shopping habits, visits to almost any attraction, time spent and monetarily created benefits. The studies will contribute to well-calculated decision-making for tourism destination management and development and will ultimately have an effect on GDP growth.

2.3.2 The emergence of Internet of Things(IoT)

According to statista.com's forecast report,Forecasts suggest that by 2030 around 50 billion of these IoT devices will be in use around the world, creating a massive web of interconnected devices spanning everything from smartphones to kitchen appliances with the prognosis for worldwide spending on IoT by 2023 was 1.1 trillion U.S. dollars, as estimated in 2019.(H. Tankovska, Oct 26, 2020)[10].

In two ways, the IoT is divided according to the use in industry/business or user end, the difference is the devices where it is connected. Production flow control, remote supply chain, construction management, equipment management, condition-based maintenance notifications, security frameworks, healthcare, retail and so on are the key areas covered in the IoT company.

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[9] "(PDF) Analyzing the Influence of IoT in Tourism Industry." 8 Nov. 2020, https://www.researchgate.net/publication/332048599_Analyzing_the_Influence_of_IoT_in_Tourism_Industry. Accessed 1 Jan. 2021.

[10] "• Number of connected devices worldwide 2030 | Statista." 26 Oct. 2020, https://www.statista.com/statistics/802690/worldwide-connected-devices-by-access-technology/. Accessed 8 Dec. 2020.

Home protection, smart homes, personal wellness, wearable technology, personal asset monitoring, remote devices, and wireless devices are the market IoT. The IoT's ultimate advantage is today's ease and analysis for rapid decision-making and ensuring the future of industry and the environment. For instance, energy conservation, solar plants and initiatives, water conservation, pollution and waste reduction, green buildings, management of emissions and recycling.(Verma and Shukla, 2019).

2.3.3 IoT in the Tourism Industry

The tourism industry is made up of several stakeholders and influences every nation's overall GDP. The industry is revitalized from time to time by the new technical advances. The tourism industry involves the service to a museum or train ride from a travel agency and flies along with airplanes and liner cruises. In order to express the effects of IoT in the industry under the following heads, a broad categorization was made. Trains, airlines, airports, hotels, transport, restaurants (kitchen), destinations and attractions for visitors. This segment will briefly examine the recent effect of developments on the industry in particular (Verma and Shukla, 2019).

2.3.4 IoT of Flights

The effect of IoT has revolutionized the aviation industry and more developments are still expected to be made. The next generation of Airbus (A380 Neo) is coming up with 10,000 sensors on its wing.The Panasonic technology supplier to many airlines has started to meet the demands of advanced aircraft management and its device (in-flight contact, four-dimensional weather forecasting, Aircraft Tracking Service, etc.) and is preparing to equip ten thousand airlines in the coming decades with the development of IoT.

Wind River, the worldwide pioneer in embedded software, incorporates the IoT approach through the use of real-time system data for predictive maintenance and flight tracking to minimize the overall operating cost of commercial aviation. Real-time communication and data flow will optimize performance and benefit both parties by reducing landing and take-off times across measured flight paths. The other can also schedule alternatives to avoid the route and save consumption and consumer loyalty by sharing real-time situations such as turbulence ('The Internet of Things in Commercial Aviation,' 2015).

Through applying wearable technology and integrated sensors to instruments and machines, Airbus has resolved the problem of potential failures and their related costs due to the complexity of the process and components in a commercial aircraft. Similarly, in order to seek efficacy in the factories and supply chain, the Boeing has also actively deployed the IoT in development. ("The top 20 cases of industrial IoT use," 2017).

2.3.5 Internet of Hotels

The IoT Technology boom will fuel the future of the hospitality industry, bring a competitive edge to the market and attach devices (sensors, actuators, ID tags, mobile devices, etc.) through the internet (Kansakar et al., 2017). IoT is no longer in ideas and analysis, but much of it is growing in business and statistics because IoT facilitates processes, data and outcomes.

The hospitality industry relies primarily on the highest quality of service and their executions with intangible characteristics. In such a diverse industry, IoT's revolutionary technology has started to affect the pursuit of customer loyalty, cost savings and business benefit. Apart from the customized rooms, the predictive repair and maintenance of the IoT will improve the guest experience as well as the Electronic Key Cards sent by the hotel on your mobile phone to enter the room directly without wasting their precious time at the hotel reception (Martijn, 2018b). The hotel can also charge the guest with the removal of beer cans from the mini bar of the room without having an additional staff to check.

The intrusion detection system should inform the passenger of the status of the door and window and if anything is not as planned, the guest will be advised to take the appropriate action. The protection of the guest and the security of the hotel will be cost effective and will be one of the key factors for the customer's decision. Health records and habits of the guest (condition, medications taking patterns, appointments, etc can be tracked via the sensors and can be reported to the hospital in case of emergency (Diachuk, 2018). The security of any hotel is critical and requires a lot more investment and attention to keep guests secure all the time. Intelligent video IoT can track suspicious activity in surveillance security camera footage and can alert and seize the risk of fraud or intrusion ('ARCULES HT Interview,' 2018).

Marriot's forthcoming smart rooms will be fitted with IoT's ultra-facilities in partnership with Samsung. The mirror will serve as a screen and conduct exercises at the scheduled time, and the room can change its lights and temperature as per the smartphone order. The shower will change the temperature of the water according to the needs of the guests and at the same time, the leakage, the condition of the tank, etc can be reported to the workers for the required actions (McMullen, 2017).The effect of IoT technology has already influenced the industry by introducing smart parking, remote control of the swimming pool, airflow balancing between rooms.

2.3.6 Internet of Kitchen

Restaurants and kitchens of the star hotel, or in any tourist location, would be safe and healthy because IoT technology is not the only reason for its success. While it will also simplify operations, reporting, certification, performance of each facility, energy savings, HVAC ('IoT,' 2016), employee productivity, timely maintenance of equipment and provision of real-time service monitoring data, execution and satisfaction by linking front and back ends. In addition, the effect of IoT is evident in accordance with food safety legislation, automating and standardizing a variety of main restaurant processes and tracking the condition and status of kitchen equipment. ('Cooking Up Value: How to Use the Internet of Things to Boost Commercial Kitchen Efficiency' 2019).

IoT can increase the accuracy of inventories, minimize food waste ('IoT Cooking in Commercial Kitchens,' 2016) and track food quality at all three stages of the food supply chain (from farmer's field to manufacturing plants to supermarkets and stores to consumers) via kitchens. China began introducing it in 2011 and the European Commission has also recently integrated food protection and agriculture through IoT into the pilot project. ('The Internet of Things,' 2016).

2.3.7 Internet of Destination

Tourism has been changing technology for many years and has shown a variety of advances in its operations and processes. Another technological trend of IoT is the transformation of Tourism into Smart Tourism and IoT is the central technology to transform the tourism industry with the aid of cloud computing, mobile communication, blockchain, big data and artificial intelligence to improve tourism experience (Wu, 2017).

Smart cities are cities that use data and technology to make a decision to save time by avoiding illegal activity, pollution and diseases. Growing smart cities and the use of such technologies are a strong reason to seek **70% of sustainable development goals.** Smart cities are a feasible method of promoting the needs of society in an effective and sustainable way. Technology optimizes infrastructure and serves a more linked, reliable and sustainable city. According to McKinsey's study, the capital and infrastructure of a smart city can be saved from 10 to 30 per cent on the basis of a key quality-of-life metric ("SMART CITIES: DIGITAL SOLUTIONS FOR A MORE LIVABLE FUTURE," 2018).

The tourism will be exponentially growing with the age of smart city not just by witnessing the smart city infrastructure, however, the substantially reduced disease burden and crime rates in the reports will ultimately enhance the image of a destination and the emergency response will build a long lasting trust among the tourist. In addition, environmental objectives can be accomplished by effective water savings, saving time and saving life, which will lead to a longer use of energy and additional time to concentrate on leisure and pleasure.

2.3.8 Internet of Tourist Attractions: A case of Museums

An attraction is a place of interest for which tourists travel and enjoy leisure activities, be they museums, theme parks or monuments of historical, cultural or religious importance. Almost all areas of tourism are moving forward with the IoT, hence attractions as well. The 24th edition of Museums of the World Book, which included more than 55,000 museums in 202 countries and the Institute of Museums and Library Services, cited 35,144 museums in the United States alone ("Government Doubles Official Estimate," 2014). The IoT can allow asset monitoring within the museum and visitors' feedback can be created through data analysis and sensors such as facial recognition, etc. It will improve user experience through the abduction of heavy hearing aids and computer fidgeting by allowing a museum with user-friendly smart apps to assist the tourist. At the same time, the battery-driven displays and other properties can be renewed or upgraded through the sensor-enabled IoT technology(Hornecker and Bartie, 2006).

The museums will improve the visitor's experience by providing appropriate, up-to-date, informative or reliable information on the specific segment and showing the choices made by the visitor and making a profit by saving operational costs by active analysis and using

the data accordingly. The same would be the case for all other attractions and theme parks that might be closer to the user's insight into the attraction and collect a lot of data to understand and provide the desired products. Travel companies, Destination management companies or outbound agencies may remain linked to travellers, guests and tourists at all times and may provide them with the appropriate and most important information and advertising on the basis of where they are located. The location-specific information generated with the aid of smartphones, IoT, sensors and beacon technology can easily provide an enormous amount of accurate data to be analyzed by companies (Martijn, 2018a). The IoT sensors will record the conditions of the monuments and also inform the changes, thus monitoring health of the existing monument.

2.3.9 Key takeaways from this chapter :Emerging Trends and Impacts

The influence of IoT in tourism is mostly applied in the transportation sector and in closed settings of the industry, only a few tourist populations across the globe have encountered this technology, it still needs to be delivered to the masses.

The emerging technologies are more tourist centric and business oriented without considering the overall understanding of sustainable development. The idea of exchanging local cultural value through IoT is missing and it only addresses the ease of practicing the IoT technology in the domain of tourism. The thesis will draw more attention to the local residents and formulate a technological social equity which is currently missing from the IoT in tourism framework.

IoT for Tomorrow's Tourist : These Applications are directly linked with the tourist / visitors/ travellers point of view in the tourism industry. Listed are some direct ways the IoT needs to shape the way a tourist would be traveling.

1. Fuel consumption
2. Passenger ID / Tourist ID
3. Asset Monitoring
4. Predictive Maintenance
5. Connected vehicles
6. Connected rooms
7. Location Based Travel Tips / trips
8. Hyper personalization
9. Wearables to streamline operations
10. Baggage and luggage handling and tracking

Since there are many areas to focus from a tourist's point of view it is necessary to map the problems to understand the challenges faced due to over-tourism by the other important stakeholders, like the the local communities and Local businesses in the host destination.
The problem space is mapped check ***appendix 3.***

Chapter 03 : The Problems Space & Objectives

There is a need to overhaul the current system and management in the tourism sector. The tourism economy has been heavily hit by the coronavirus (COVID-19) pandemic, and measures introduced to contain its spread. Depending on the duration of the crisis, revised scenarios indicate that the potential shock could range between a 60-80% decline in the international tourism economy in 2020. Beyond immediate measures to support the tourism sector, countries are also shifting to develop recovery measures. These include considerations on lifting travel restrictions, restoring traveller confidence and rethinking the tourism sector for the future. The list of Problems and issues in travel and Tourism industries as follows:

3.1 The problem space

Overtourism

Cities are originally built to accommodate non-agriculture human activities along with their dwellings and other basic needs for normal times while city residents usually travel to remote places, suburban or any open view spots for meditation or other ritual purposes to heal up from crowdedness and busyness of the city, it evolved by time to reach what we see today in cities where the city itself is an attraction to other city residents due to globalization and mass media influence.

Throughout history, travel always has a meaningful purpose, but these purposes has decreased by time to reach a show point or just to check-in as much geo locations as possible which results in some improper effects such as over-tourism due to propaganda about a place or user generated experience and it is highly affected by users not by significant artistic value or economic benefits.

Over-tourism is a recent term is been used simultaneously with internet user growth, since 2015 it became a serious crises for some places around the world such as Venice and

Heritage sites in Croatia where high number of tourists became a huge risk to the local businesses and original city character or the original reason for tourism and can be very bad for tourism itself because it deliver bad experience to tourists.
(Figure 3.1) shows the use of 2 terms from 2004-2020 and how the over-tourism topic has increased simultaneously with the rise of using accommodation sharing apps. (Google Trends)

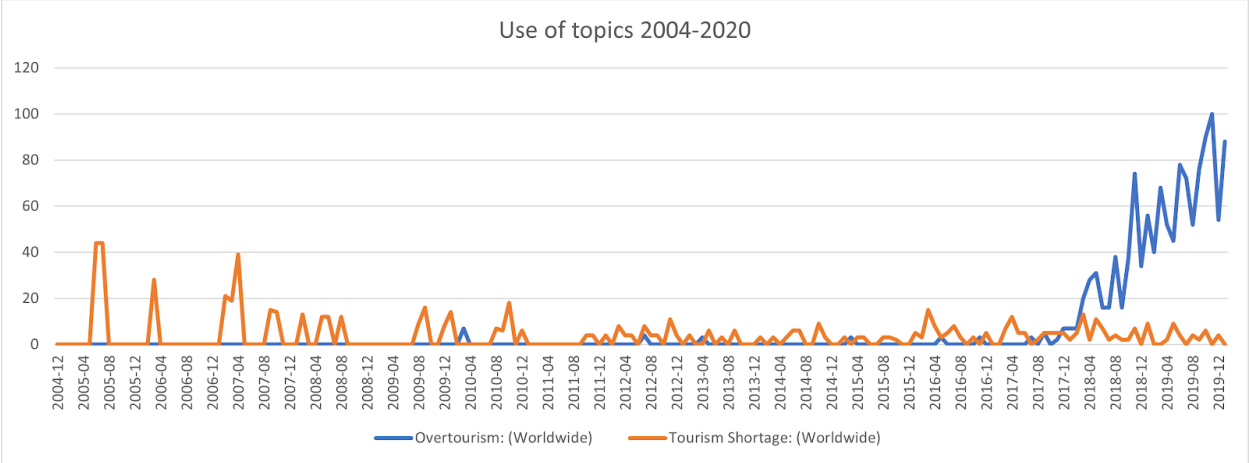


Figure 3.1 Over tourism (source :Google Trends)

The main problems of over tourism is **losing the authenticity** of the place, the place has 2 main elements that makes it authentic which are people and space and stuff too much people in a space preventing people from maintaining a space and will enforce them to escape the situation, and this is what is happening in Venice and Kyoto and other major touristic destinations where locals are endangered as a side effect of growing number of rental properties in the city centre which became catastrophic to local residents economically.

Another main issue is the local market which is no more local, it became a destination for foreigners so the products changed accordingly which is another absence of basic resident needs for daily products.

An example for this situation is Venice where number of tourists are way more than original Venetians; according to Forbes 2019 named Venice among "most notably over-touristed destinations" list, and by interviewing residents they suffered from absence of daily products and services that used to serve their typical activities, most of the shops are converted to

touristic shops or souvenir's shops etc which can be described as (Tourist needs prioritised over local needs). (Ronald W. Glensor & Kenneth J. Peak, 2004)

Image 3.1

Inflation is another serious impact to over touristic sites, the vast amount of visitors means more spendings and at the same time means more core changes to the original activities of a certain place, all these factors lead to unproportional increase in rents and prices for services for the same place compared which causes migration of inhabitants and losing the site's significance.

Inflation can cause significant demographic changes and serious urban issues such as gentrification where adjacent neighborhoods are subjected to renovations to host migrants from touristic spots, and that lead to further urban expansion at best.

Also it is important to mention the effect of crowdedness on **urban security and quality of life** for the inhabitants, more touristic places are more subjected to wide range of improper behavior whether from tourists or locals such as abnormal signs of maintaining quietness or full-time security guards to keep the visitors disciplined like in seoul- korea, or other authentic places which is considered an attraction for its quietness or cultural reasons; important to mention bad behavior along with thrown packages everywhere and sometime fast filled trash pins which requires continuous maintenance cycles and what it causes is also a negative impact on touristic sites. (Ronald W. Glensor & Kenneth J. Peak, 2004)

Also a vast increasing numbers of crimes per square meter are more expected to have in touristic areas over more controlled spots in adjacent areas, usually more robbery or violence against tourists..

An important problem related to over touristic locations is basically the **bad experience** and losing trust to travel advising providers which results to inconsistency to number of visitors, most of the advising providers use inaccurate data about the timing and the best strategies to visit certain site it is more influenced by word of mouth rather than accurate data provided to users on real time basis; years ago the city map and agency's touring plans were the best way to get the most of target destination however, it is still limited and majority of tourists are individuals.

Figure 3.2

Until today, touring is highly dependent on traveler decision and the absence of interactive alternative providers based on real time data might be the solution for the unjustified long queues in many places while other adjacent important places have no queues or maybe visitors, due to short timing and waiting times.

Overtourism is the result of growing tourist numbers in a given area. It refers simply to the notion that there are too many visitors in a particular area. How many is too many, isn't always easy to determine, but there are some telltale signs that a destination is suffering at the hands of overtourism.

The impacts by tourism resulting in tourism fatigue

- **Destruction** of nature and habitat loss.
- Pressure on the **resources** of the area.
- Loss of the **cultural identity** of the place and **community**. Cultural Erosion.
- Growth of **aggression** and crime rates.
- The **exploitation** of animals to entertain the tourists.
- **Congested** human and vehicle **traffic**.
- **Increased prices** on goods and services.

- Over **Dependence** on tourism.
- Increased **pollution** (plastic, noise, light, sewage).
- **Destruction** of historical monuments and natural landmarks.

With respect to key Issues, a data driven system enables tourism industry with a stimulus during the toughest times and provides a sustainable real time solution to problems like travel restrictions, unemployment, food and resource wastage and more importantly the minimising the economical loss subjected due to aforementioned unforeseen scenarios or natural disasters. The research highlights methods and practices which can be inculcated towards recovery design by using IoT applications technology and data.

Core Aims are derived from the aforementioned problems and issues in the travel and tourism industry.

1. Maintaining a destination's sustainable tourism Industry: social, cultural, natural and built resources.
2. Concerns for safety and security remain an important issue for the travel and tourism industry.
3. Responding to increased interest in the long-term impacts on tourism of climate change and global warming.
4. Impact on the travel and tourism industry resulting from a global economic-political perspective.
5. Necessity for increased **local**/regional/national leadership in tourism policy and strategic planning.
6. Resolving barriers to travel: visas, passports, airline services, fees, and delays.
7. **Educating users** about optimizing the application of new technologies in the tourism industry.
8. Understanding the transformative effect that tourism has on the geopolitics of socio-economic progress.
9. Effect on travel and tourism from natural/human-induced disasters, health issues, and political disruptions.
10. Seeking a quality experience and positive balance for both **local residents** and **tourists** at a destination.

From the aforementioned core issues in the tourism industry listed the selected problem

statement for this paper would be the *Unbalanced flow of tourists and its effects on Local Communities.*

3.2 The objective:

01. The main aim of this paper is to understand the adaption of the current tourism market and its problems caused to the local communities. It strives to avoid over-tourism to satisfy the locals and visitors. On that account, the thesis advocates a smart grid that enhances the tourism ecosystem through the medium of IoT beacons and sensors which will be strategically scattered around the city.

02. To highlight from the 17 Sustainable Development Goals (SDGs)[11] and indicators & to strategically align the outcomes in achieving the target points from the following selected indicators. No 8, 11, 12, 17 and they are listed respectively ..

    - *Decent work & Economic Growth. (8)*
    - *Sustainable cities & communities. (11)*
    - *Responsible consumption and production. (12)*
    - *Partnerships for the goals. (17)*

03. Due to the coronavirus pandemic, the tourism industry will have a long lasting effect on the economy and will enter into recession due to failure of existing tourism infrastructure. And thus the final objective will be to formulate a smart grid for the tourism industry stakeholders and develop sustainable processes which helps to circulate and distribute the resources to empower local communities and local business for a specific country. In this paper the case highlighted is for the Baltic region.

