Introduce StarDetect to Market:

A Roadmap Towards Small Satellite Application in Smart Tourism

Master Thesis
Strategic Product Design
by Qian He

TU Delft | StarDetect

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A roadmap towards small satellite application in Smart Tourism

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Acknowledgment

Presented to you is my graduation thesis from the Master of Strategic Product Design program at the Delft University of Technology. Looking back on the past two years, there are happiness and regret. The happiness is that my study at the Industrial Design Engineering faculty has increased my ability and allowed me to explore a lot of new fields. The regret is that due to COVID, I was only able to study face-to-face in the faculty's classroom for just a half year. Regardless, it is still encouraging to be able to present my knowledge and experience from these two years with this graduation report. I would like to take this opportunity to thank the people who have accompanied me during this project.

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Finally, I would like to say that, hope you will like my report and enjoy reading it!

Executive Summary

The aerospace industry's global market has risen considerably in recent years. Since small satellites are lowering the cost and difficulty of entering space while disrupting the government-led low cost-effective market model, new players could enter the satellite industry and compete with established businesses.

StarDetect, founded in Beijing in 2020, is one of the new players, a startup focusing on small satellite technology. StarDetect is developing functional payloads and providing customised services within the needs of space astronomy or earth geography observation. To provide competitive satellite data and services to clients, StarDetect has established a three-phase product strategy, which are the space science standardised payload, on-orbit artificial intelligence processing platform, and global real-time sensing service.

However, due to the relatively short and immature development of China's small satellite commercial industry, the current market has a limited number of satellite service targets, and most of the end-users are government and research institutes. StarDetect's challenge is figuring out how to reach out to more potential customers and develop new satellite application scenarios. Therefore, the purpose of this thesis is to investigate a new commercial market for StarDetect and formulate a strategy for its entry.

The thesis employed the double diamond design process to provide structure for the creation process, and obtain solutions by using iterative analysis.

First, Smart Tourism was defined as a new market to enter after a thorough understanding of small satellites and an extensive exploration of business environment trends. Then, the possibilities of satellite applications in smart tourism, as well as the challenges of entering the market, were identified.

In order to find a way to enter the market, SWOT analysis was applied to uncover strengths and opportunities for satellite technology in smart tourism, and concluded that satellites are much suitable for more remote and less developed areas, as well as being able to offer cheaper and more accessible solutions. Afterwards, further insights for satellite applications were gathered from brainstorming sessions and future travel trends research, thereby three design directions for entry strategy is generated. The direction of supporting sustainable tourism in national parks was chosen after assessment.

Lastly, to clarify specific steps for entering, the possibilities for satellite application in the National Park scenario were further investigated through a literature review and interviews with experts, and all findings were compiled into a 2x2 matrix for integration. As the result, a new future vision was generated: "StarDetect supports sustainable and safe travel with reliable and affordable satellite services.", and three horizons toward the vision were defined.

The first step towards the future vision is the Destination Discovery Service based on mature techniques, which is designed to meet the needs of tourism project developers for quick access to destination information. The goal of adopting this portfolio is to lower the risk of entering new markets in an easy implementation and low investment way. As an added benefit, a service that visualizes destination information is available. To acquire new clients, horizon 1 use a price penetration strategy.

In Horizon 2, The destination environmental monitoring service is introduced with the goal of increasing sales with new products, this service will meet the demands of management organizations for monitoring the sustainability of natural destinations. Meanwhile, a website providing sustainable travel information to responsible travellers is offered to develop StarDetect's brand recognition, and build connections with potential consumers in preparation for Horizon 3's B2C business.

Finally, Horizon 3 continue to grow market segments by launching a new range of business-oriented Disaster warning and Safety monitoring services. In order to seize new business opportunities, StarDetect will also directly supply consumers with a one-stop service platform to support outdoor travellers' adventures in remote areas.

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Chapter 1

INTRODUCING THE PROJECT

In this chapter, the project background will be introduced and the overall goal and assignments of this thesis will be determined. First, briefly discuss the small satellite market and introduce the StarDetect. Then, the problem definition and design goals will be described, and several research questions representing the iterative design process will be provided. Lastly, the overall approach of this thesis will be explained, and the individual ambitions of this project will be introduced.