Note : Smart Grid consists of the following 5 Game - changing technological parameters for the tourism industry in the thesis.

- A.I
- IoT
- Blockchain
- Cloud
- Big Data

The amalgamation of the following technological paradigms is ideated into the digital transformation of a city's grid is the hypothesis of this design dissertation. Deploying and

[11] "THE 17 GOALS - Sustainable Development ...." https://sdgs.un.org/goals. Accessed 5 Jan. 2021.

planning the new self reliant digital smart grid and more resilient tourism system which is proactive in adapting to unforeseen scenarios in the travel- trade - tourism ecosystem with the help of IoT based tourism.

Chapter 04 :Methodology

This chapter maps the research done from stakeholders in the tourism industry.
It makes use of direct and in-direct affiliations in contexts to the tourism industry and its ecosystem. This is done to find a set of goals from each stakeholder and understanding the tourism product and narrowing down the three core personas which would be mapped in the customers decision journey.

4.1 Work System Method - Mapping stakeholders

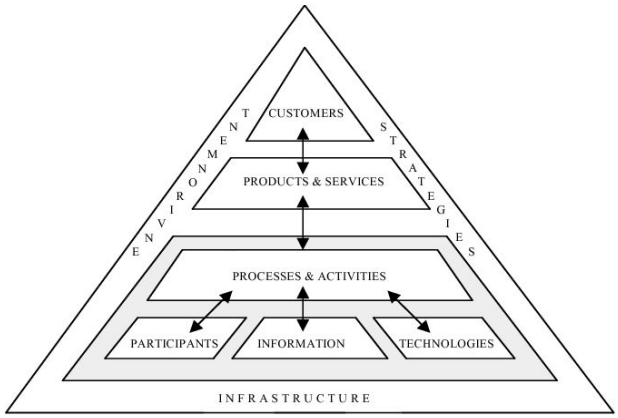


Figure 4.0 : Work System Method (Source :Alter, 2006)

The following research provides the basic information about the system of tourism and the tourism industry, the aim is now to handle this data and analyze the system.This study was processed following the work system method (WSM). It is a method commonly used to define, analyse and improve a work system. It provides an efficient guideline in the form of questions and models to define a work system's issues and their solutions. It is directly linked with the work system framework(Figure) which shows the elements of a work system and how they must be balanced. It is used as an outline for answering the elements of the WSM [Alter, 2006]. This method is applied to understand the system and process of the travel industry and its stakeholders in the value chain.

4.2 System of Tourism and Travel Industry

4.2.1 Components of Tourism

1. **Tourism Boards** : Responsible for the promotion of tourism in a particular area. This could be a city, a region, a country or a group of countries.

E.g Visit Britain, Incredible India, Visit Estonia.

2. **Transport Services** : Service offering transport between A to B points of destinations.
   E.g . Air, Rail, Road, Sea.
3. **Accommodation Services** : Services offering a place for the tourist to stay.
   E.g Hotel chains, hostels, Holiday parks. Campsites, homestays, accomodation innovations.
4. **Conferences and Events** : Business and leisure events varying size. E.g WTM, ITB, Football world cup, Formula 1, Holi Festival, Tomorrow land etc.
5. **Attractions** : Important sights with historical or cultural heritage visited by the tourists. Can be natural or built
   E.g The Great Pyramid of Giza, Dead Sea, Niagara Falls
6. **Tourism Services** : All other services offered within the tourism industry. Eating establishments, outlets for handicraft and souvenir, tourist information offices kiosks, medical assistance and facilities etc.

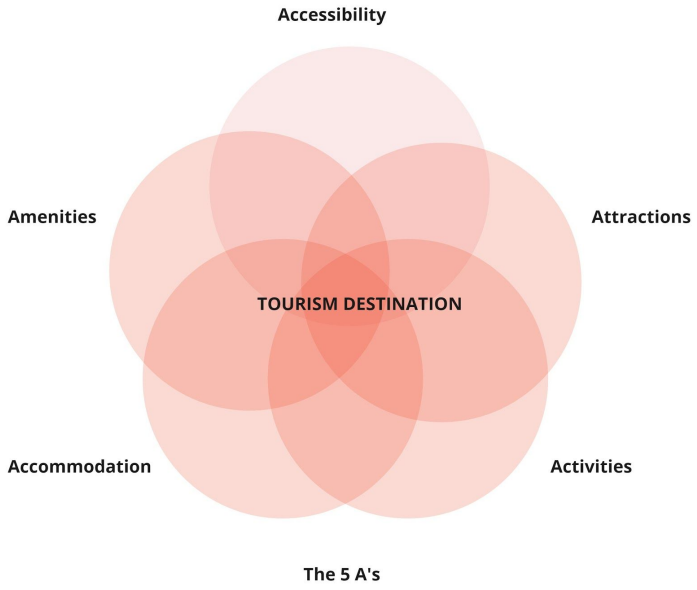


Figure 4.1 Components of Tourism (Source : Author)

4.2.2 Tourism Products

A tourism product, as described by the UNWTO, is "a combination of tangible and intangible elements such as natural , cultural and man-made resources, attractions, facilities , services

and activities around a particular center of interest that represents the core of the marketing mix for the destination and generates an overall visitor experience for potential customers, including emotional aspects."

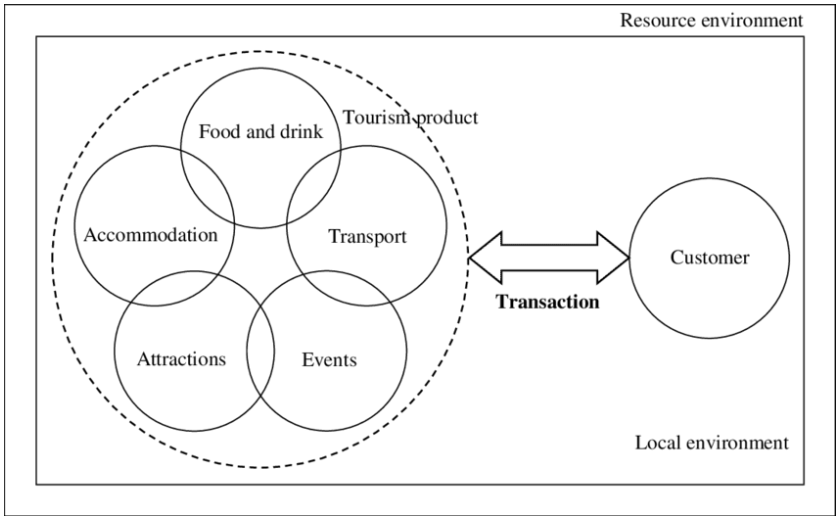


Figure 4.2 Tourism Product (Source: Cooper, Scott & Kester, 2006,)

The transactions made by the tourist during the trip from the determinants of destination attractiveness which are (Ritchie & Crouch, 1993, pp. 53–56):

- natural features (e.g. general topography, scenery)
- access and transportation facilities (e.g. distance and time to get there, frequency, ease, and quality of transportation)
- climate (e.g. temperature, amount of sunshine, rain)
- culture and social characteristics (e.g. traditions, style of architecture, local foods)
- general infrastructure (e.g. roads, water, sewage, electricity)
- basic services infrastructure (e.g. shopping, car maintenance)
- tourism superstructure (e.g. lodging, information);
- attitudes about tourists (e.g. warmth of the welcome, ease of communication);
- cost/price levels (e.g. value for money, exchange rates);
- economic and social ties (e.g. international trade, common culture, language, religion)
- uniqueness (e.g. one-of-a-kind attractions or events

4.2.3 Characteristics of Tourism Product

1. **Intangible** - There is no transfer of ownership.

2. **Psychological** - Involves the acquisition of experiences and events.

3. **Perishable** - Only exists when the customer is present.

4. **Composite Product** - Cannot be provided by a single enterprise.

5. **Unstable demand** - Demand is affected by external influences.

6. **Fixed supply** - Cannot be brought to the consumer.

7. **Absence of ownership** - Ownership remains with the provider.

8. **Heterogeneous** - Tourism varies in standard and quality over time.

9. **Risky** -Purchase is before consumption.

10. **Marketable** - Requires destination marketing and service marketing.

4.3 Key Stakeholders in Tourism

The stakeholders in the Travel and Tourism Industry could be defined as anyone who is involved with a particular project, organization or tourism based Industry.

1. **Tourist** : Backpackers, Families, Luxury, Business, Adventure, Gap - Year, Students
   A visitor (domestic, inbound or outbound) is classified as a tourist (or overnight visitor) if his/her trip includes an overnight stay, or as a same-day visitor (or excursionist) otherwise. (IRTS 2008, 2.13)

2. **Suppliers** : Farmers, Factories, Manufacturers.

3. **Employees**: Waiters, Taxi drivers, Holiday representatives, Call center operatives, CEOs.

4. **Education**: Students, employees undertaking training and development.

5. **Utilities and Infrastructure**: Power Plants, Utility companies, road maintenance.
6. **NGOs**: The Tourism Society, The Travel Foundation.
7. **Small and Medium Enterprises**: Retail, Restaurant, Hotels.
8. **Transport**: Airlines, Taxi Companies, Cruises, Trains, Bus Companies.
9. **Tourism Organizations and Operators**: Travel agents, DMOs, Travel bloggers.
10. **Government**: Local, regional and International Governments.
11. **Communities**: Host Community, tourist community and International community.

4.3 The work system snapshot (WSM)

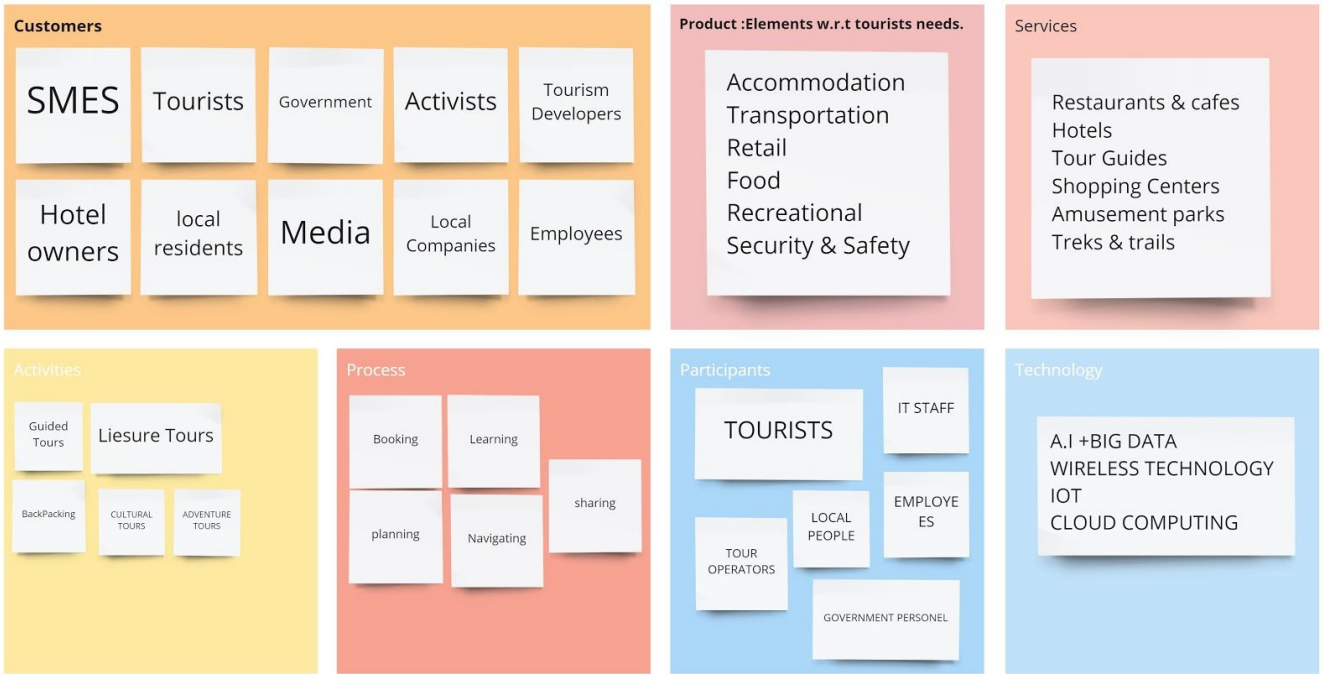


Figure 4.3 : work system snapshot

To get a holistic overview of the Tourism system the work system snapshot was applied as part of the first step of the WSM. It is presented in Figure .

This comprehensive but simplified perspective provides a clear, short and easy to understand outline. The six system elements recap all system users, the produced goods, how the production is done, all required and established data and the technologies used.

When comparing the system's customers and participants, it can be seen that Tourists and local residents are considered as both customers and participants because even though they benefit from the system.

4.4 The categories of stakeholders.

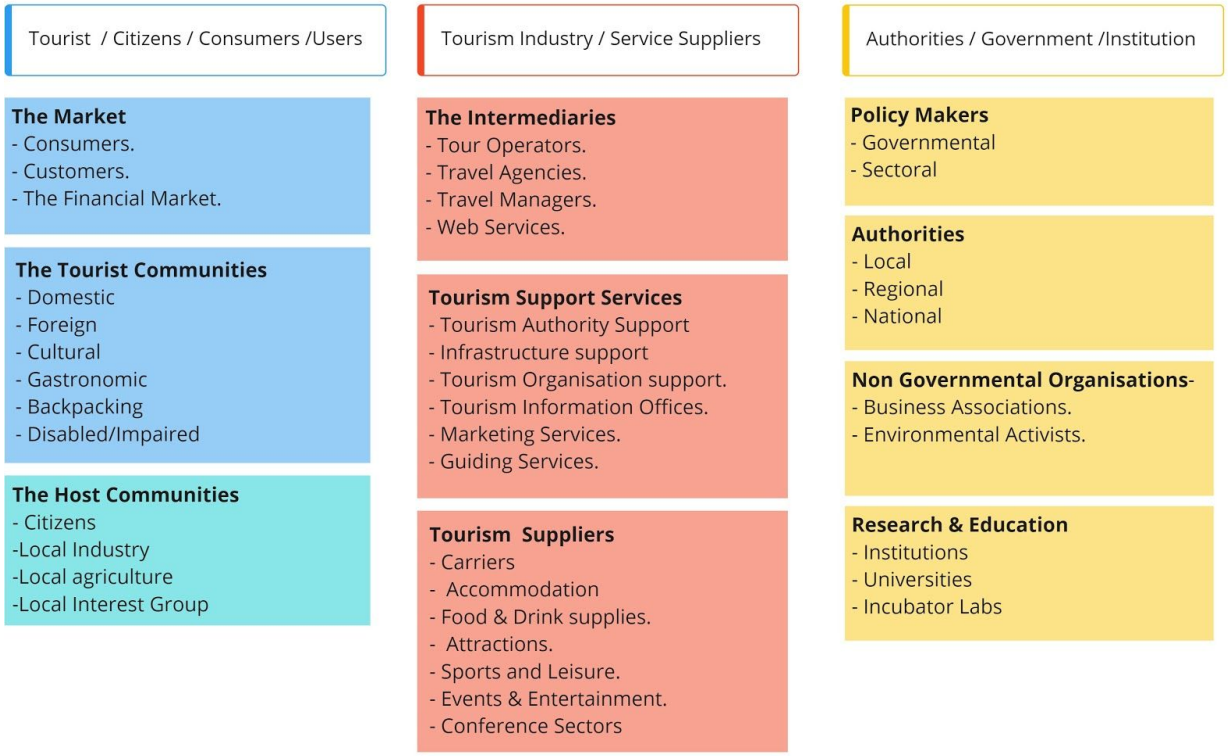


Figure 4.4 : Categories of stakeholders (Source: author)

In order to have a greater understanding of an extensive list of stakeholders in the tourism industry , they are categorized based on their hierarchy of authority and their business value. The smallest investment will be from the tourist, visitor, traveller and the largest from the government for providing and developing infrastructure.

The host community plays a dual role since they consist of local / domestic travelers as well as an intermediary to tourism service providers. They can provide service to the tourists taking supplies from the tourism suppliers.

This becomes an Important touchpoint for the local communities to develop business. It also shows that they need the help of the tourism industry providers to make profits. The local industry is heavily dependent on the international tourists market and its consumers are mostly visitors from distance.

4.5 The Goals of the stakeholders

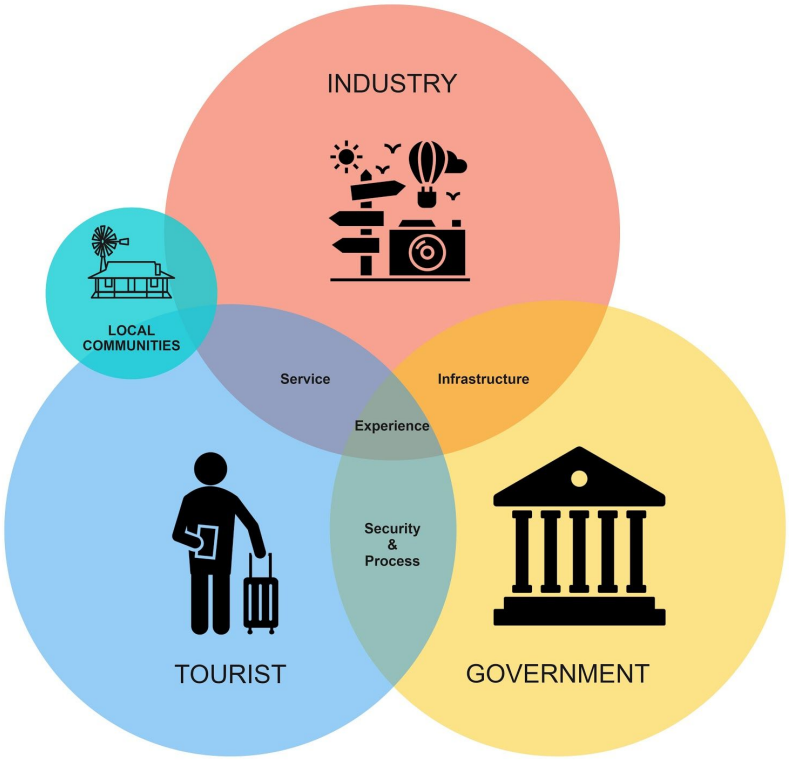


Figure 4.5 : The key 4 stakeholders in Tourism Industry (Source: author)

Goals of Stakeholders ***(Appendix 1)(Appendix 2)*** was mapped from the Customer journeys of each stakeholder. The map shows the stages of the journey and its mircroments, such as waiting time, spot payment and exploration.

The touch points created between the individual traveller and industry are at payment points and social media. From the experience generation to the user feedback most of the touch points are done via online. Since the users read the reviews, scroll through photos posted online and then book their journey. ***(Appendix 3)***

The industry makes both the platform available website and the smart phone application to its end users to receive feedback and monitor results from their customers. On the other hand the government and the tourists have no contact points except for immigrations checks. The government is highly dependent on the survey conducted by the industry about the tourist behavior. Also it is to be noted that the government can only have the statistics of a travellers visited after they have finished their whole journey.The real time data is at the moment is only available to few cities which helps the tour destination managers and not the local communities or local entrepreneurs.

4.6 Tourism Value chain - Production System

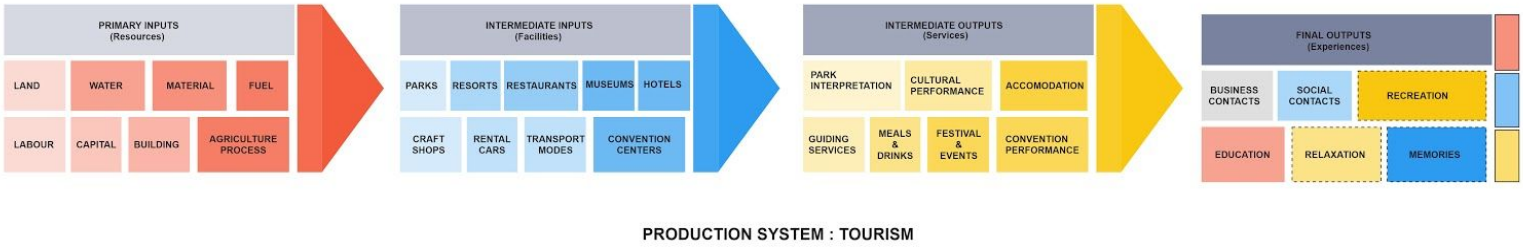


Figure 4.6 : Production System (Source: author)

The primary inputs are the resources offered by the local government to its citizens (local residents) like land, labour, building, fuel, material to develop facilities for the tourists and local travelers. Intermediate inputs are further to be expanded to facilitate services as an intermediate output products to travellers such as cultural performance, accommodation spaces, leisure activities which reflects the various experiences as the final output as tourist products. The touch points for local communities are with the tour operators as it does not have the power to use large scale infrastructure or technologies.

Upgrading trajectories in ever-growing Tourism global value chain is due to following reasons :

- Residents or individuals in another industry shift to tourism.
- Local businesses Firms or individuals in another industry shift to tourism.
- Locals that catered to domestic tourism add international tourism.

- Countries become a destination for incoming tourists.

The current value chain shares a very weak nexus between local hosts and local businesses, also the local communities have a high risk factor to develop and serve the tourists. Since tourism is considered as an important avocation the locals compete with themselves creating an unhealthy environment. Also, with the unpredictability nature of this industry it creates stress points on the host destination in the current ecosystem.

Before Ideating and conceptualizing the technological paradigms it is important to understand the theoretical frameworks of the tourists and tourist types, where we study its emotional quotient, behaviours and materialistic collectivity during the journey.

Chapter 05 :Theoretical Framework

In this framework the research is done to understand the end users, the most important stakeholder in the tourism ecosystem, the ***tourists*** and their behaviours, their types, actions taken by them also cognitive understanding on how they conduct emotionally in the journey. Tourist behaviour directly matters to the tourist / public sector managers / and groups of business interests in the tourism industry. It learns about the interests of Tourists, particularly their personal satisfaction and growth during the journey. For public sector managers it generates community benefits and occasionally manages impacts to the media for high profile incidents or events which evasively leads into political interests. Lastly Tourist Behaviour matters to various business interests particularly for marketing sales, management and profitability.

5.1 Collective Memory vs Individual Memory

As the tourists plan their trips and events beforehand, they already envision some amount of foresight or their dreams how the trip would flow, there is a great deal of infatuation with respect to destination which is created during the process of booking and planning a tour and the way each individual thinks, their perceptions are very subjected.

This is the start of generating memories and it continues throughout the journey till the tourist has reached its destination. Understanding about what the thoughts or dreams of the tourists will ultimately result in his/hers memory and that it becomes the important seed which could yield outcomes for the tourism industry. Individual memory[12] is irreproducible and very personal. It can have accountability with physical evidence such as letters, texts, images etc. The memories created can be mixed and adulterated with misinformation and random gossip to fulfil one's ego. Individual memories during a travel journey can fade away due to the conditions at the trip. On the other hand the 'collective memory' splits in social, political and cultural memory (Tilmans, van Vree, Winter and Assmann, 2010). In this thesis we only focus on social and cultural memory of the users since the tourists have the power to control both but cant have a political stance. They work as an authentic memoria since it is validated by one to many people since that memory is shared.

Tourists / travellers & visitors often to please their own ego would indulge in materialistic possessions. These are often linked to the culture of the place visited and the value is high if it's very regional and rare. It creates value in the host destinations by the degree of beauty offered and experience absorbed by the visitor.
Some type of Cultural Probes - Tourist Journey Possessions are listed below.

- Maps
- Postcards / Letters / Stamps
- Currency
- Books
- Souvenirs
- Travel diaries
- Pictures
- Clothes
- Tickets

Nowadays these have been the victims of cultural erosion, since photo mimicry and mass production has sabotaged the core values of authenticity from the local communities. This makes the authentic materials to have a higher price and makes the fake materials circulate around the globe.

[12] "Memory, Individual and Collective - Oxford Handbooks." https://www.oxfordhandbooks.com/view/10.1093/oxfordhb/9780199270439.001.0001/oxfordhb-9780199270439-e-011. Accessed 4 Jan. 2021.

In the later chapter no 7 the concept helps to formulate a cultural authenticity over cultural drama with the help of blockchain technology. New means of producing authentic local experience with appropriate opportunity to possess an authentic cultural probes.

5.2 The Types Of Tourist

The Scheme of Tourist, Routes, Behaviour, Models & Traveling trends. The following models are studied from the book "Tourism Theory" (Palhares, Panosso Netto and Palhares, 2017) which is a collection of all fundamental theories which elaborates more into tourism concepts and systems. Out of many models the following are selected to map out tourist behaviour and their associated touchpoints linked to local hosts and communities. This is further considered in the ideation of a new concept for the proposed solution.

5.3 Bell and Ward Model : Temporary Mobility.

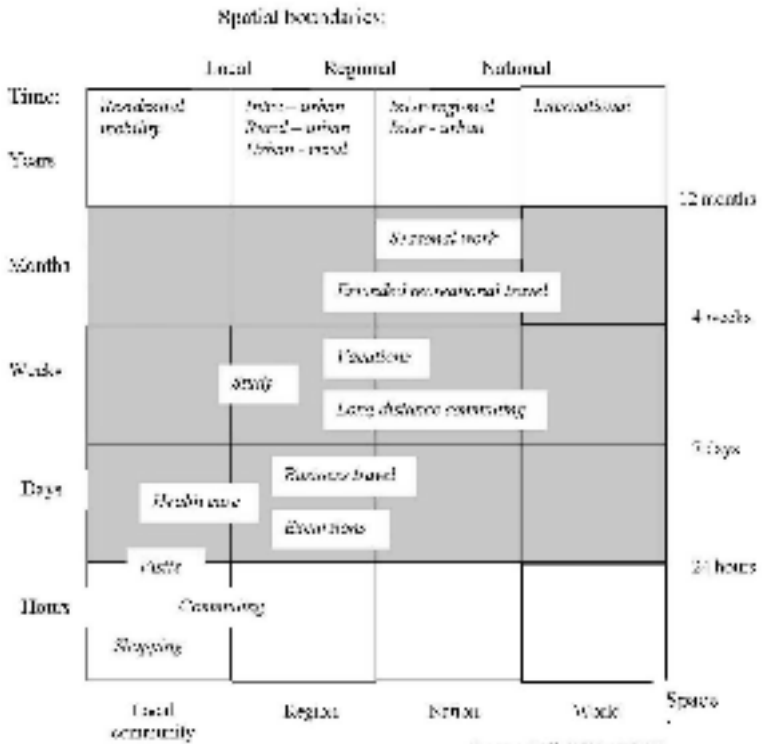


Figure 5.1 source Bell & Ward(2000)

The above figure allows a much further discussion of time and space dimensions, both in tourism and other types of travel. From the above model the types of tourists can be mapped with respect to their duration of stay and their mobility within the spatial

boundaries. This would help in creating population heat maps with respect to time and space of a region. From the above model one can chart out the length of stay (LOS) of tourists and forecast the event impact. Which can help the local organizers from an economic, social and environmental point of view. This model is later considered as a plotting tool in smart grid proposals for sustainable tourism.

5.4 Plog's Psychographic model - Tourist Behaviour

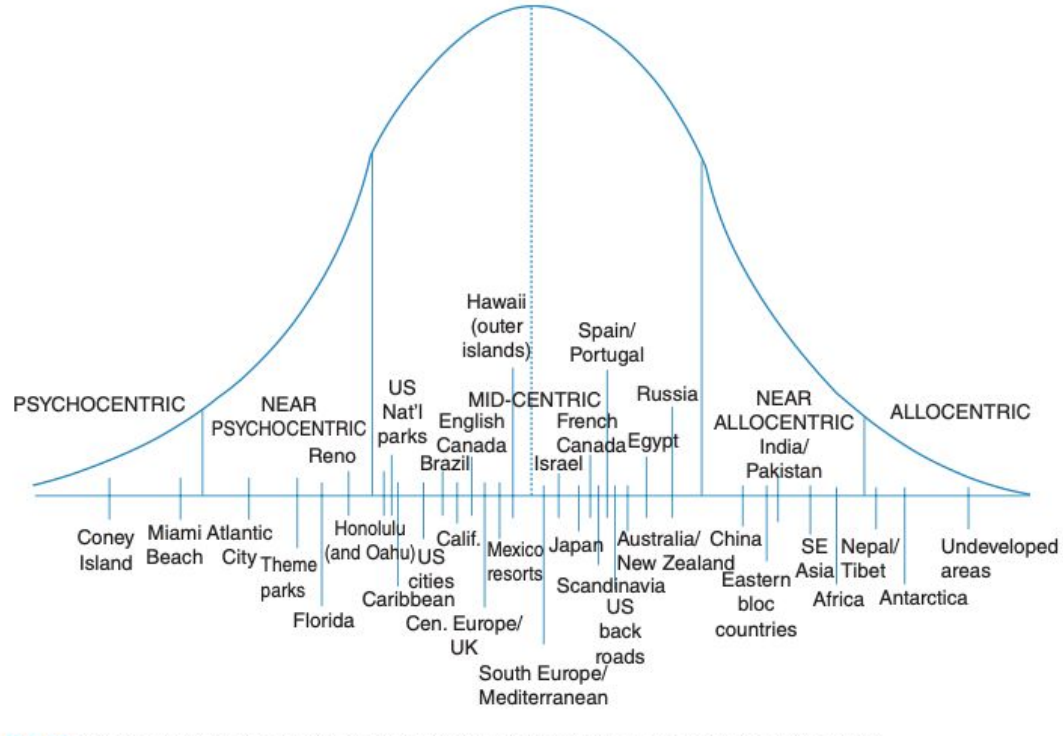


Figure 5.2 Positions of selected psychographic targets (from Plog,1991b)

Type of Behaviours :

Allocentric travellers are those who want to explore new destinations and experience many cultures in a spirit of adventure and tourism. Ruschmann (1997) commented that the term 'allocentric' comes from allo, meaning 'in various ways,' explaining that they are visitors whose interests are focused on a variety of activities. Allocentric visitors have an engaging, inquisitive attitude, and they are optimistic. Many people do not want to be called visitors because in a way, they are trying to blend with local culture and people.

Nearly allocentric: seeking challenges; many opt for ecotourism.

Mid-centric: looking to unwind and relax when travelling, especially through entertainment.

Nearly psychocentric: those tourists who experience a new destination only after it has become popular.

Psychocentric: mass tourists seeking safety, travelling accompanied by tour guides. The name derives from psyche or self, and this type of tourist is characterized by a personality that is more inhibited and opposed to adventures (Ruschmann, 1997). Psychocentrics prefer a familiar environment ('westernized'), in which they can maintain their lifestyle even when travelling. They are tourists seeking popular resorts.

5.5 Butler's Model (Tourism Destination life cycle)

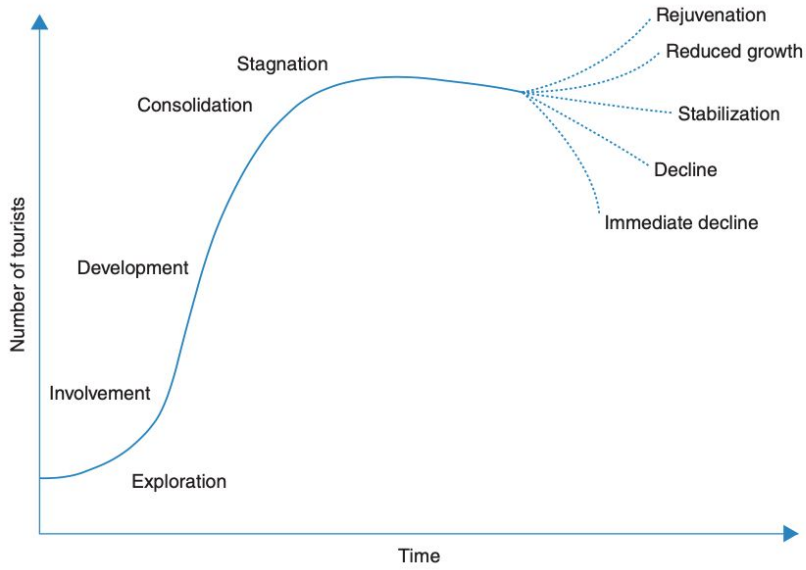


Figure 5.3 Butler's Model (source :Butler)

Butler shared a model that, despite the criticism of recent decades, best represents the life-cycle of a tourist destination, in particular a tourist hotspot or tourist traffic. Using a term from outside the tourism industry, Butler adapted the sales curve and the product life cycle to tourism. According to this model, tourist destinations, and in particular tourist towns, have at least five stages of growth. Simply put, a destination transitions from the initial stage of discovery (exploration) to a time of great tourist interest (stagnation), with the subsequent rise in tourist infrastructure to receive mass tourism, with all the social consequences that this could have (Douglas, 1997).

The model traces changes in visitor rates and the growth of a tour-oriented infrastructure (e.g. accommodation and tourist attractions). Theoretically, these phases of development are defined on the basis of the number of tourists visiting the tourist destination, the

typology of these tourists ('Plog's psychographic model') and the growth rate of the demand for tourism.

After these five stages, the destination may pass through other stages that will vary according to the response of the tourism destination's planners and administrators. Various scenarios are possible, including continuing stagnation, decline or rejuvenation. According to Butler (2009), the model can be useful for explaining the spatial distribution of tourism growth on the ground that when a tourist destination hits its development limit, factors such as lack of space, high land costs and the need for new developments can be addressed by promoting the development of new attractions that have similar characteristics to the original attraction.

5.6 Campbells's model of Recreation and vacation travel

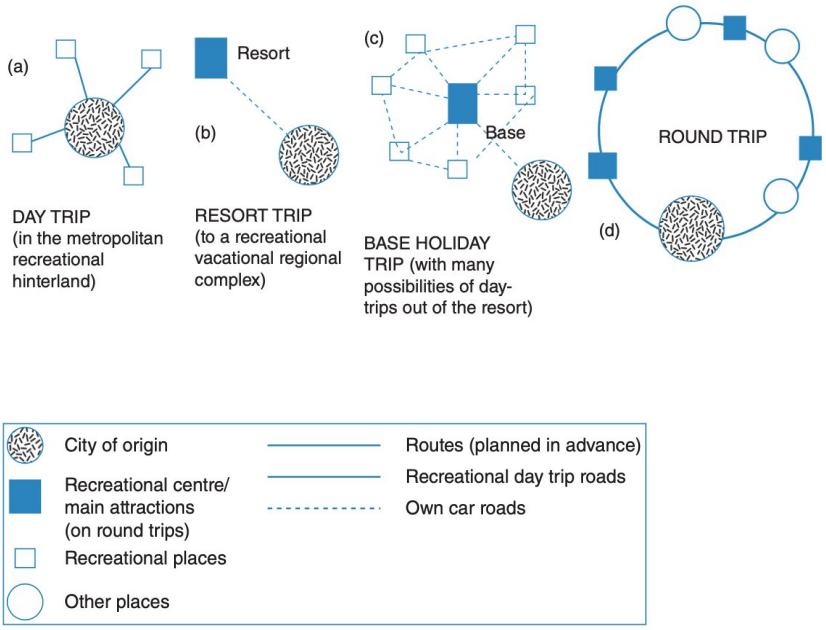


Figure 5.4 source : Campbell's (1967)

Campbell's (1967) method basically addresses tourism leisure travel. Campbell identified three separate groups of travelers leaving the city center, classifying them according to their travel motivation.

The first is the recreationist who travels radially from the city; the primary motive of the traveler is the urge to engage in recreation activities.

An example of this traveler is a city resident who travels to nearby destinations on the weekend to find recreation areas, such as a lake for a boat trip or a picnic in a national park.

The second is an intermediate category, called a recreational vacationer. This form of traveler goes to a recreation center (a holiday resort) from which they take numerous recreation trips to the surrounding area. Vacationism, in this context, does not apply to a traveler who does not spend the night at the place visited, but rather to a traveler who visits a variety of places along the way, instead of being restricted to a single destination.

The third is a vacationer whose travel habits have a linear or highway orientation. Travel or tour is the primary activity which includes a variety of stops on a circular journey.

5.7 Key takeaways from this chapter

Each model has shared that tourist behaviour is repetitive, predictable if their interests are known and also provides the value of tourists for its actions made during the journey. These models can be applied in the product development stage where the system learns to predict these behaviour and movement patterns by Artifical intelligence or machine learning protocols. This data produced would be an asset to the end users (local communities and local entrepreneurs) as they would be able to predict and control movement patterns to their interest and profitability. In exchange for authentic tourist experience, which the tourist would be ever ready to imbibe that. The next chapter focuses on state- of -the-art technological uses of IoT technology along with best practices of smart city strategies.

Chapter 06 : Applications & Technology studies.

In this chapter we study the best practices of how IoT works and how it has built an innovative platform in showcasing the ease of Installation, a prime working example in trade and logistics, new radical engineering & infrastructure projects. These examples map out how IoT is used in different scenarios and are selected samples of state-of-art technology for different challenges.This would further help in ideating IoT in tourism and creating a solution for the issues shared in this paper.

Ease of Installation and procurement.

In the last 4 years from IoT based companies are constantly innovating and making it more accessible to users to adopt IoT based smart appliances, the market for owning such products is very limited as the available tech is very expensive and the utility is very limited. Disruptive Technologies is the developer of the world's smallest commercial-grade wireless sensors and a rapidly growing innovator in the IoT market. The Internet-of-Things promised a self-sufficient world of interconnectedness, but the technology was expensive, cumbersome and limited. It also came with a range of new privacy and security concerns, hindering adoption. Also they have developed a robust solution which allows for the optimization of all operations with the help of tiny wireless sensors which can be installed easily to the required application[13].

The solution to sensing data was made easy by their installation of sensing solutions based on tiny sensors that simplifies data collection and delivers the data securely to our own dashboard (DT Studio) towards their own analytics programs in the cloud. The technology enables sensor solutions for smart buildings, facilities management, workplace, manufacturing & warehousing, cold storage and substations. Finally it is safe, cost efficient and sustainable operations allow people to truly unload the ordinary for more rewarding pursuits. From predictive maintenance to energy efficiency and sustainability, and endorses to connect people and information to deliver real time connected changes in the environment in one platform.

Figure 5.5

Real world use case from using DT sensors, where a Global Restaurant Chain Immediately Saved £1.25M with Sensor Technology[14]. Due to the COVID-19 lock-down, a global restaurant chain in the UK (ca. 100 locations) was facing a cold monitoring problem. Within three days, the Infogrid cold storage solution powered by Disruptive Technologies was implemented in all locations. As a result, more than £1.25 million in food inventory was saved. Compared to the initial investment, that amounts to cost savings of 4,462.04%.

[13] "Disruptive Technologies - Tiny wireless IoT sensors." https://www.disruptive-technologies.com/. Accessed 8 Dec. 2020.
[14] "Use cases | Disruptive Technologies." https://www.disruptive-technologies.com/use-cases. Accessed 8 Dec. 2020.