Content

1.1 Project Background

1.1.1 Small Satellite Market

In recent years, the global aerospace industry market has grown rapidly, reaching 350 billion US dollars in 2019 (Facchinetti, 2016), and is expected to grow to more than 1.1 trillion US dollars in 2040 (Saeed et al., 2020). There is no doubt that the future of the aerospace industry will be amazing, and small satellites will play an important role in the fast-growing market. This is because small satellites have broken the government-led low cost-effective model by reducing the difficulty and cost of entering space, allowing more players to enter the aerospace industry market and be able to compete with traditional enterprises in the field. It can be said that the development of small satellites has revolutionised the global space industry, prompting new enterprises and innovative business models to emerge in the traditional aerospace industry, leading people into the commercialised "new space" era (Facchinetti, 2016).

At the same time, with the development of digitization and geographic information industry, the demand for satellite services in the market is also increasing, including smart cities, resource surveys, disaster prevention and mitigation, automatic navigation, shared bicycles, etc (Dan, 2020). Therefore, the market for small satellites is also growing rapidly. According to data from the United Nations Office for Outer Space Affairs in 2020, more than 20,000 commercial satellites will be launched in the next 5 years (Logue & Pelton, 2020). And the global small satellite market is expected to soar from US$2.1819 billion in 2019 to US$23.572 billion in 2029 (Yao, 2019). Therefore, many countries in the world like United States, European countries and Japan have noticed the application value and commercial potential of small satellites, and have released plans to stimulate new businesses (Yao, 2019). Also, China has issued the "Medium and long-term development plan for national civil space infrastructure" in 2015 to encourage private

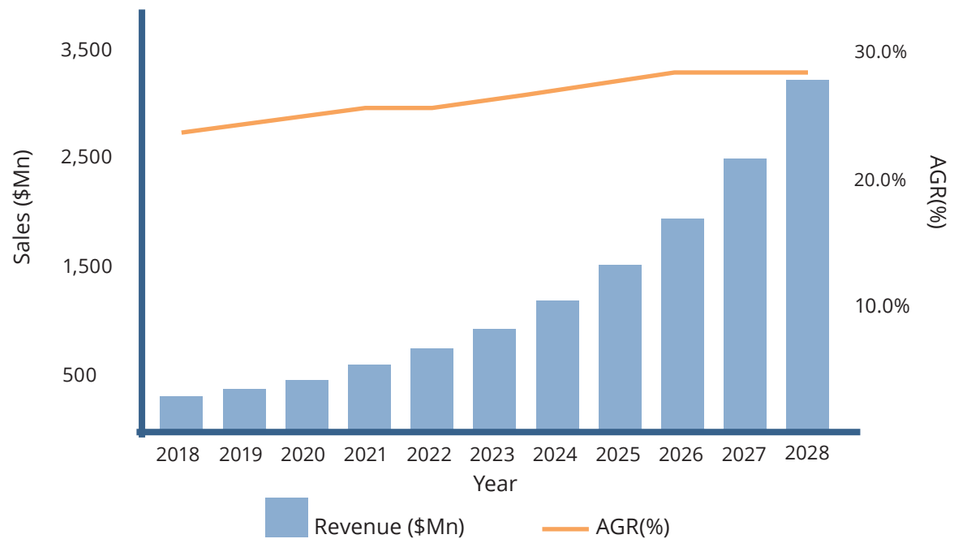


Figure 1. Small Satellite Market Forecast 2018 -2028 (US$n, Total Market Sales AGR %) (Visiongain, 2021)

enterprises to enter the aerospace field and promote innovative satellite applications (HuaXi Securities CO.,LTD., 2020). However, although with the opening of policies and the reduction of costs, China's business environment of small satellites has become gradually mature and more players began to join (Orient Securities, 2019), the current end-user of small satellite is still mainly governments and research institutions (Dan, 2020). This is because until 2015, China's satellite industry was dominated by the government and mainly relied on national investment for development (Dan, 2020). Due to the short commercialisation time, China's small satellite market still has problems such as weak innovation capabilities, limited service targets, fewer application scenarios, and unclear business models (Dan, 2020). In order to better apply and promote small satellites in the commercial field, it is still necessary to better introduce the small satellite to the public and further explore the potential application scenarios and users.