Google loon project (United States)

Experimental balloon Beacons

Image 5.1

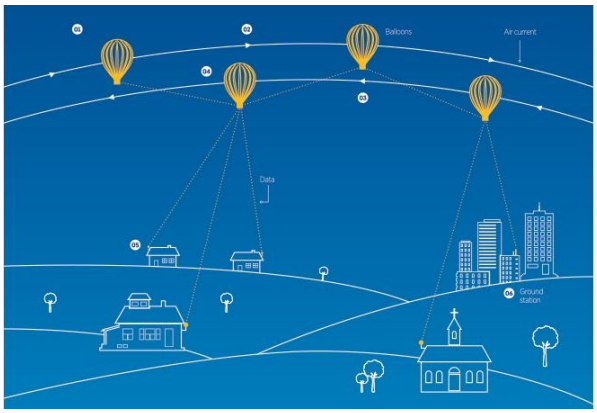


Image 5.2

(Source: Google Loon project)

This experimental project demonstrates how airborne air travelers can get connectivity by Wifi enabled floating hot air balloons in the airspace of the flight. Loon's mission is to connect people everywhere by inventing and integrating audacious technologies. By effectively carrying cell towers 20 km above Earth, Loon makes it possible to deliver 4G LTE and 5G connectivity in partnership with mobile network operators.[15]

Tech giants like Facebook and Google have been working on numerous projects aiming to make the internet available throughout the world covering not only the metros and cities but also the disaster hit and remote areas where internet is scarcely available or not at all. In recent years, Google proposed a research based project called "loon project" which aims to provide internet access to remote areas. The basic idea is to use high altitude balloons in the stratosphere at an altitude of about 20 miles(32 km over 40km) to generate an aerial wireless network giving a speed of upto 1 mbps. This communication requires the infrastructure that comprises antennas that use the technology of radio frequency.

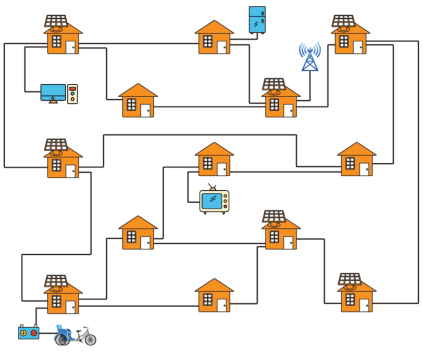
These balloons provide internet using the same technology as used by the cellular devices at any latitude.In this project, they are considered as cell towers that have mobility and the devices will be connected to their nearest Loon balloons in the same way they do with the stationary towers.

[15] "high altitude, higher ambitions - googleusercontent.com." https://kstatic.googleusercontent.com/files/700fe7484ef07f5b986715faaa846f183be7e952c65e49bf75256c287cd1721451b2762b327a50f58a3b1589e37e52324767c67796a4b8d9f6139017233c4987. Accessed 6 Dec. 2020.

Each balloon has a radio antenna that provides connectivity to the ground as well as with other balloons. Also there is a special ground antenna that provides access to the internet from the balloon. The reports provided by Google indicate that each balloon can provide the signal range of about 40 km in diameter. In 2013, tests were conducted in New Zealand indicating that project loon uses ISM bands (specifically 2.4 and 5.8 GHZ bands) which are available for anyone to use and can even reach the most rural and disaster affected areas.
These internet beaming balloons have also been tested in countries like Indonesia and Sri Lanka where the high speed data was transmitted from the balloon clusters floating 60,000 feet above the Earth.

This project specifically aims for countries that have limited internet access. According to the research conducted by Google X research lab, around 4.5 million people in the world have no access to the internet. Thus, in the technologically evolving world where internet communication and connectivity has become the basic need, this project will not only provide the benefits to remote areas but will also enable communications even at the times of scarcity of ground infrastructure due to natural disasters.

SolShare (Bangladesh)



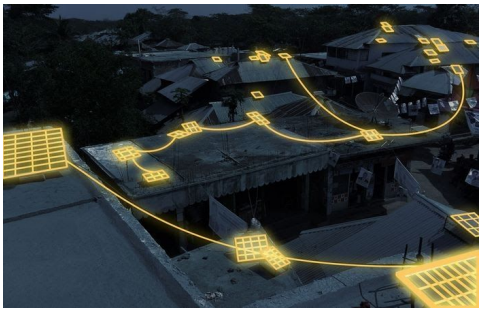


Image 5.6 Image 5.3

(Source: SolShare)

In countries with a lot of sunlight, it makes sense to want to mount solar panels whenever possible. But often, even though the target succeeds, work isn't completed at all. Take Bangladesh: over the last 15 years the country has managed to deliver millions of solar panels and batteries through an ambitious government program; the country currently has more than 5 million solar home systems.[16]

The statistic puts Bangladesh at a fast rate for the most widespread use of solar power in the world, but these solar panels are largely not networked the way they are elsewhere. One European start-up named SolShare[17] is trying to turn these diverse power sources into a makeshift grid or grids. In the U.S. and Europe, solar home systems are connected to the larger electricity grid. In certain cases, if a homeowner generates more electricity than the home needs, the homeowner can potentially sell surplus electricity back to the grid. But many of the systems in Bangladesh have been installed in homes or businesses that have never been connected to the power grid in the first place. This means that they are now closed-loop structures, unable to share surplus power. And because of the small batteries installed by the government in these systems, there is always quite a bit of surplus power in one home, while there is still no electricity at all next door. SolShare Managing Director Sebastian Groh reports that 30 percent of the power produced by these panels is actually wasted because the owner of the solar panel does not need it, and there is nowhere to go.

SolShare aims to build what they call "nanogrids": small, decentralized electrical grids where anyone with a solar panel can be their own power plant. The company installs tiny smart meters in people's homes with solar panels and links them to other homes with electrical wiring, just as any power company would do. Those consumers of solar panels have the option of choosing how much of their surplus power they need to sell; many only want to sell some power automatically until their own batteries are complete. Houses without solar panels that have been connected to these localized grids will purchase power from their neighbors in the same way that they buy electricity from an electrical utility in

[16] "SolShare Creates Mini Solar-Power Grids in Bangladesh." 17 Oct. 2018, https://nymag.com/developing/2018/10/solshare-mini-solar-power-grids-energy-bangladesh.html. Accessed 8 Dec. 2020.
[17] "ME Solshare." https://me-solshare.com/. Accessed 8 Dec. 2020.

the cities. All transactions and sales are made with a digital wallet, which can be cashed out at any time.

With a scheme like SolShare, which gives money to the owners of solar panels, people would be more likely to fall into the system. After all, they may owe some money every month for panel payments, but those panels still receive revenue.

6.1 Best Practices in Smart tourism

The intent of the study is to note the implementation of smart tourism tools and initiatives, sharing best practices in urban tourism and improving peer-to-peer learning and creative growth of tourism across the EU in general. This study would further be helpful in learning the existing technology in the tourism industry for conceptualizing the proposed problem solution (BEST PRACTICES - European Capital of Smart Tourism, 2020).

The European Commission introduced the first EU-wide competition for the European Union in 2018. Smart Tourism Capita[18]l. 38 cities from 19 EU Member States have submitted their applications To bid for the title of the European Capital of Smart Tourism in 2019. Helsinki (Finland) and Lyons (France) dominated the race and became the European Capitals of Smart Tourism in 2019. Subsequently, the search for the 2020 European Capitals of Smart Tourism was also launched in 2019 and 35 cities from 17 EU Member States submitted their applications. Göteborg (Sweden) and Málaga (Spain) received the title of European Capital of Smart Tourism in 2020 (COMPENDIUM OF BEST PRACTICES, 2020).

The Four Categories to evaluate best practices in Smart Tourism Capital were as follows:

1. Accessibility
2. Sustainability
3. Digitalization
4. Cultural Heritage & Creativity

6.2 BEST PRACTICES IN ACCESSIBILITY

Accessibility :

[18] "European Capital of Smart Tourism." https://smarttourismcapital.eu/. Accessed 4 Jan. 2021.

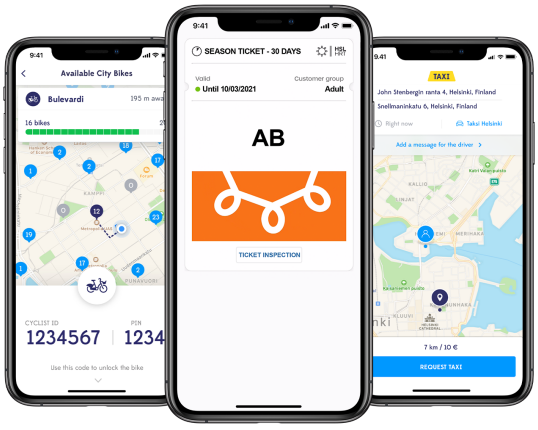
It questions the types of services needed by a city to be open physically and mentally to visitors with special access requirements, regardless of their age, social or economic situation, and if they cater to the physically disabled. Accessibility means that it can be easily accessed by various modes of transport and with a good transport system in and around the city. Too much accessibility can create a negative impact by adding tourist pressure on local residents as famous, important city sights, parks, places would be having heavy tourist traffic.

Besides the infrastructure itself, how do you make offers for tourism? Physically and mentally, barrier-free? To answer this question we understand that accessibility does not only mean being a barrier-free destination, it also encompasses services that are multilingual and, for example, digitally available to all travelers or visitors, regardless of age, cultural background or physical disability.

6.2.1 Accessibility of Information to All:

1. Barrier-free access to the city's digital offerings - Helsinki, Finland.

The Whim App, which integrates all the city's transport choices, such as bus, train, bicycle, taxi and car sharing, has been created by Helsinki into a single app with a monthly subscription. Therefore, as well as a means of payment, one may only need an app that contains all the tickets. Whim claims to be more economical than buying a vehicle and essentially seeks to make outdated personal vehicles.Three forms of services are provided through Whim: a free service, A monthly subscription offering unlimited public transport and discounted taxi and car sharing rates and a package that provides not only unlimited public transport, but also unlimited access to taxi and car sharing[19]. At present, not only in Helsinki, but also in Birmingham and Antwerp, the app is live. Furthermore, public transport in Helsinki is free to use while traveling in a baby stroller or wheelchair.



[19] "Whim app." https://whimapp.com/. Accessed 1 December. 2020.

Image 5.4: Whim App Covers all your journey.©

2. The smart city cards; Copenhagen, Ljubljana, Lyon, Tallinn

The Copenhagen Card: The Copenhagen Card is a city pass that offers all-inclusive access to over 80 attractions and public transport connections. More than €1 million was produced by the Copenhagen Card[20]. Visits to the participating museums and attractions in 2017, representing a 172 % rise from 2012. The card will be integrated soon, allowing users to send appropriate and personalized inspiration, while also dispersing visitors to other parts of the world. Tourists around the city and between attractions are guided by the attached Copenhagen Card App.The app offers data with a monitoring module - asking for permission before triggering - to understand users' movement patterns. It is sustainable, digital and conveniently available to all.

Image 5.5: Copenhagen Card.©

Urbana Smart Card, Ljubljana: The Ljubljana Urbana Smart Card makes it very easy to switch between various modes of transport and allows people to use public transport. Users of the Urbana Smart Card have access to Park+Ride (P+R) services, city buses and the BicikeLJ bike-sharing scheme. With the pass, unlimited bus trips can be used for the price of one ride within 90 minutes and when a tourist uses the P+R facilities, he/she gets two 24-hour tickets that allow him/her to use a bus to the center and back. It is a contactless card and enables the customer to pay parking fees and cable car rides to the castle of Ljubljana. In addition, it also acts as the key to enabling bike docking stations for BicikeLJ. The Urbana Smart Card, which can be purchased and updated at tourist information centers, newsstands and newsstands, is used by over 500,000 people. As well as at other bus stations, the ticket offices.

[20] "Copenhagen Card | All-inclusive city card." https://copenhagencard.com/. Accessed 2 Jan. 2021.

Image 5.6: Ljubljana Urbana Smart Card.©

*The Tallinn Card; Tallinn, Estonia:*The Tallinn Card makes traveling around the city and sightseeing extremely easy-it allows free access to more than 40 museums and attractions in the city, free public transport, free city tours, and more than 30 special offers and discounts. Some of the attractions included are: the Tallinn Zoo, the Tallinn City Tour Bus, the Tallinn Bicycle Tour, the Estonian History Museum, the Tallinn Town Wall. The Tallinn Card is activated automatically the first time it is used, either by attraction or by public transport, and is valid for the next 24, 48 or 72 hours, depending on the plan that has been purchased. The Tallinn Card has been available for 20 years and has started as a paper card – now it's an electronic ticket containing a QR code that you simply need to show to the caissier – or a public transport operator.

Image 5.7: Tallinn Card.©

3. Using innovative signage in historic sites; Lyon

Innovative pedestrian signage has been deployed throughout the UNESCO-listed historic site of Lyon. The system has been designed to blend into The urban landscape (with colors inspired by the Renaissance Lyonnaise) guides visitors without overloading the urban landscape. Three types of street kiosks provide information to visitors, the most important of which are orientation tables erected in locations that provide information. A remarkable view of the surrounding site. They are relayed by signposts installed on existing urban kiosks and by specific markings such as on the edges of the pavements. This new signage enables both tourists and locals to find their way around on their own.

Image 5.8: iGirouette signposts.©

The system includes 11 orientation tables equipped with NFC (no contact technology) and flash codes (that access apps). There are a total of 68 signs and 45 markings on the pavements. Lyon has also deployed an innovative digital signage network for iGirouette[21] in real time.The 15 iGirouette signposts that are capable of 360° movement can tell visitors in just a few dozen seconds what direction they need to follow to get to a place of interest and how long it will take them (to a museum, station, event, etc.)

4.Personal city helpers'; Helsinki, Lyon, Nice.

The Helsinki Helpers; Helsinki, Finland: Helsinki provides tourist information and other additional resources to the visitors, through the Helsinki Helpers. For over 20 years, the Helsinki Helpers, who are involved during the summer, have provided visitors and residents with information about locations, activities, restaurants and shopping. They are young locals who speak 14 languages altogether and are present in areas where visitors, such as around major attractions, have the most questions. Helsinki Helpers wear green jackets and work in pairs throughout the city centre, also using their 'Helper Mobile,' a customised bike with a

[21] "Wayfinding signage: iGirouette®, LED variable message sign." https://www.igirouette.com/. Accessed 11 December. 2020.

booklet basket, to serve as many visitors as possible. In the beginning,Helsinki Helpers receive a two-week training period during which they learn comprehensive knowledge of Helsinki's history and tourist attractions. Approximately 90% of the visitors served by the Helsinki Helpers are foreigners.[22]

Image 5.9:Helsinki Helpers.© Visit Helsinki/Jari Kippola

The Lyon Airport Helpers; Lyon, France: The Lyon Airport Helpers scheme feeds on the idea of capitalizing on the sense of community shared by employees working for companies at the Lyon-Saint Exupéry airport. By training volunteers with different skills and in different areas of business to provide basic information. Lyon Airport won the Grand Prix de la Qualité en Aéroport award in 2008 thanks to this approach and the European Business Aviation Awards 2009[23]. The Community currently represents more than 2,500 Airport Helpers, and the concept has been exported to six other European airports: Munich, Rome, Paris, Milan, Toulouse and Naples, giving rise to a large international community of Airport Helpers.

The Nice Greeters; Nice: Nice's Tourist Office website features a service that connects visitors to volunteers from Nice Greeters who act as ambassadors for their neighbourhood. They propose places to visit that are off the beaten track, based on shared interests, and provide accessibility advice.From jogging sessions in the old city, to aperitif walks and social breakfasts, the service offers visitors a whole new way to experience the city like a local.

[22] "Helsinki Helpers serve 145,000 visitors over the summer | City ...." 1 Sep. 2016, https://www.hel.fi/uutiset/en/helsinki/helsinki-helpers-serve-visitors. Accessed 2 Jan. 2021.
[23] "Lyon stimulates industry - Aderly - Yumpu." https://www.yumpu.com/en/document/view/46633549/lyon-stimulates-industry-aderly. Accessed 2 Jan. 2021.

5.Visitors with disabilities; Valencia; Bari; Gothenburg;; Ravenna; Venice

Image 5.10: Sea By Wheelchair . ©Nice's Tourist Office

Bari's accessible beaches; Bari: Bari is characterized as a city by its coastal position, and the city authorities have ensured that tourists with physical disabilities can enjoy their seaside experience to the fullest. Completely accessible beaches provide adapted paths and beach mats that allow direct access to the sea by wheelchair users and slow water. Also, several tourists come by sea. Tourists are made assured that all moorings for wheelchair users are well adapted. Via a fully adapted train shuttle service, cruise vessels are also linked to the city[24].

Funktek Project, Tourism for disabled people; Gothenburg:

The goal of the Funktek project[25] is for people with disabilities to be able to visit and experience museums and, like anyone else, to engage in culture. The Museum of Gothenburg employed individuals with different disabilities to examine the Museum's exhibitions as their expertise. A better museum can be built with an experience of what it's like to be rejected from society.[26]The Museum of Göteborg's aim was to change the way in which exhibitions are designed, planned and constructed, so that future museums can incorporate accessibility into their designs – not finding special solutions, but solutions and

[24] "My wheelchair travel in Apulia, Italy: Terra di Bari and Itria Valley." 4 Jan. 2019, https://www.iwheeltravel.com/en/travel-wheelchair-apulia-italy-disability/. Accessed 2 Jan. 2021.
[25] "About us | FUNKTEK." https://www.funktek.se/about-us/. Accessed 2 Jan. 2021.
[26] "Funktek - Co-creative Museum Development | Mistra Urban ...." https://www.mistraurbanfutures.org/en/project/funktek-co-creative-museum-development. Accessed 2 Jan. 2021.

conditions that worked for everyone. The project has made it possible to gather thoughts, experiences and ideas into manuals, reports and educational materials.In addition, thanks to the Funktek project, 'city walks for all', a new concept for the Museum's guided city walks has been created. Here, all the senses of the visitors are activated. Interactive 'city sittings' are proposed in the museum's courtyard, as well as guided walks of 30 minutes and 75 minutes.

6.2.2 Smooth access points to historic sites :

Ravenna: No matter how old an attraction is, it can always be made accessible to people with any kind of disability. Ravenna excels in this area and therefore plays a leading role in the USEFALL- UNESCO[27] site experience for all projects. In the context of this initiative, local tourist operators have received special training to welcome visitors with physical disabilities or special needs. In addition, dedicated audio guides and tactile mosaics have been created to ensure everyone can experience visiting a UNESCO site.

Image 5.11 Figure 00:Addition of Ramps to one of the insulas.

Making the city of bridges more accessible - Venice:

By making 40 insulas available, Venice is improving the city's pedestrian access. More than 60 out of a total of 129 insulas are already accessible. The city's water bus operates every 10 to 20 minutes, 24 hours a day, and goes to all the main attractions. All boats are accessible, seats are reserved for customers with mobility problems, and visitors with disabilities and their accompanying persons can continue at reduced rates. Bridges and pedestrian walkways have been improved, such as through ramps, lifts for stairways, which lead to some 30 km of accessible routes in Venice, also the city has introduced systems that assists the visually impaired visitors to navigate, by installing the tactile flooring[28]. These

[27] "About the Project - USEFALL - Italia-Croatia - Italy-Croatia." https://www.italy-croatia.eu/web/usefall. Accessed 2 Jan. 2021.
[28] "Venice Without Obstacles." https://venicewithoutobstacles.herokuapp.com/. Accessed 2 Jan. 2021.

measures improve the warnings about the danger of falling into the water and the presence of bridges. Venice recently decided to invest in order to further improve the accessibility of public transport stops on the mainland. In total, more than 70% of Venice is accessible to the disabled visitors.

Key Takeaways:

- By studying the use cases we can highlight the important touch points created for tourists by local authorities, and tourist organizations to provide a better tourist experience and make the cities more accessible digitally and personally to visitors of all kinds. It displays how the locals are serving and contributing to the tourism industry by serving information to tourists.
- Also it shows steps taken by the local government and the tourism organizations to map out innovative infrastructure projects which are centered involving citizens of the host cities.

6.3 BEST PRACTICES IN SUSTAINABILITY

Sustainability :

What opportunities does a city have to protect and improve the natural environment and resources while preserving sustainable economic and socio-cultural development? How natural resources (including innovative environmentally friendly initiatives) are handled at a tourist destination and how resource efficiency measures are implemented. .It is applied and the practices are aimed at preventing or adapting to climate change

Can there be certain steps designed to minimize tourism seasonality and involving the local community? How do cities contribute as tourism destinations Local jobs and diversification of the local economy? Therefore, being sustainable is not just about maintaining and protecting the natural environment. Resources as a city, but to reduce seasonality and include the local community.

6.3.1 Combating or adapting to climate change :

1. Carbon Neutrality Initiative Helsinki

By 2035, the city of Helsinki aims to become carbon neutral. Its plan to do this by Carbon Neutral Helsinki 2035 Operational Programme initiative[29]. Hereby, Helsinki is accelerating its target by 15 years from the previous target year of 2050. Around 140 measures are

[29] "Home - Helsingin Ilmasto - Helsingin ilmastoteot." https://helsinginilmastoteot.fi/en/. Accessed 2 Jan. 2021.

included in the program that will allow the entire city to move towards carbon neutrality.The concept of carbon neutrality in Helsinki is to minimize greenhouse gas emissions by 80 percent within the city and to offset the remainder. Heating is the largest cause of greenhouse gas emissions in Helsinki. According to the action plan, the city will slash buildings' heat energy consumption by one fifth with the Upgrades in energy efficiency in the old building stock, tougher new construction requirements and heat recovery.In addition, the City aims to reduce greenhouse gas emissions in Transport by nearly 70% by expanded use of sustainable mobility modes. The city will give visitors and residents the potential for sustainable tourism, energy-efficient real estate and renewable electricity. In addition, several hotels offer automated carbon footprint calculators.

2.City tours and environmental volunteering; Copenhagen

Copenhagen offers many opportunities for tourists to discover the city from the water, such as 'GoBoat.' GoBoat[30] lets visitors rent solar-powered boats that anyone can sail. GoBoats are partially made of recycled plastic bottles and 100 % of recycled fiber materials are to be produced for the next generation of boats. The GoBoat Pavilion, the dock and the tables in the boats are made entirely of sustainable wood.The 'Miljokajakken' initiative (Green Kayak) [31] has also been launched. It lets you rent a kayak for free if you commit to collecting garbage while kayaking and share your actions on social media to spread the word. Word, man. With this initiative, Copenhagen wants to focus on the city's environmental challenges and encourage Danes and tourists to take greater responsibility for the waste they produce.

Image 5.12 - Willemstraat, Breda

[30] "Boat rental in Copenhagen | Safety procedures in place - GoBoat." https://goboat.dk/en/. Accessed 2 Jan. 2021.
[31] "greenkayak - kayak republic." https://kayakrepublic.dk/en/diverse/greenkayak/. Accessed 2 Jan. 2021.

3.Smart city lighting; Breda

In its street lighting, Breda is the first city in Europe to use remote control, colour-changing LED technology. This was first piloted on Willemstraat, the main road that connects the station to the center of the city. Streetlights can be changed to all colors of a rainbow and can be brightened and dimmed and tailored to certain events to create a particular ambience.The color and intensity of the light varies during the night, night, and evening. It's early morning. A spotlight is placed on Breda's landmarks through the LED lighting and the illumination improves the look of the city in the evening. Light pollution for humans, flora and fauna can be avoided, particularly at night, and light can be changed during the day depending on the seasons. The first thing that visitors experience on their way on foot from the station to the core, renovated as a peaceful alley with trees on either side, is a sense of sustainability and the locals feel less vulnerable to light pollution.[32]

4.Málaga's Integrated Sustainability Strategy; Málaga

Málaga has several city-wide sustainability action plans, such as the 2020-2050 Integrated Sustainability Strategy, aimed to make the city a greener place for both residents and visitors.The far-reaching energy saving measures, such as the installation of LED technology in public lighting, smart meters, the implementation of city-wide energy management systems and power grid automation, are a key aspect of this. A variety of programs have been initiated by Málaga to ensure that residents and visitors enjoy the clean air and water of the area.Via the smart watering system for parks and gardens, water is saved. A system for separating rainwater and plumbing has also been introduced to promote the discharge of stormwater and a bio-tracking treatment system is in place for odor control and treatment. In addition, steps to control air and noise levels have been implemented by the Air Quality Sectoral Programme.

5. Sustainable tourism tax; Palma

In recent years, Palma has drawn record numbers of visitors, placing a strain on the island's restricted natural resources. In response, a sustainable tourism tax was imposed by the authorities on accommodation paid per person per night.Tax funds are collected and used for environmental conservation and protection programs, climate change research and sustainable tourism growth, especially during the off-season. Last year, it was estimated to produce EUR 120 million (EUR 4 for luxurious hotel stays, EUR 3 for mid-range accommodation, EUR 2 for cruises and cheap hotels, and EUR 1 for campers and hostel guests).

[32] "Smart Light from Eindhoven brings Breda city prize ...." 25 Aug. 2017, https://innovationorigins.com/smart-light-eindhoven-brings-breda-city-prize/. Accessed 2 Jan. 2021.

Image 5.13 visitljubljana, © (Nea Culpa)

6.Closing down the city centre to cars; Ljubljana

In order to reduce air pollution and to establish a more pleasant pedestrian zone for visitors and residents, the city center of Ljubljana has been a car-free zone for more than 10 years, making Ljubljana one of the few cities in Europe to take such a step. However, elderly people, people with disabilities and mothers with infants are still allowed to enter the city center by means of a vehicle and are also eligible for free rides throughout the area with electric taxis. Busses and bicycles also enter and there are underground car parks outside the center of Ljubljana. As a result of the car-free policy, traffic in Ljubljana has decreased by 12% since 2011 and the concentrations of black carbon have decreased by 70%.

6.3.2 Maintaining and improving the natural environment:

1. Local environmentally friendly insights.

The Green Key eco-labelled hotels, Tallinn:The Green Key (Green Key, 2020)[33] is a voluntary eco-label that is awarded in over 50 countries to more than 2,500 hotels and other establishments. A Green Key stands for the pledge of a company to its customers that the guests help make a difference for the world and for sustainability by choosing to stay with them. In 2001, Estonia joined Green Key. The Green Key label was awarded to 10 hotels and a concert hall in Tallinn. Important requirements that must be met by the owners of the Green Key eco-labelled establishments include water, cleaning, waste, energy, as well as food and landscape maintenance, i.e. the supply of tap water to visitors, rainwater toilets

[33] "Green Key." https://www.greenkey.global/. Accessed 1 Jan. 2021.

for flushing, no pesticides used on the premises, waste sorting, no heating of empty rooms, etc.

Image 5.14 Fächer-Becher © KME / Jürgen Rösner

2.The Fächer-Becher reusable cup, Karlsruhe, Germany.

In the summer of 2018, Karlsruhe introduced its own specially designed 'Fächer-Becher'[34] (Fan Cup), named after the city's layout, which looks like a fan. The Fan Cup is a robust porcelain container designed to reduce the consumption of disposable coffee cups and, at the same time, to be a Karlsruhe memorable object or a souvenir for tourists visiting the city.Tourists can exchange cups or simply refill them in a number of cafes, bakeries, supermarkets and restaurants throughout the city.

3.Involving visitors in a city's sustainability; San Sebastian; Venice

The campaign 'Live San Sebastian, Love Donostia' aims to engage tourists in the sustainability of the region. A list of good practices, accessible in four languages and through different devices, has been developed. For example, they encourage tourists to keep public places clean, value the need for residents to rest at night, use public transport, and help local businesses.The practices allow visitors to enjoy the town and appreciate the area and those who live in it at the same time.

6.3.3 Spreading the flow of tourist :

1.Pacer challenges / Virtual challenges.

Since the Covid - 19 pandemic, most of the events are planned and scheduled online. One such platform was designed for physical fitness where users can take part in long marathons which would have a deadline and a particular distance required to complete the race. This is

[34] "Fächer-Becher." https://www.faecher-becher.de/. Accessed 2 Jan. 2021.

tracked by a smartphone application, as well as smart watches which track how much each user has run. The theme is based on different levels and locations. Like for example 'The Mount Everest Virtual Challenge[35]' takes users to the summit of the world's highest peak through an amazing 40 mile (64 km) journey. Each time users complete a distance-based exercise such as running, walking, cycling, swimming, etc., users will travel along the Mount Everest map. This concept can be used in tourism since it can encourage people to walk and avoid unnecessary use of transportation. Indirectly it can help in increasing the duration of stay for a visitor, which would be sustainable for the communities as more parts would be explored by foot.

Image 5.15 -The Mount Everest Virtual Challenge

2.MIXITY walks to all city sites; Brussels

In Brussels, the city centre is under a lot of pressure from visitors. The tourism board recommends 'MIXITY hikes'[36] to allow tourists to explore all 16 districts in order to handle tourist flows more sustainably.The program was complemented by advertising campaigns showcasing the diverse offers of different communities (shopping, food, history) and a bike map with eight cycling routes to help tourists discover the hidden gems of the area.

3.Off-season travelling incentives; Lyon

Lyon has predominantly received business visitors. As early as 2010, the growth of leisure tourism helped to restore the balance of the seasonal presence, which was initially higher during the week. Important In the French and European sectors, promotion actions were targeted at the general public (85 percent of customers).The quality was greatly restored by these campaigns, Over the past 5 years, with weekend occupancy rates in Lyon (which stood at 65% in 2017) rising 8.3 points. As for the business segment, focused outreach has

[35] "Mount Everest Virtual Challenge | The Conqueror Virtual ...."
https://www.theconqueror.events/everest/. Accessed 2 Jan. 2021.
[36] "Neighbourhoods walks : Discover Brussels ... - Visit Brussels."
https://visit.brussels/en/lists/neighbourhoods-walks-discover-brussels-neighbourhoods. Accessed 2 Jan. 2021.

been introduced during the summer months to host activities in Lyon. Example: The August 2014 World Library Congress, the August 2015 World Veteran Athletes' Championship, the August 2017 World Bridge Championship, and the August 2018 World Congress on Parkinson's Disease.In collaboration with the Lyon Convention Centre, which created a special seasonal rate (-35 percent) for those wanting to rent a venue in Lyon, this approach was carried out, making the destination extremely attractive. During major congresses and under certain conditions, the city also provides free travel passes to encourage visitors to take advantage of public transport.The visitor tax that funds tourism development activities has increased from less than EUR 2 million in 2011 to more than EUR 6 million in 2017. This impacts the local community directly.

4.'Half Price Poznań'; Poznań:

What started out as a simple recognition of the touristic phases in a city, meaning that fewer people were likely to visit the city during the winter and spring periods, resulted in the implementation and extension of a municipal action inspired by the sale of bargains. 'Half Price Poznań'[37] is considered a great marketing strike, offering tourists the opportunity to visit the city during the off-season, while benefiting from a 50% discount with over 200 participating partners. Several cultural institutions, hotels and tourist offices offer their own range of products and services at half the regular price during a certain period of time when the city is considered less attractive to tourists.The Poznań Fair, which usually hosts fairs and industry meetings in its huge spaces throughout the year, now lends these spaces to the city every year to organize 'The Summer at the Fair' event following a similar idea of optimizing the use of capacity by sharing it with others.This festival offers free kids' workshops, an outdoor cinema and Saturdays themed to trigger the imagination of the local community.

5. Successful Strategies used in Japan to tackle Over-tourism; Kyoto, Japan

Smart technologies are considered the most efficient solution to tackling the effects of overtourism, according to UNWTO (2019). For example, Kyoto residents are angry at the traffic and congestion caused by tourism growth, and the government has responded by conducting an experiment to analyze cell phone data. The experiment is ongoing and monitors the time of day when most mobile phones are present at the destination, usually found peak results in the early-to mid-afternoon hours. As a result of data gleaned from the experiment, Kyoto has already changed its opening times for its tourism attractions.

[37] "13th "Half Price Poznan" - a virtual edition - POZnan.travel." http://poznan.travel/en/r/wydarzenia/trzynasty-poznan-za-pol-ceny-w-innym-wydaniu. Accessed 2 Jan. 2021.

6.4 BEST PRACTICES IN DIGITALISATION

Digitalization :

Finding possibilities on how the cities are helping the local tourism businesses in yielding growth by the use of digital skills and tools. The city helps the digitalization of tourism services, means the provision of creative tourism and hospitality knowledge, goods, Services, spaces and experiences customized to the needs of customers through ICT solutions and digital tools.The aim is to understand the how cities can provide digital information on destinations, attractions and tourism offerings, as well as information on public transport and to make attractions and accommodations digitally accessible.

6.4.1 Facilitating information for specific target groups

1. : WeChat mini program to attract Chinese tourists; Helsinki, Finland: Among Chinese tourists, Helsinki has become more and more popular. In the past five years, the number of overnight stays by Chinese travellers in Helsinki has more than doubled. Therefore, in February 2018, the Internet service firm Tencent launched the WeChat Helsinki mini program along with the city of Helsinki and the Finnish airline Finnair. WeChat, known as China's 'app for all'[38], is a Chinese multi-purpose messaging, social media and mobile payment app. The WeChat Helsinki mini software is intended for Chinese travelers who want to learn more about the capital of Finland, with details such as current weather conditions, a list of holidays and activities, sightseeing information, emergency assistance and translation services, all in Chinese. Chinese tourists can also apply through the program for tax refunds on purchases and have the money deposited in their WeChat Pay account.

2.Smarter information for tourists; Málaga: All of the Málaga digital channels are designed to make information available to tourists, however tourists prefer to receive it. The museums offer individual applications, as does the local tourism authority, which includes an audio guide to the city. QR codes and beacons are installed in places of interest throughout the city for information on the way.Information is also available on all social media

[38] "New visitor app by the City of Helsinki and Tencent takes ...." http://materialbank.myhelsinki.fi/deployedFiles/1368ba1ab6ed38bb1f26f36673739d54.pdf. Accessed 2 Jan. 2021.

channels, and if a visitor can't find what they're looking for, they can use the chat function of the tourism website[39].

Image 5.16 Self-service bicycles for hire © velobleu / Nice Tourism

3.Create your own digital travel itinerary; Nice: The Nice Tourist Office is working on a paperless promotion of the region and is providing a travel journal app that enables visitors to compile their holiday schedule and save their own itinerary for a stay[40]. The app also details local events and the availability of Vélos Bleus (self-service bicycles for hire) and car park locations in real-time.The future updates will include information on accessible tourism services using NFC tags and QR codes for tourist attractions. In addition, the City of Nice also encourages eco-friendly travel through the 'Nice Tram Connect Project,' which seeks to develop and test applications for business and leisure travelers. Four start-ups have been chosen to design new services relating to smart mobility and to encourage the use of environmentally friendly modes of transport.

6.4.2 Collecting information for smarter management - Mapping visitors via big data:

1.CRM Tool; Lyon: ONLYLYON has developed its first **CRM** city-scale tool. This has been used to gain a better understanding of the visitors and to improve the way they are guided around the city. The principle of ONLYON is to compile a common database of customer-related information (currently containing close to 2 million contacts). ONLYON experience is based on its extensive knowledge of the entire area, which means that it is capable of providing visitors with highly relevant information and advice. The messages sent to visitors aim to enhance the customer's experience and make it possible for them to truly enjoy all aspects of the city. This system can also be used to send itinerary suggestions, thus reducing traffic in congested areas during peak periods.

[39] "Malaga Turismo; web oficial del Área de Turismo del ...." http://www.malagaturismo.com/. Accessed 2 Jan. 2021.
[40] "Nice in your pocket : Apps corner - Nice Tourisme." https://en.nicetourisme.com/apps-corner. Accessed 2 Jan. 2021.

6.4.3 Smart tourist traffic control using sensors for Visitors and Host:

1. Enhancing the city centre by analysing data, Aix-en-Provence, France :The Aix Living Places project[41], a partnership between the Camp Foundation and 12 local start-ups, aims to install hundreds of **sensors** in the streets of Aix-en-Provence. The collected data is transferred to the town hall with the goal of enhancing the quality of life of **locals**. It offers a relevant perspective, as it is focused on the evaluation and common priorities of local urban planning policy and decision-making. Ideas in development include tracking pedestrians to ease the flow of people walking through the city, bins that communicate how full they are in real time to optimize collection, and measuring air quality (Aix Smart Places, 2017).

2.Urban Environmental Monitoring programme; Nice:
Nice's Urban Environmental Monitoring (UEM),[42] The program collects environmental data from 2,000 **sensors** around the city points and transfers the data and vital information to 20 digital services and apps to produce indicators which branches out more than 20 specific digital services and apps. The apps provide real-time information on sun exposure, pollen levels, sea conditions at beaches, and even water and air temperatures. This creates a leading ecosystem for the smart city and innovative uses for local residents and local entrepreneurs(The 'Smart City Innovation Center' opens in Nice - Invest in Côte d'Azur, 2020).

3.Open data platform VLCi, which collects data from sensors; Valencia:
The Smart City Strategic Plan, promoted by the City Council of Valencia, includes 17 initiatives aimed at making Valencia a smart destination, including long-term tourism plans. The Council has developed an **open data platform,** VLCi[43], which collects data from **sensors** across the city, to promote these projects. Public transport data, the utilization of city bikes and the purchase habits of tourists using the VLCi IMPULSE card are collected and given free of charge to local tourism businesses and start-ups. Big data is also analyzed and reports generated by the initiative to help companies develop their tourism offerings.

[41] "Aix Smart Places | thecamp." https://thecamp.fr/en/projects/aix-smart-places. Accessed 3 Jan. 2021.
[42] "The 'Smart City Innovation Center' opens in Nice - Invest in ...." 16 Mar. 2020, https://www.investincotedazur.com/en/the-smart-city-innovation-center-opens-in-nice/. Accessed 7 Jan. 2021.
[43] "VLCi Platform | València Smart City FIWARE information ...." http://smartcity.valencia.es/vlci/vlci-platform/. Accessed 3 Jan. 2021.

2. Event Impact Calculator; Gothenburg.

The City of Gothenburg is a frequent user of the Event Impact Calculator[44], a forecasting tool developed in Gothenburg that helps event organizers analyze and calculate the impact of events from an economic, social and environmental point of view. The transport emissions of tourism are also included in the forecast, giving the organizers a broad sense of the scale of the impact of the event. Therefore, to produce maximum positive outcomes, organizers are given the ability to experiment with various variables. The tool has been registered for use by more than 300 professional users.

6.4.4 Cognitive accessibility through innovation.

1.Nexto app[45]: Experiencing culture; Ljubljana

Nexto is an app that was built by developers from Slovenia. It's a storytelling app that aims to deliver value to the sightseeing experience of travellers by engaging them. The app is not a typical audio guide – it combines the traditional audio guides with added features such as puzzles, quests and the collection of objects by scanning your smartphone.

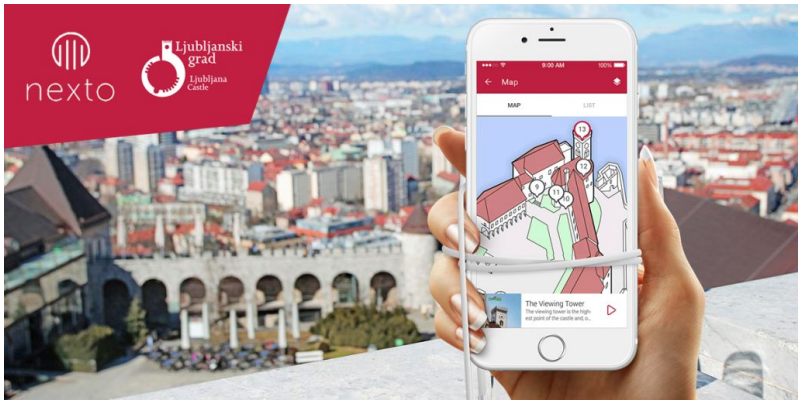


Image 6.10 Nexto app

With the support of augmented reality, Nexto builds game-like learning opportunities. It includes interactive maps that allow tourists to explore the secret jewels of Ljubljana and use location-aware technology to enable the audio guide whenever the user is close to a point of interest. The software can also be used offline, as it is possible to preview the material beforehand.