1.1.2 About StarDetect

This graduation project was conducted in cooperation with StarDetect. StarDetect is a startup company focused on small satellite technology, aiming to provide customers with competitive satellite data and services to drive the world forward with satellites.

StarDetect was founded in April 2020 and is located in Beijing, China. After sensing a huge market demand for commercial satellites, StarDetect's founders established the company and began developing functional payloads (carrying equipment placed on spacecraft) to provide customized services for customers with space astronomy or Earth geography observation needs.

So far, StarDetect has completed the development and launch of multiple satellite payloads. StarDetect launched their first small satellite together with Tsinghua University to detect space astronomy at the

Figure 2. StarDetect team and their satellites

end of December 2020. And it has long-term cooperation with leading companies in the small satellite industry such as Tianyi Research Institute and Nebulas to provide AI payload platforms for about ten satellites that will be launched in 2021.

StarDetect positions its core technologies as low-cost, standardized satellite payload development and high-performance, low-power in-orbit AI remote sensing image key feature extraction. Their vision is to build a global satellite in-orbit real-time service platform that aims to shorten the value chain between data and customers to provide high-value information and services.

To achieve its goals, StarDetect has formulated a three-phase product strategy. Phase 1 focuses on developing standardized payloads to provide space science data collection and intelligent processing services for scientific research and military fields. Phase 2 focuses on developing on-orbit computing platform, aiming to provides on-orbit data compression, space algorithm verification, and ground target search. Phase 3 focuses on building multi-sensor load networking to provide on-orbit real-time data processing and information output services. Up to now, StarDetect has achieved the first phase of the strategy and has made progress in the second phase.

Although StarDetect has a detailed strategy for the future product and services it will provide, their current main customers are

still government and research institutions, the capacious commercial application scenarios and customers are still under discovered. Therefore, this thesis aims to explore new business opportunities for StarDetect.

1.2 Project Objective & Approach

1.2.1 Problem Defination & Design goal

At present, China's small satellite commercial market is still immature, the main users of satellite technology are government and research institutions, with limited business opportunities (Dan, 2020). Meanwhile, because the satellite industry was dominated by the government for a long time and has been less used in commercial and social fields, satellite technology has not been well introduced into the market. Now, potential users in the market do not have enough awareness of the value of satellite data and will not actively seek the use of satellite technology (Dan, 2020).

Under this low commercialisation market environment, as a startup company, StarDetect is facing the challenge of exploring new satellite application possibilities to find more business opportunities. Therefore, the **goal of this thesis is to design a roadmap for StarDetect to enter a new business market and build strategic advantages for future growth.**

1.2.2 Research Questions

To reach the goal of entering a the new business market, the following questions should be answered:

1 | What are the potential business markets for small satellite technology?

2 | What are the possible applications of small satellite technology in the target market?

3 | How should StarDetect position itself to compete with existing competitors in the target market?

4 | What product/service should StarDetect provide to enter the target market?

5 | How to form a profitable business model in the target market?

6 | How can Star Detect be sustainably developing in the target market?

1.2.3 Approach

To achieve the design goal, this thesis was guided by the double diamond design process to obtain solutions through iterative problem analysis, which included four main phases: Discover, Define, Develop and Deliver, as shown in Figure x. The key activities and outcomes of each phase will be explained below.

Discover

The focus of this phase is to understand the small satellite technology and gain insights into possible application markets. Due to the novelty of the technology, literature review was used to fully understand the capabilities of satellite technology and the value chain of satellite services. Then, combining the market's demand for satellites and insights into future trends, explore new markets (Smart Tourism) where satellites can be applied, which led to more specific research directions.