[44] "Bakgrund | Event Impact Calculator™." https://www.eventimpactcalculator.com/bakgrund/. Accessed 3 Jan. 2021.

[45] "Nexto / 5 star self-guided experiences." https://nexto.io/. Accessed 3 Jan. 2021.

2.A website as a cultural experience: The 'Voyage à Nantes'[46]; Nantes

Value of taste via digital experience: A new, vibrant and imaginative piece of art unfolds as you reach the 'Voyages à Nantes' website, gathering all the relevant news under only one roof. All the information about the region, the 'Nantes Food Forum' can be found here, the latest agenda of the 'Voyage à Nantes'-the' Voyage 'into Nantes' surroundings, the' Parcours Vignoble'-the 'marathon' wine tasting as well as, most notably, the green line. When discovering the community of Nantes, the green line is important. On the page, the customer merely checks out the green line and looks at the cultural offerings before choosing which ones to visit offline, either through a slideshow or on an actual map.

6.5 BEST PRACTICES IN CULTURAL HERITAGE AND CREATIVITY

Cultural Heritage & Creativity :

Focusing on cultural heritage and creativity means preserving and capitalizing on local heritage as well as on cultural and creative assets for the benefit of the destination, industry and visitors. The city makes an ingenious use of its cultural heritage and creative industries for an enhanced tourism experience. Some steps are being taken to identify and integrate the tangible and intangible heritage of art, history and culture into its centre. Cultural heritage and creativity are used to draw visitors from outside the EU in particular and to leverage synergies between local tourists and the cultural communities.

6.5.1 Reviving traditions and cultural heritage sustainability

Image6.11 :Löyly

[46] "Le Voyage à Nantes | Evènements, expositions, visites à ...." https://www.levoyageanantes.fr/. Accessed 3 Jan. 2021.

1.Reinventing sauna culture; Helsinki

Bathing in a sauna is an important part of Finnish society and only a few public baths exist in Helsinki. To reinforce the sense of **community** and keep this vital part of Finland alive, Finland is also developing new ecological saunas for **visitors**, one of which is Löyly sauna[47]. With district heating, Löyly is warmed and its energy is provided by licensed solar and wind power. The building's cafeteria serves fresh food and seafood captured sustainably. The sauna is Finland's first FSC-certified building and Scandinavia's second. The certificate of the FSC (Forest Stewardship Council) proves the timber content comes from responsible forest management.

2.The traboules agreement; Lyon

2.The Traboules arrangement[48] is a win-win combination for **visitors** and **residents**. The ancient Traboules of Lyon are a form of passageway that dates back to the 4th century, running between buildings and courtyards, and is as old as the city itself. They boast architectural curiosities: spiral staircases, façades and galleries of priceless aesthetic and historical significance appear in the traboules. But, for safety purposes and to protect them from decay, owners and tenants were tempted to close them. However, considering its historical and cultural importance, the city of Lyon agreed to commit to the upkeep and cleaning and lighting costs of 31 key sites, as long as their owners agree to keep these traboules open to the public.

Image6.12 source :The traboules

3.Smart tourist trails; Málaga

[47] "Löyly Helsinki - an urban oasis occupying a stretch of beautiful." https://www.loylyhelsinki.fi/en/. Accessed 3 Jan. 2021.

[48] "Courtyards and Traboules of Vieux-Lyon - Lyon France." 1 Aug. 2019, https://en.lyon-france.com/Discover-Lyon/heritage-unesco/Renaissance/courtyards-and-traboules-of-vieux-lyon. Accessed 3 Jan. 2021.

The Málaga Tourism Authority has partnered with **local companies** to provide **tourists** with unique routes. This includes the Cicerones Málaga Confraternity Trails, which guide visitors through the most relevant spaces and activities involving confraternities; culinary trails that guide visitors through the gastronomic highlights of the city; the espeto trails that allow visitors to experience life in the traditional fishing additionally the most important route, The Picasso trail, which introduces the most famous son (Pablo Picasso) of the city to visitors.

4.Meet the Locals; Gothenburg

4.'Meet the Locals'[49] links tourists with locals and brings the tourist to the everyday life of Gothenburg and the Swedish lifestyle, personalizing the visitor's journey from a local perspective. The center of 'Meet the Locals' is Sharing. Locals and visitors will meet in various ways, such as a car sharing service, a tour of local landmarks, sharing surplus fruit from their garden for someone else to enjoy, making Swedish designers available for hire or staying at a local house to see what a Gothenburg home could look like. 'Meet the local' concept of sharing involves people who share their passions or hobbies, but also collective projects where resources can be used easily instead of purchasing through sharing and renting. The West Sweden Tourist Board has gathered groups, apps, Facebook groups and blogs to allow visitors and locals to meet in different ways, all having a common aim.

6.6 Key takeaways for developing the concept & Value :

This research of use cases and best practices in smart tourism gave a direction to ideate and conceptualize a smart city concept with the current use of technology in tourism. Some ideas were inspired and some were brainstormed during the aforementioned study, they are listed as follows:

Flow of tourists : Alternating routes suggestions are provided to locals when the roads are congested with tourists which directly helps spreading out the tourist crowd keeping their final destination the same. Less crowd is less damage to the infrastructure and the tourism destination management structures the (Carrying capacity) which is a certain number of people per destination. Which decides how many people can fit at one time. Some key actions taken after stagnation such as diversion, stopping, prioritizing to control the flow of tourists at a given destination.

[49] "Meet the Locals - Discover the daily life in West Sweden." https://meetthelocals.se/en/. Accessed 3 Jan. 2021.

Tourists will still get where they need to go but in a more enjoyable way, and see less crowded streets on their journey. Making it a better experience overall.

Pedestrianized zones - Getting rid of tour buses & vehicles which bring large masses of people from outside the regional zone in one giving time. Since it adds pressure on the carrying capacity in some vital sites. For smooth flow of tourist movement in a city, it is necessary to encourage local communities to adhere to tourism like how it's practiced in Zermatt, Switzerland. The tourists are not allowed to get their vehicles inside the hilly town of Zermatt. Local communities have their own transport to help tourists pick and drop to other feeder systems.

Social Equity : Locals to benefit from tourism by Developing social equity for locals living in the tourist area. In sustainable tourism it is necessary to think about people, planet and profits. It is really important to understand people, not only the visitors but the local communities. Without the local people tourism destinations will not be successful. There is a need to get the local people happy, and also create some kind of benefit for local people from tourism. Like for example providing free entries to museums and shrines for areas which gives them social equity for living in that area. Local people shouldn't compete with tourists. If the locals won't live there and indirectly create an authenticity vacuum, the meaningfulness is lost without the local people. Culturally significant places like Kyoto, Venice, Málaga need to start thinking about developing social equity to take care of the local people.

Direct subsidies from tourism profits can create higher social equity. Just like how For example the town in Tokushima called Kamikatsu, Its local government (Town office) subsidizes the compost machines for all residents of Kamikatsu so they can have hundred percent compost, which reduces the amount of waste they create in the town. By this we can assume if the locals get connected to the local governing bodies and practice smart subsidies on infrastructure support in the region on a whole. Example Subsides in having solar panels and producing efficient green energy and making more profit in total savings. (Solshare, Bangladesh).

Length of stay (LOS) : Sustainable tourism study shares that in the busiest tourist towns it is important to encourage tourists / visitors to stay more than two nights. It is learnt that the damage from tourism usually happens on the first night. Since all the work taken to arrange new room resources like new bedsheets, cleaning, sanitizing and using new products happens on the first day of service. Making tourists stay for more than 2 or 3

nights has the same damage as staying for 1 night. The increase in length of stay can recover more money by making them spend an additional night. The research shows that when people stay longer they also spend more money in the local area making it more beneficial for the local area. Basically slowing the travel experience for better experience for tourists and less damage being done to the host community. Furthermore Short Stay tax should be applied on tourists who stay for less than 2 days making them care about the destination evasively and can add more appeal to tourism management structure.

Chapter 07 :Design Brief

7.1 Concept : City Senses

Enabling a city to sense tourist interactions, movement patterns and behaviours with various IoT parameters such as light, sound, population density, 5g data usage etc, in real time and notifies the end users (Hosts/locals) the communities and business to make proactive actions to achieve sustainable tourism. City Senses is activated by deploying a smart city grid system at important city nodes where maximum human intervention is mapped.(see Theoretical Frameworks chapter)These nodes are marked from the study of tourist route patterns and analysis based on Haggett's mode[50].

It highlights the movements of tourists which creates a gateway for the system of nodes. These nodes are important places where the tourists will be arriving for example it could be a heritage building, or having cultural significance. When some parts of the route are either visited longer than others or have more visitors, a system of hierarchies is created. Most of the route structures would be based on hierarchies, either as primary attractions (Leiper, 1990) to visit or as main destinations. Yet hierarchies may also be seen as markets. The Sensors will be deployed at these specific spots and based on these hierarchies.

By understanding the tourist logic and its type, the data collection can be mapped and be applied from different behavioural studies. It works both ways for the tourists as well as the local doing business. The system would sense whether the visitor is *Allocentric* or *Psychocentric* in nature from Plog's Psychographic model. Accordingly it updates the local entrepreneur to trigger offers to its customer. And parallely the system generates a new route for the visitor which matches its behaviour and interests.

The city senses the tourist ethnicity, for instance, An Indian and a Chinese traveller are right outside a place where best beef stu is served. The system understands that the Indian tourist is a Hindu and would rather make the offer to the chinese tourist and close a deal with him. Overall the system senses each aspect and helps the visitor to get a best experience possible with the host communities. The constant flow of real time information help to develop the senses for the city to serve the end users i.e tourists & locals. The city sense works on the deployment of the smart grid which incubates information.

[50] "The tourist route system – models of travelling patterns." https://journals.openedition.org/belgeo/12406. Accessed 3 Jan. 2021.

7.2 The proposed solution : The Smart Grid

The proposal of deploying a smart grid in a city which collaborates with local communities and local business with the use of ICT technology to balance and manage the flow of tourists, visitors, travelers in a dynamic way.

What is the Smart Grid ?
A smart grid is a digital data layer between public services and public infrastructure. In this thesis the smart grid consists of 5 main technological parameters for the tourism industry. Each parameter has its own significance and its objectives to deliver in order to achieve a fully responsive tourism system.

IoT - Beacons BLE Sensors - Real time data (Deploying Seeds)
They are small, durable, low-cost, and low-power wireless transmitters that bring attention to their location by broadcasting a signal (Data packets) with a unique identifier at regular intervals. These battery operated beacons which are to be deployed all around the important nodes, feeder systems points of interest (POI). In the proposed system, the following types of sensors will be used which are available currently in market and fully reliable and tested by various industries and would be powered with solar cells as a secondary power back up:

1. Proximity Sensor - To chart out the movement pattern of the tourists.
2. Wifi Sensor - To plot tourist population and processing heat maps.
3. Noise Level Sensor - To depict the event type.
4. CO/ CO2 monitor Sensor - To monitor environment and air quality.
5. Luminosity sensors. - Energy consumption based on environment conditions.

The BLE sensors will be triggered with and without users using bluetooth connectivity.The sensor sends the normal raw data to the cloud for storage while performing location based services(LBS). This data can be archived and can be analysed by business analysts or by various other A.I based cloud platforms. They are used in many other situations like retail, inside a museum, airports etc.

Cloud - Storage of Data (Collecting)

The data is collected from the BLE sensors to a cloud device which could be portable as well as a virtual instance, e.g. Microsoft Azure[51] or Amazon AWS[52]. Sometimes the data is too small and BLE sensors would not require a lot of storage, in that case there are options like having a cloud beacon[53] which can be connected to the nearest wifi server. This data is collected and stored in

Big data - Tourist Behaviour analysis (Harvesting)

Big data plays a vital role in a smart city. To understand trends and needs, cities can process data from IoT devices and sensors. The proposal will decrease the congestion created by tourists and help visitors find a place according to their interests. Data can also minimize crime, enhance intelligent urban lighting and strengthen water and energy services. Big Data will allow business analysts to create data visualization in context of tourist flow using BI tools that can be shared and broadcasted on the web based API of 'City Senses'. This in return would be helping the local entrepreneurs to strategize their business and plan out the locations where they want to deploy the IoT BLE sensors around the city.

A.I - Prediction models & Product development (Executing)

As with time, many tourists and locals will start interacting with beacons applying them to explore and open new routes, The A.I would comprehend the tourist logic and start auto generating routes to provide maximum profit keeping the end users goal of having to deliver the best tourist experience to the visitors.

Blockchain - Security and Safety (Protecting)

Tourism subscription and Tourist ID : Before planning the journey the tourist has an option to subscribe to City Senses and create a Tourist ID. For security and privacy of the user, details such as name, ethnicity, country of origin is not needed in the system. He/she can create a an *Anonymous Avatar* by sharing his age and sex and places of interests. Once registered the tourist can alter its user preferences by sharing two variables into the system

1. Time
2. Budget

Based on these two parameters the smart grid will generate various predictive journey plans with respect to their duration / stay period in a particular country, region, city. By

[51] "Microsoft Azure." https://azure.microsoft.com/en-us/. Accessed 3 Jan. 2021.
[52] "Amazon AWS - Amazon.com." https://aws.amazon.com/. Accessed 3 Jan. 2021.
[53] "Introducing the New Cloud Beacon! - Kontakt.io." 13 Apr. 2015, https://kontakt.io/blog/introducing-the-new-cloud-beacon/. Accessed 3 Jan. 2021.

enrolling at this stage the user has feeded his intentions and motives into this system and hence the system is updated before the traveler has even reached the destination. This alerts the local communities and business around the journey planned by the tourist, giving them knowledge in real time and sufficient time to prepare for resources and present their hospitality to the probable tourists. This would help them in reducing their assumption, risk and indirectly saving resources.

This is the least explored component in this thesis but gives an overview of how the 5th pillar would work in tandem with the other mentioned technologies. The system also works by developing value to cultural probes like digital souvenirs etc (Theoretical Framework) would help to keep the cultural probes authentic and digitally alive. It has the potential of developing the concept of tour mining; when less explored routes are found and shared, the value is created by blockchain.

7.3 Flow of data in the Tourism Ecosystem

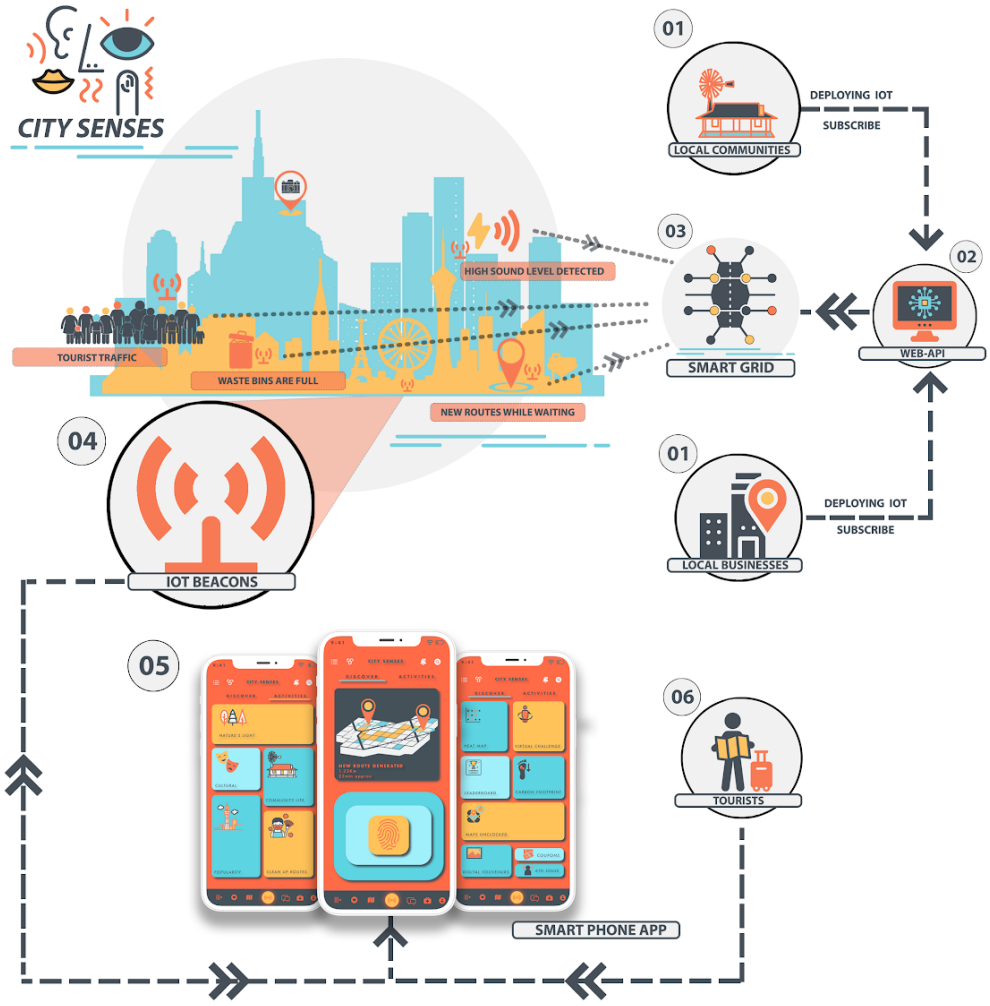


Figure 7.1 : The Flow of Data with stakeholders (Author)

The Tourism Ecosystem should have three prerequisites for the flow of data:

1. The IoT beacons should be planted for the local communities to select.
2. The City Sense App acts as a touch point for tourists. Thus it is to be taken as a fact that the application is used by the visitor to act as an actuator.
3. 5G connectivity speed is to be considered with zero or minimal network latency.

The flow of data in the proposed tourism ecosystem is as follows :
(Hypothetical Scenario)

Stage 1. - Subscribe and Deploy

The local businesses & the Local communities subscribe to the 'City Senses' web portal. They select and deploy the IoT beacon types by manually browsing through the city map from the website of 'City Senses'(Web-API). A series of requests are made by the local communities to activate IoT beacons near a city town hall.

Stage 2. - Transfer of Request by Web API

The smart grid takes the request from the web portal and activates the IoT beacons at the city town hall location.

Stage 3. Trigger Points

The IoT beacons near the city town hall start transmitting the local entrepreneur's event as data packets. And keep sending the data back to the smart Grid.

Stage 4. - Real time data

Since the IoT beacon is equipped with proximity sensors, It records the number of tourists passing by the city hall at a given day and time. This data can be seen by the local entrepreneur in real time.

Stage 5. - Understanding Insights

The following day out of 234 tourists only 102 tourists showed interest. This was recorded by the city sense smart phone application. As the tourists were notified when they passed the city town hall route and only 102 tourists tapped on the event via their smartphone. The rest chose some other event or activity.

Stage 6. - Monitoring Results

Out of 102 only 32 tourists showed real interests, since these 32 tourists took a detour and reached the event hosted by the Local entrepreneur in the last one hour.

Stage 7 - Strategizing the next plan of action.

The local entrepreneur quickly changes the IoT Beacon location from the portal towards the bus stand as he gets a prompt notification about a heavy tourist spot that is going to be triggered soon due to the arrival of 3 buses from Spain. By taking this action he received more customers than before and tourists who changed their routes got to see a very unique route as it has a low density of tourists.

This is one of many scenarios of the local communities and local business, enabling them to use the IoT Based community tourism to achieve their business targets and more importantly giving the tourists the best local experience.