Define

The goal of this phase is to clarify the design direction (application scenarios of satellites in smart tourism) to gain insights into the way of entering the target market. Continuous literature research was conducted to keep up with the new theme of smart tourism, defined the opportunities and challenges for small satellites to enter this new market. And gained insights into the possible role of small satellites in smart tourism by understanding the needs of stakeholders and brainstorming sessions. Combining the insights of suitable scenarios from SWOT analysis and future travel trends, the design direction of satellites in smart tourism was further defined.

Develop

At this phase, iterative research was carried out for the specific design direction (national park), to create possible solutions for the earlier identified design problem. Further insight on the challenge of national parks context with literature review and stakeholder interviews was used to generate the initial ideas of satellite application.

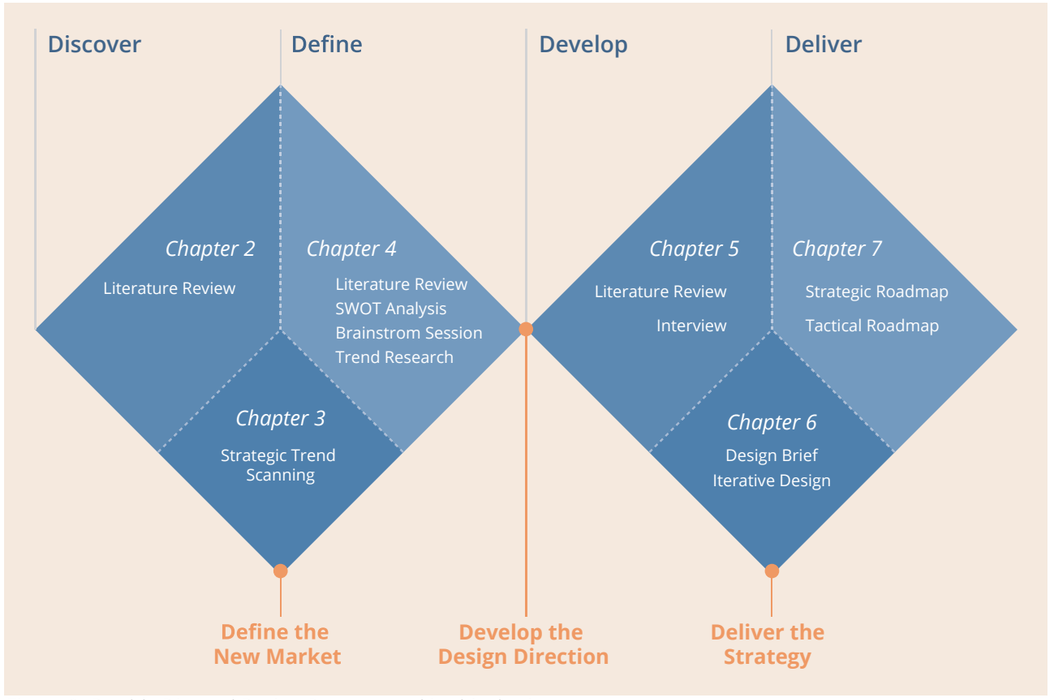


Figure 3. Double Dimond Design Process used in this thesis

Deliver

Through synthesising all the ideas and developing them into concepts. The final phase determines the roadmap for StarDetect, including an implementation plan on how to introduce and scale up satellite business in the new market.

1.3 Personal Ambitions

Usually, people think that the satellite is not only far from us, but also far from our lives, only official organisations like the government or research institute have the power to launch and operate it. But Star Detect told me that satellite is actually very close to us, for example, it applies in the navigation software we use for finding roads, and help us know about the weather every day. And with the development of the commercial satellite market, satellite is becoming more and more closely related to our lives, it can help farmers better manage their lands, and providing real-time warnings of natural disasters.

As a strategic designer, our strength is to exploit business resources and market opportunities for the companies and translate their strategy into a strong product or service portfolio. In this project, I want to prove to the company the power of design in the business world, help the company develop and launch products and services with social significance and commercial success. Besides, as a graduating student, I want to prove to the faculty that my knowledge, skills and abilities can provide effective solutions to the current and future changing complex social problems, and be able to well apply design theory and methods, prototyping and visualization skills in the project

Therefore, my ambitions in this graduation project are:

1 | Help Star Detect better face the dilemma of technology commercialization with an implementable result.

2 | Expand the application of small satellite payload technology, to make it has more contributions to people's wellbeing.

3 | The results of this project can have social significance, can meet one or several SDG goals (Sustainable Development Goals).

4 | Expand my ability on research, design methodology and skills

Chapter 2

UNDERSTANDING SMALL SATELLITE

The aim of this chapter is to give a comprehensive understanding of small satellite technology and related aspects. First, the small satellite and its background are introduced. Then, the capabilities of small satellites are described through existing small satellite applications, and lead to the discussion of the small satellite segment market. Followed by the introduction of the small satellite value chain to understand how it provides service to customers. Lastly, explore the trend and challenge of the development of small satellites.

Content

2.1 What is Small Satellite?

Artificial satellites refer to artificial objects that have been put into orbit intentionally, and those with a mass below 1000 kg are usually called small satellites (Facchinetti, 2016). Classification according to quality, small satellites can also be divided into micro-satellite, nano-satellite, pico-satellite and femto-satellite. Specific classification criteria can refer to figure 4.

StarDetect focuses on a standardised small satellite called CubeSat, which is made up of multiple cubic modules just like Lego. Each cube module is usually at the size of 10x10x10 cm and mass between 1-1.33 kg and regards as standard unit call 1U (Facchinetti, 2016). Since be structured by commercial off-the-shelf components, CubeSat has the advantages of rapid manufacturing and low cost, which is often used for scientific and teaching purposes (Welle, 2020).

Name	Wet Mass	Classification
Large satellite	>1000kg	Large satellite
Medium sized satellite	500-1000kg	Small Satellite
Mini satellite	100-500kg	
Micro satellite	10-100kg	
Nao satellite	1-10kg	
Pico satellite	0.1-1kg	
Femto satellite	<100g	

Figure 4. Satellites Classification (Sweeting, 2018)

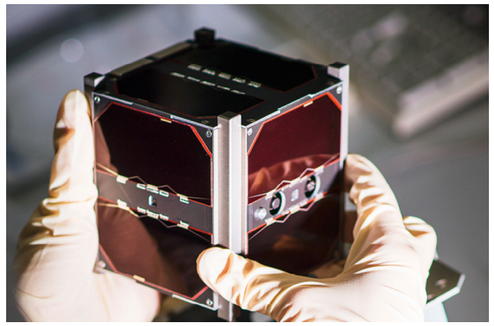


Figure 5. 10x10x10 cm CubeSat (Forinyak, 2018)

Detailed descriptions of small satellite features can be found in Appendix A.

2.2 Business Background of Small Satellites

Since the Soviet Union sent the first basketball-sized artificial satellite "Sputnik 1" into space in 1957, by the end of the 20th century, the artificial satellite had grown from 80 kilograms to 420,000 kilograms of the International Space Station (Sweeting, 2018). Space technology has become increasingly large, complex and expensive, which can only be affordable by space agencies or large companies of the most developed countries in the world (Sweeting, 2018).

This pattern was not broken until 1980, when the emergence of microelectronics technology allowed people to manufacture smaller satellites (Sweeting, 2018). Since then, the satellite has become smaller and lighter, which make it easier to be sent into space, and allow small teams or organisations to have the opportunity to enter the space (Sweeting, 2018). In addition to improving the availability of satellites, compared with conventional large satellites, small satellites have a shorter R&D cycle and lower manufacturing costs, which can not only achieve faster upgrade iterations, but also reduce investment costs and risks, and have a powerful data collection capability that is not inferior to large satellites (International Space University & University of South Australia, 2017).

These features and advantages make satellites begin to have commercial utility, and stimulate the proposal of new applications and business models. The factors of market growing interest in small satellites can be found in Appendix B. As the result, small satellites have led the revolution of the aerospace industry, break away from the traditional model dominated by government agencies, and start the "New Space" business that is guided by privately funded enterprises and industries (Sweeting, 2018).