7.4 Main Features of the touchpoints App & Web API

The 'City Senses' Web Based API - Dashboard for the **locals communities** and **Local Businesses.**

A. Main Features : Web API & DashBoard

1.The users subscribe by selecting and deploying IoT BLE beacons by interactive map. The local entrepreneurs can mark areas and select types of beacon data they need to carter to their personal businesses.It gives the local hosts a flexible control of technology as they get the opportunity to analyze their markets strategy.

It provides an opportunity to use the infrastructure at their own will and without to worry about the maintenance costs. Local governments can subsidize this subscription package to create a social equity for the locals who are away from the hot tourist spot, where there is under tourism and tourists bypass them due to the unawareness of the location.

2.Create virtual challenges for the tourist and deploy those challenges to attract tourists towards their business products, thereby getting the tourist engaged to pursue the virtual challenge interactively and providing them with digital souvenirs as incentives for completing the tasks.

3.The local communities and local entrepreneurs can create a digital enterprise for having a local conference, discussions, and can work in collaboration with themselves to get them connected to the local governments to share demands and requests.

4.Local businesses can post advertisements via BLE beacons in the cloud space of the tourist routes.

5.They can control movement of tourist flow, if they (Locals) sense there is heavy tourist traffic or stagnation at a given touristic site. They can optimise the flow by 3 methods -

Diversions of routes or blocking or closing the routes if the carrying capacity has exceeded the limit or prioritizing the flow, by allowing access to few individuals at a time.

6.Every local entrepreneur and the local residents would have access to open tourist real time data to monitor results and share insights. This would be open source and could share insights to discuss strategies before subscribing to the smart grid.

7. The local communities will have access to important insights shared by their probable customers, such as visitor's ethnicity, physical disabilities and interests. No other Identifications will be needed or shared with the end users.

B. The 'City Senses' Smart Phone application for the tourist and visitors.

Main Features : SmartPhone Application

It has two main sections namely the ***Discover*** & ***Activities***. The detail of each sections is explained as follows:

Image 7.4 :City Sense Application - Discover page. (Source : Author)

1.Discover Section.

- Heat Map : Showcases the population densities across the city. It has sound filters to see where the noise level is high or low. Helping the visitor to make decisions according to its needs. It shows the maximum carrying capacity of a specific destination. The tourist can avoid long standing ques and generate a different route and get connected to a local community.

- Virtual Challenges : Like virtual races, the host communities have generated heritage walks, which the visitor can enroll into and they have to complete by walking on a route shared by the community. It is necessary that the task needs to be completed by using no modes of transport, since it is tracked by the application to get awarded authentically post the challenge is completed. The virtual challenge makes tourists walk more and explore places which are off beat and lesser known. On its way during the challenge the visitor has an opportunity to find rare virtual postcards which can be monetized as a digital cultural probe (collectable). Also it makes the tourist stay longer as these tasks, challenges are long, indirectly making the tourist spend more time locally.

- Leaderboard : This shows the tourist its own ranking which is reflected upon his activities and interaction with the local communities spending money on local businesses, retail, food, goods etc which are developed and made locally. This score would help with further discounts in buying authentic products, free access to some heritage sites. This encourages sustainable community growth in the region and doesn't allow cultural erosion.

- Carbon Footprints % :This calculates the tourists carbon footprint from the day of arrival to its day of departure. It is measured by what mode of transport taken, type of transport, restaurant takeaways, length of stay etc. If the score is less, then the visitor has a chance to avoid the short stay taxes.

- Maps Unlocked : As the traveller explores the city new maps unlock. The whole city map will always be accessible but more detailed maps would unlock when the user enters the event space. For example the tourist enters the City Zoo, the detailed map of the zoo and its information will be only available when the traveller has paid for entry and then can use it to explore even after his journey has ended. Same goes for museums and churches. This would be adding value to heritage sites and making people inquestitive to enter the premises and experience it.

- 6th Sense : This feature works when the visitor wants to generate a new route and is looking for an instinctive plan. The application uses tourist logic and suggests something which he/she could participate in. For example if the user has just finished having his lunch, the application would not suggest an interesting place which related to gastronomy pleasures. It would provide a route where the traveler could be more relaxed or suggest a local retail store. It uses the 6th senses which means being intuitive.

- Digital Souvenirs : Whenever the tourist takes a detour or follows a real time event from the application, it has a chance to collect a digital souvenir, whilst reaching its chosen destination. These are generated by the local hosts and our very event specific making it a must-have rare collectable.

Image7.4.1: Activities Page (Source : Author)

2. Activities Section

- Natures Light : It showcases the natural beauty of the city and highlights the surroundings with interactive routes. To find these spots are extremely difficult since its based on time, weather conditions and season. But the users would be notified if there is a possibility to catch them.

- Cultural :Many tourist squares have street artists and performers and they are an instant crowd puller but at times the visitor joins the performance midway and is not able to follow these street artists again. The application understands this issue and solves it by notify and tracking these street artists. The local street artist checks in by updating the IoT beacons, letting the tourist know its location and time beforehand.

- Popularity : The list of local places such as cafes, breweries, retail shops, restaurants which are categorised based on their popularity by the local residents and communities.

- Community Life : These are events hosted by the local communities which are theme based and very periodic in nature. The visitor can book and live with them at any time of arrival. They act as helpers and they mostly earn on donations made by the tourist. The reason why they kept the system this way is to entertain tourists with ease.

- Clean up routes : When the locals see their cities polluted due to a major tourist event (FIFA, Carnivals, Festivals,) they can call for an immediate help to the tourist to voluntarily help them for a clean up route. In exchange they share cultural significance by their stories, food and personal memories, while keeping most of the experience anonymous.

7.5 Summary

The characteristics of the Smart Grid - City senses portal & Application.

- It is customizable, highly personalized and easy to access.
- It helps local communities make proactive decisions and not adaptive.
- The prediction models and statistics are generated real time with high accuracy and not assumed.
- The stakeholders can monitor their results and make decisions instinctively.
- The platform can share tourist movement patterns and behaviour insights.
- It can offer a predictive forecast of the tourist population to the local business, which helps them in saving resources and reducing wastage.
- It brings tourists closer to the local communities and hosts them with digital interactions, incentives, competitions and gamification.

- The grid understands the tourist type and offers an interactive travel experience independent of any tourist ethnicity or of physical disabilities.
- It matches the expected experience with the absorbed experience for tourists.
- It requires less maintenance and creates a platform for more employability in the tourism ecosystem.
- Offers a sustainable travel experience for local and international tourists.

Chapter 08 : Conclusion

8.1 Impact of IoT in Tourism

The IoT has already begun its influence in the industry as shared in the best practices chapter and, with the tourism industry is currently restarting and it is highly likely that it will be booming in the forthcoming years. To meet the speed of being smartly linked with its guests in transportation or attraction of hotels all the time would be the next parameter. The technology is still in the early stages of creation and execution. The effects are both positive and negative, with some complexities as well (Verma and Shukla, 2019).

8.2 Positive outcomes

This thesis showcases how IoT would help in presenting the accurate data collection, acute customization of user access, smooth travel, accessibility and smart solution to sustainability goals, energy saving, generating new routes, and exploring business possibilities thorough understanding of users by real-time data analysis are some of the positive impacts discussed throughout.

The forecasting and prediction will not be based on old data, but will be available in real time for instant decisions (Wyman, 2015).This paper shares that IoT will improve customer experience and the performance of utilities and service providers can be benchmarked and quality can be easily tracked. The local entrepreneurs can remain more focused on customer care, despite keeping the count of guests / visitors to achieve their business targets in real time.

This would include a higher level of reliable, effective and scalable services by cost savings through effective enforcement and measured preparation based on improved tourist

movements ,behaviour forecasting and trend analysis in a transparent open sourced user-enabled environment.

8.3 Negative Effects

The negative impacts will be data security due to cyber attacks and security breaches, technological and regulatory challenges related to data sharing and collection, installation costs and interoperability, device replacement if any, harsh uncontrolled environment, self-sustainability of sensors, overdependence on sensors, data security, volume data management, data authenticity and pre-sensing tests and trainings without prior knowledge could affect the outcomes negatively.

The data can not be used until it is properly interpreted and appropriate steps are taken to satisfy the desired requirements. The huge changes in the industry will make the organizational structures that need to be changed and controlled at pre-and post-installation efficient. The transition from current travel habits will involve a well-thought-out change of management not just to ruin the experience of travel by training IT resources and tourism technologies.

8.4 Future Work in Digitalization

The continuous improvement of technology will show the connected devices to be part and parcel of the industry and the data will be gathered, refined and further used by all stakeholders to support tourists with all their basic and niche requirements. This will make it easier to interact and define the necessity, to consider the actions and the shopping / traveling / exploring patterns of the visitor. The data, if analyzed in the correct way and needed to be implemented in the correct form, may give rise to wonders in the industry. The aggressive implementation of all stakeholders would ensure a broader development of the industry in a more digital and integrated manner. With wearable technology developing at a fast pace, the future work would be the integration of this platform and having access

to real time data visually to the end users via wearable hardware, example google glasses, Apple glasses[54].

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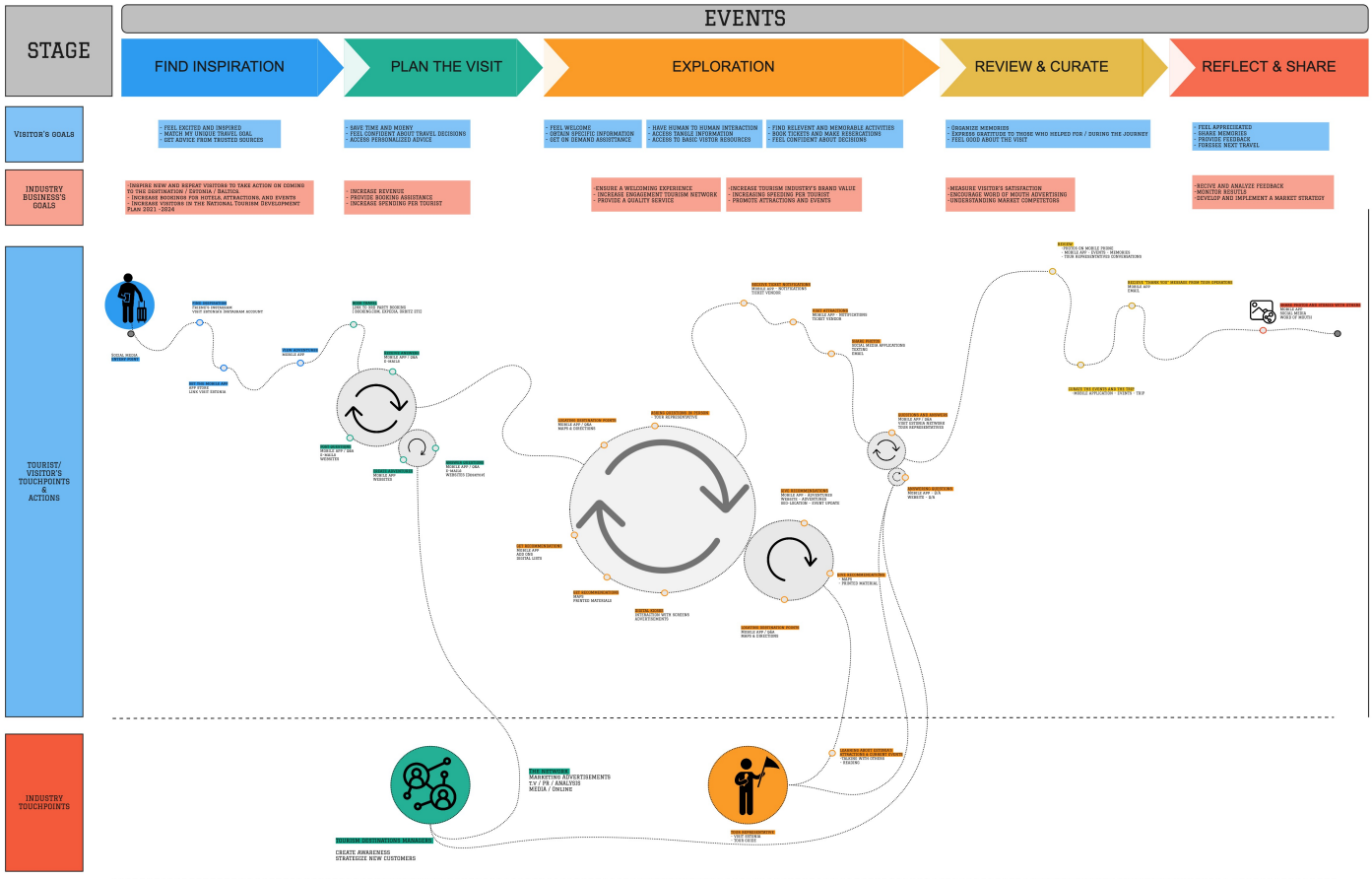
APPENDICES & CERTIFICATES

APPENDIX 2


STAGE
EVENTS
FIND INSPIRATION
PLAN THE VISIT
EXPLORATION
REVIEW & CURATE
REFLECT & SHARE
VISITOR'S GOALS
- FEEL EXCITED AND INSPIRED
- MATCH MY UNIQUE TRAVEL GOAL
- GET ADVICE FROM TRUSTED SOURCES
- SAVE TIME AND MOENY
- FEEL CONFIDENT ABOUT TRAVEL DECISIONS
- ACCESS PERSONALIZED ADVICE
- FEEL WELCOME
- OBTAIN SPECIFIC INFORMATION
- GET ON DEMAND ASSISTANCE
- HAVE HUMAN TO HUMAN INTERACTION
- ACCESS TANGLE INFORMATION
- ACCESS TO BASIC VISITOR RESOURCES
- FIND RELEVENT AND MEMORABLE ACTIVITIES
- BOOK TICKETS AND MAKE RESERVATIONS
- FEEL CONFIDENT ABOUT DECISIONS
- ORGANIZE MEMORIES
- EXPRESS GRATITUDE TO THOSE WHO HELPED FOR / DURING THE JOURNEY
- FEEL GOOD ABOUT THE VISIT
- FEEL APPRECIEATED
- SHARE MEMORIES
- PROVIDE FEEDBACK
- FORESEE NEXT TRAVEL
INDUSTRY BUSINESS'S GOALS
- INSPIRE NEW AND REPEAT VISITORS TO TAKE ACTION ON COMING TO THE DESTINATION / ESTONIA / BALTICS
- INCREASE BOOKINGS FOR HOTELS, ATTRACTIONS, AND EVENTS
- INCREASE VISITORS IN THE NATIONAL TOURISM DEVELOPMENT PLAN 2021 - 2024
- INCREASE REVENUE
- PROVIDE BOOKING ASSISTANCE
- INCREASE SPENDING PER TOURIST
- ENSURE A WELCOMING EXPERIENCE
- INCREASE ENGAGEMENT TOURISM NETWORK
- PROVIDE A QUALITY SERVICE
- INCREASE TOURISM INDUSTRY'S BRAND VALUE
- INCREASING SPENDING PER TOURISTS
- PROMOTE ATTRACTIONS AND EVENTS
- MEASURE VISITOR'S SATISFACTION
- ENCOURAGE WORD OF MOUTH ADVERTISING
- UNDERSTANDING MARKET COMPETITORS
- RECIVE AND ANALYZE FEEDBACK
- MONITOR RESULTS
- DEVELOP AND IMPLEMENT A MARKET STRATEGY
TOURIST/ VISITOR'S TOUCHPOINTS & ACTIONS
INDUSTRY TOUCHPOINTS
CREATE AWARENESS
STRATEGIZE NEW CUSTOMERS

APPENDIX 1

Tourist / Citizens

Dreaming -
***moments*: " I want to get away"**

Decide on where to go for holiday.

Touch Points- Search ,Social Media, word of mouth, Destination websites.

Planning
moments : "I need to make a plan" "I need time to make a plan"

Confirm the destination and tourism activities that will suit their travel desires.

Touch Points : Social media, reviews websites, aggregator website, word of mouth, References

Booking
Moments : "Lets book this now!"

Confidently decide and confirm the base of their itinerary and book major products (Flights / accommodation / Activities / Attractions)

Touch Points : Branded websites, aggregator websites, Tour agencies, agents, Travel and trade websites, Embassies.

Experience
Moments:" Can't wait to explore!"

Continue to book experience wish-list in destination. Ensure they have the best time possible. Share story with family and friends.

Touch Points : Social Media, Review websites, Instagram, snapchat facebook.

Sharing
Moments:" I had the best time of m my life"
Share their memories and experiences to friends and review and provide a feedback to new tourists. Sharing story to massage their ego

Touch Points :Social Media, Review websites, Instagram, snapchat facebook.

Tourism Industry

Identifying Market Targets
Types of Tourists
Domestic Vs International
Family, Teenagers, Honeymooners, adventure, active holiday makers etc.

Identifying customer's Needs and wants.

Creating demand and providing it.

How to get people / tourists / travelers motivated for a holiday trip?
How to understand their wants and offer a personalized activity?

Match tourism Needs to products and resources

Connect the dots within the resources.

The products chosen are coherent with target we want to attract?

Study the competitors

Thinking differently

What are other destinations doing on the same products / targets?
What are my direct competitors doing?
Which products are developed by my competitors.

Develop and implement a market strategy

To hold or Increase marker share.

Develop a marketing plan in identifying tourist experience goals and analyze timing and budget.

Monitor Results

Understanding user feedback and analyzing the outcomes of the travel journeys.

Try to work on and study user experiences to map new enhanced experiences for the next user.

Enhance Visitor satisfaction

To control and mange quality in the destination.

To plan and control new developments in tourism Infrastructure.

Authorities /

Economy

Investments & Funding

Local govt : eg- Tallinn City
Wants to know how tourism is performing and how well it contributes to the local development goals.

National Govt : Wants to know the economical & social value of tourism and how it contributes to national development goals.

Key sectors : Capital Investments, employment, trade, Innovation, Savings, knowledge Economy.

Governance

Openness & public participation

Governance and social & gender equality , Income consumption and equality.
Key sectors : Tourism Policy and Regulations

Environment

Sustainable Resource Use
Electric cars, Solar based technology, No plastic.
Key Sectors : Water soil and Noise Energy, CO2 emissions, Air quality.

Infrastructure & Mobility

Shelters, dwellings, movements.

Key Sectors : Sanitation, Electricity, Health Infrastructure, Piped water, Building.

Living

Safety and Hygiene, Community integration.

Key Sectors : Education, Public safety and security, Health.