Figure 6. Small satellites drive the growth of the space commercial market

2.3 Current Capabilities of Small Satellite

When talking about small satellite applications, people always question what can satellites bring to us? The list of answers can be endless, just like wondering what the Internet does. Therefore, this section will divide the capabilities of small satellites into seven categories by introducing the applications of small satellites, which have become a reality or are about to become a reality.

Earth observation through remote sensing

- **Capturing the image of the earth**
  Small satellites usually operate in low earth orbit (LEO), be able to capture high-resolution images of the earth by camera payloads, which is one of the most widely used applications of small satellite swarms (Alén Space, 2019).

- **Earth mapping**
  From the most remote areas to the most densely populated areas on the earth, small satellites can provide accurate and up-to-date maps of the entire planet (Alén Space, 2019). In 2020, China's BeiDou Navigation Satellite System was applied to measure the newest height of Mount Everest, the latest elevation is 8884.86m (Baidu, 2020).

New solutions for communication

- **IoT and M2M communications**
  By carrying payloads for receiving, storing and processing information, satellites can become an ideal solution to connect globally and improve the efficiency of existing terrestrial communication networks (Alén Space, 2019). In the next few years, the communication constellation of small satellites will be used to serve and support the rapidly growing Internet of Things (IoT), machine-to-machine communication (M2M), telephone and Internet access market (Wharton School of the University of Pennsylvania, 2019).

- **Communication in isolated areas**
  In the 21st century, there are still places on the earth where there is almost no communication, such as vast rural areas, frozen areas, high seas, etc.(Alén Space, 2019). And half of the world's population still has no access to the Internet(International Space University & University of South Australia, 2017). Small satellites can provide cheap and reliable communication solutions for these areas that do not yet have networks. KEPLER Communication launched its KIPP CubeSats in 2018 to provide connections to users in the North and South Pole (Saeed et al., 2020).

Asset tracking and management

- **Vehicle tracking and logistics**
  All types of vehicles can be tracked by satellites, including vehicles on the road, ships on the sea and aircraft in the sky. By locating vehicles, satellites can realise the precise control of moving resources through the ubiquitous network, to improve the safety and efficiency of traffic systems (Alén Space, 2019). Meanwhile, by monitoring various asset groups anywhere on the earth, the logistics department be able to track and adjust the traffic situation in real-time and estimate the time of arrival, so as to improve the controllability and traceability of the logistics (Alén Space, 2019).

- **Resource management and evaluation**
  Small satellites can automatically identify crops and predict yields through artificial intelligence (AI) algorithms, providing low-cost and high-efficiency resource management solutions for countries that are highly dependent on agriculture and land management (International Space University & University of South Australia, 2017). In addition, satellites can be used to evaluate and monitor the assets condition, for example, by observing the parking status and passenger flow changes to judge the operating conditions of the mall (Wu, 2020); Evaluate changes in the photovoltaic industry by identifying the number and installation progress of photovoltaic power stations in the area (Wu, 2020).

Awareness of the earth's environment

- **Collect climate data to predict the weather**
  Satellites can conduct aerial measurements and analysis once an hour to understand weather conditions, the data obtained can be used to improve climate models to better predict weather, to provide basic information for activities such as commercial flights and agriculture (Facchinetti, 2016), and early warning of possible natural disasters (Alén Space, 2019).

- **Environmental monitoring and protection**
  Small satellites can monitor regional environmental changes in real-time to understand the impact of human activities on the environment and take corresponding measures. Such as the early detection of forest fires, the discovery of marine oil spills, the monitoring of marine organisms, the control of desertification, the study of ice melting processes, etc. (Alén Space, 2019).

Defence and security

- **National Security**
  Many countries around the world face security challenges, such as border protection and irregular immigration. Government departments can obtain real-time images and data through small satellites to better solve these security problems (International Space University & University of South Australia, 2017).

- **Monitoring potential threats from outer space**
  So far, the application of small satellites in this field has been focused on the study and transfer of asteroids that may harm our planet, such as the Hera project of the ESA (Alén Space, 2019).