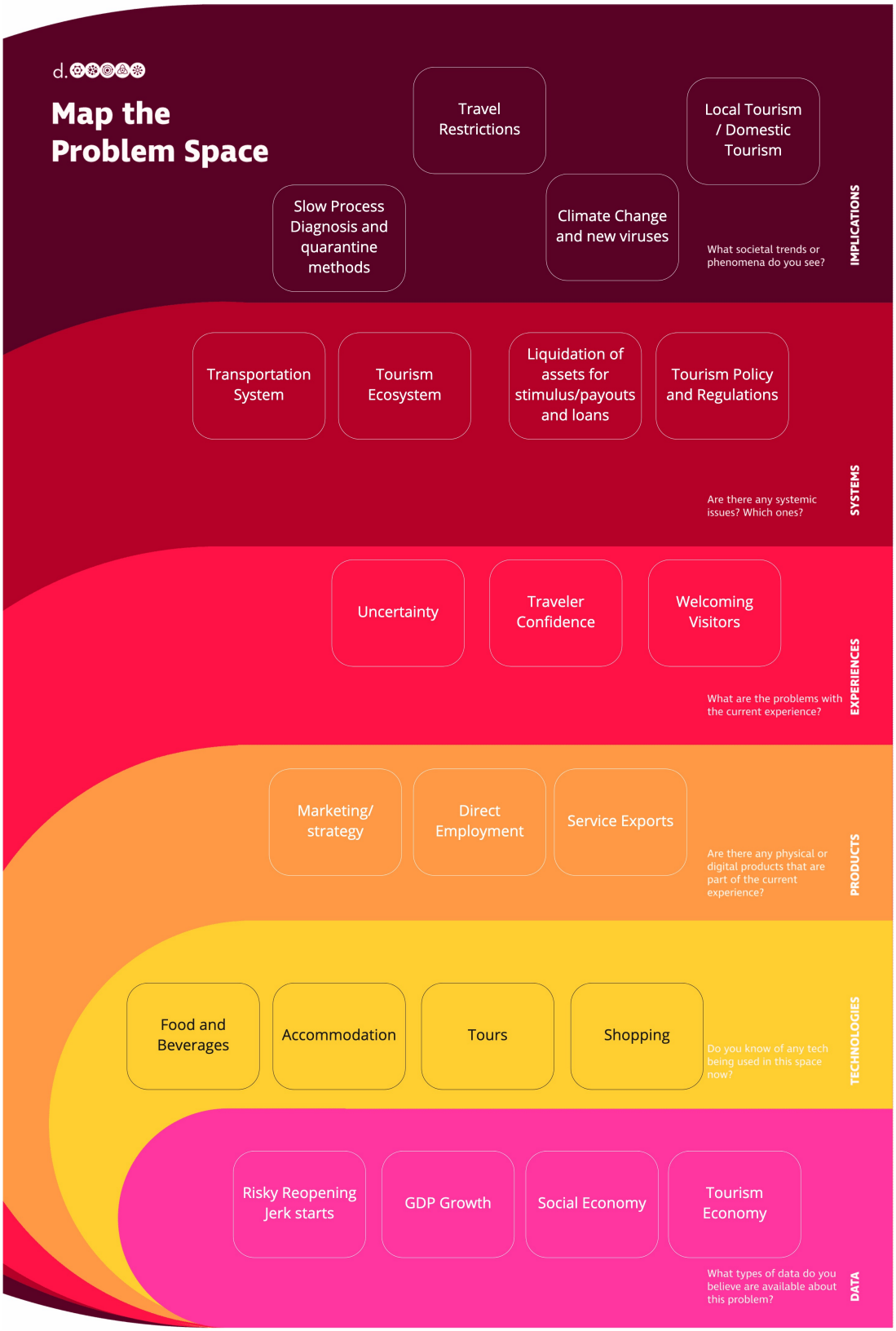
ICT Infrastructure

Network and Access to 4G/5G Data to tourist and communities.

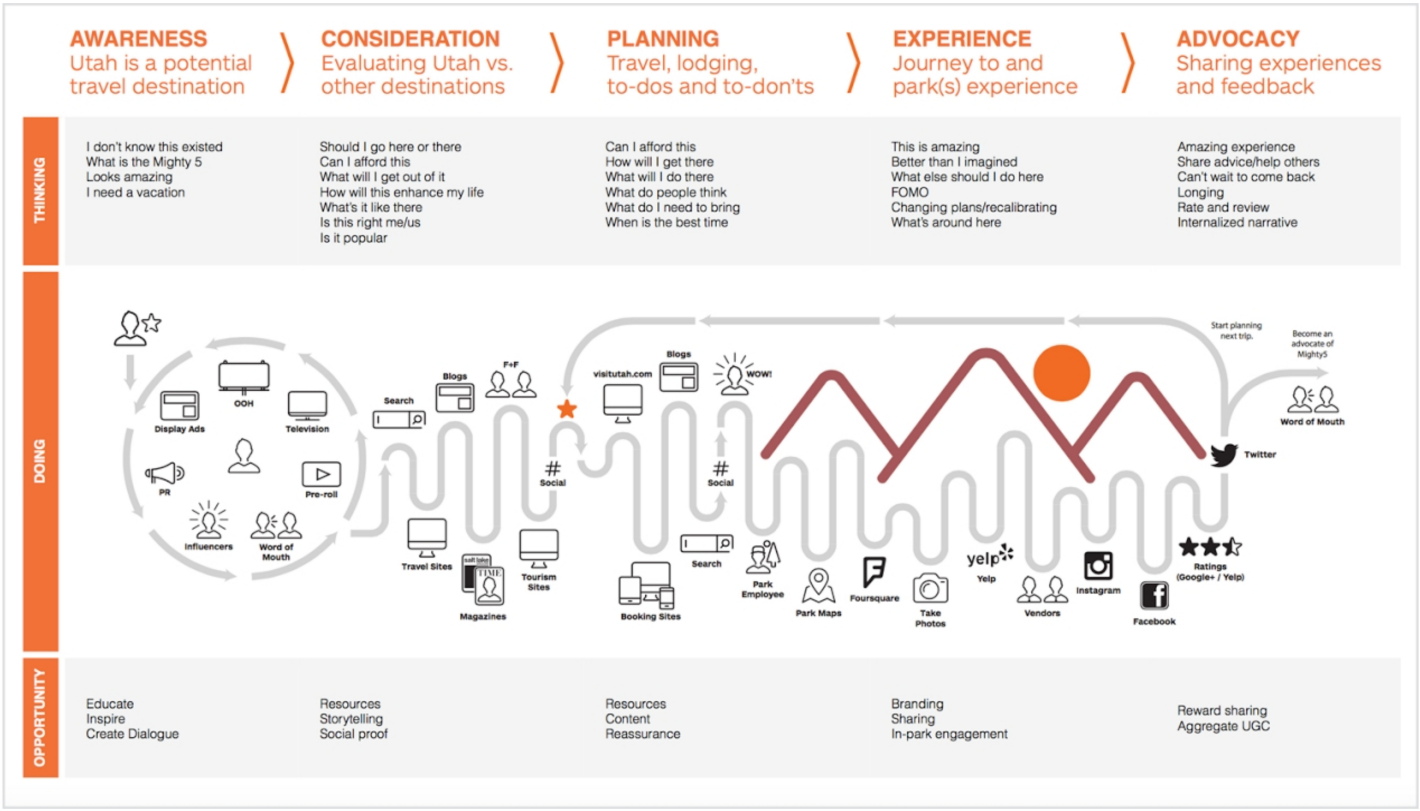
Key Sectors :
Services and platforms, Information and security & privacy
Electromagnetic field.

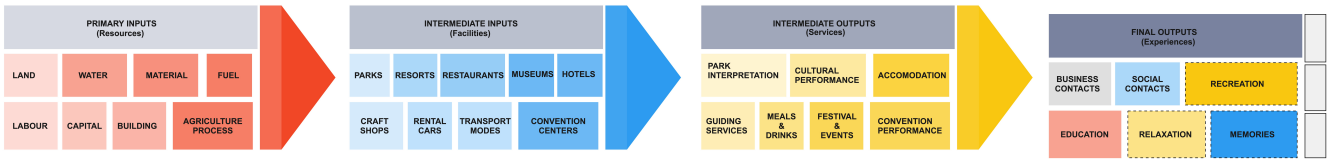
GOALS OF STAKEHOLDERS

APPENDIX 3


d.
Map the Problem Space
Travel Restrictions
Local Tourism / Domestic Tourism
Slow Process Diagnosis and quarantine methods
Climate Change and new viruses
What societal trends or phenomena do you see?
IMPLICATIONS
Transportation System
Tourism Ecosystem
Liquidation of assets for stimulus/payouts and loans
Tourism Policy and Regulations
Are there any systemic issues? Which ones?
SYSTEMS
Uncertainty
Traveler Confidence
Welcoming Visitors
What are the problems with the current experience?
EXPERIENCES
Marketing/ strategy
Direct Employment
Service Exports
Are there any physical or digital products that are part of the current experience?
PRODUCTS
Food and Beverages
Accommodation
Tours
Shopping
Do you know of any tech being used in this space now?
TECHNOLOGIES
Risky Reopening Jerk starts
GDP Growth
Social Economy
Tourism Economy
What types of data do you believe are available about this problem?
DATA

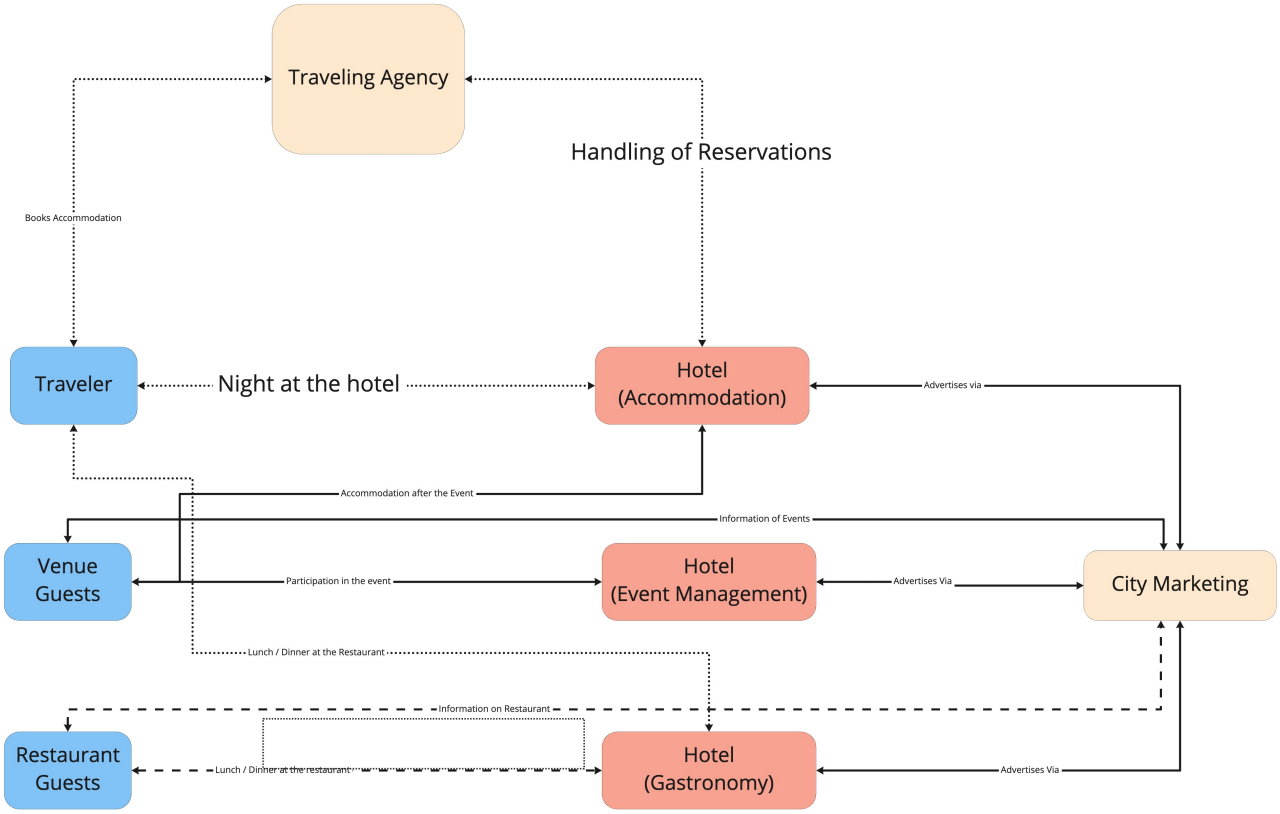
APPENDIX 4


AWARENESS
Utah is a potential travel destination
CONSIDERATION
Evaluating Utah vs. other destinations
PLANNING
Travel, lodging, to-dos and to-don'ts
EXPERIENCE
Journey to and park(s) experience
ADVOCACY
Sharing experiences and feedback
THINKING
I don't know this existed
What is the Mighty 5
Looks amazing
I need a vacation
Should I go here or there
Can I afford this
What will I get out of it
How will this enhance my life
What's it like there
Is this right me/us
Is it popular
Can I afford this
How will I get there
What will I do there
What do people think
What do I need to bring
When is the best time
This is amazing
Better than I imagined
What else should I do here
FOMO
Changing plans/recalibrating
What's around here
Amazing experience
Share advice/help others
Can't wait to come back
Longing
Rate and review
Internalized narrative
DOING
Display Ads
OOH
Television
PR
Pre-roll
Influencers
Word of Mouth
Search
Blogs
F+F
Travel Sites
Magazines
Tourism Sites
Social
visitutah.com
Blogs
WOW!
Social
Search
Booking Sites
Park Employee
Park Maps
Foursquare
Take Photos
yelp
Yelp
Vendors
Instagram
Facebook
Ratings (Google+ / Yelp)
Twitter
Start planning next trip.
Become an advocate of Mighty5
Word of Mouth
OPPORTUNITY
Educate
Inspire
Create Dialogue
Resources
Storytelling
Social proof
Resources
Content
Reassurance
Branding
Sharing
In-park engagement
Reward sharing
Aggregate UGC

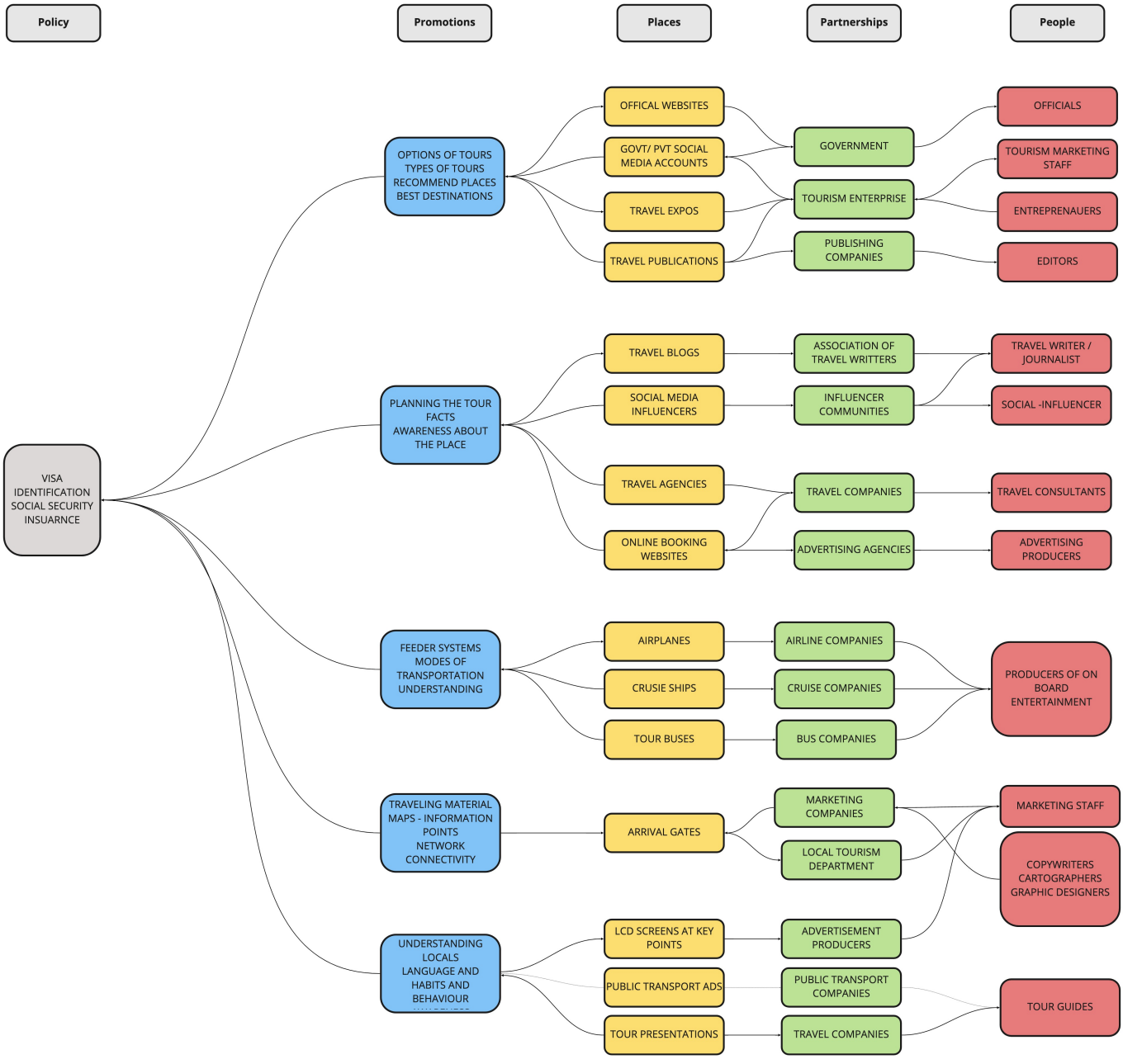


APPENDIX 5

PRODUCTION SYSTEM : TOURISM


Traveling Agency
Handling of Reservations
Books Accommodation
Traveler
Night at the hotel
Hotel
(Accommodation)
Advertises via
Accommodation after the Event
Information of Events
Venue
Guests
Participation in the event
Hotel
(Event Management)
Advertises Via
City Marketing
Lunch / Dinner at the Restaurant
Information on Restaurant
Restaurant
Guests
Lunch / Dinner at the restaurant
Hotel
(Gastronomy)
Advertises Via
Consumers / Customers
Hotel / Local Business
Third parties

APPENDIX 7


Policy
Promotions
Places
Partnerships
People
VISA
IDENTIFICATION
SOCIAL SECURITY
INSUARNCE
OPTIONS OF TOURS
TYPES OF TOURS
RECOMMEND PLACES
BEST DESTINATIONS
OFFICAL WEBSITES
GOVT/ PVT SOCIAL MEDIA ACCOUNTS
TRAVEL EXPOS
TRAVEL PUBLICATIONS
GOVERNMENT
TOURISM ENTERPRISE
PUBLISHING COMPANIES
OFFICIALS
TOURISM MARKETING STAFF
ENTREPRENAUERS
EDITORS
PLANNING THE TOUR
FACTS
AWARENESS ABOUT THE PLACE
TRAVEL BLOGS
SOCIAL MEDIA INFLUENCERS
TRAVEL AGENCIES
ONLINE BOOKING WEBSITES
ASSOCIATION OF TRAVEL WRITTERS
INFLUENCER COMMUNITIES
TRAVEL COMPANIES
ADVERTISING AGENCIES
TRAVEL WRITER / JOURNALIST
SOCIAL -INFLUENCER
TRAVEL CONSULTANTS
ADVERTISING PRODUCERS
FEEDER SYSTEMS
MODES OF TRANSPORTATION
UNDERSTANDING
AIRPLANES
CRUSIE SHIPS
TOUR BUSES
AIRLINE COMPANIES
CRUISE COMPANIES
BUS COMPANIES
PRODUCERS OF ON BOARD ENTERTAINMENT
TRAVELING MATERIAL
MAPS - INFORMATION POINTS
NETWORK
CONNECTIVITY
ARRIVAL GATES
MARKETING COMPANIES
LOCAL TOURISM DEPARTMENT
MARKETING STAFF
COPYWRITERS
CARTOGRAPHERS
GRAPHIC DESIGNERS
UNDERSTANDING
LOCALS
LANGUAGE AND
HABITS AND
BEHAVIOUR
LCD SCREENS AT KEY POINTS
PUBLIC TRANSPORT ADS
TOUR PRESENTATIONS
ADVERTISEMENT PRODUCERS
PUBLIC TRANSPORT COMPANIES
TRAVEL COMPANIES
TOUR GUIDES


Tourism / Travel
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Geo Economics
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Aerospace
Travel & Trade
Agile Governance
Global Governance
COVID-19
Migrations
Geopolitics
Climate Change
Investments
Civic Participation
Global Risks
Security Risk
Blockchain
Global Health
International Security
Internet and Water
Digitilzation
Interent Governance
Internet of Things
VR /AR
Digital communications
Digital Economy and society
AI & Robotics
Behavioural Sciences
Cyber Security
Infrastructure
Future of Mobility
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Sustainability
Electricity
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