Science and technology

- **Space science mission**
  Small satellites can also be used to obtain outer space information and play an important auxiliary role in large-scale space science missions (Saeed et al., 2020). For example, CubeSat ASTERIA was used as a "guide star" for the latest generation of telescopes to obtain high-quality images of distant planets and celestial bodies (Alén Space, 2019).

- **Technology Demonstration**
  To ensure the feasibility of innovative technologies, it is very important to test under real conditions as much as possible, and low-cost small satellites provide a good opportunity for on-orbit demonstrations (Alén Space, 2019). Small satellites provide young engineers and scientists with an affordable test opportunity to verify their original model and ideas (Wharton School of the University of Pennsylvania, 2019).

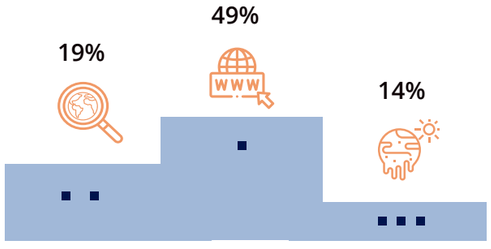


Figure 7. 2019-2028 Top 3 Satellite application (Euroconsult, 2019)

2.4 Small Satellite Value Chain

In order to understand how small satellites provide products or services to customers, the value chain of the small satellite industry should be clarified. As shown in Figure 8, the value chain includes up-stream manufacturing; mid-stream launching & operations; and downstream data value-added, which will be briefly described below.

Up-stream: Manufacturing

At this stage, the small satellite is developed and manufactured, and be ready to launch into space by the launch vehicle. Stakeholders at this steam include: Satellite development teams, Manufacturing companies, Satellite launch companies.

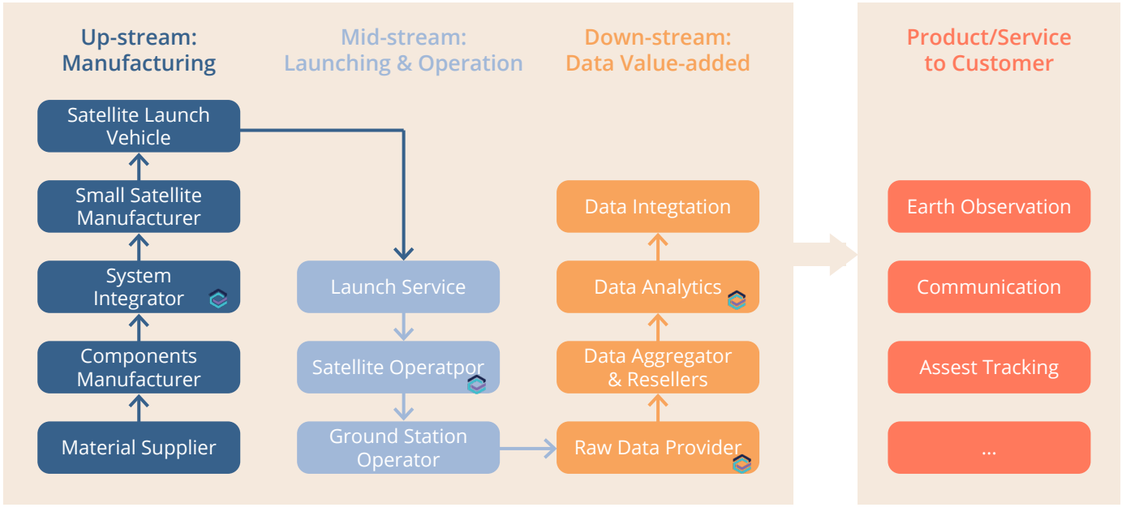


Figure 8. Small satellite value chain (Lal, et al., 2017)
The roles of StarDetect in the value chain are marked with StarDetect's Logo.

Mid-stream: Launching & Operation

The satellite is launched into orbit and operates to collect target data, then the data will be initial processed on orbit and transmit back to the ground station on earth. Stakeholders at this steam include: Satellite launch company; Satellite operator; Ground equipment operator.

Down-stream: Data Value-added

The raw satellite data is available at this stage and will be aggregated, analysed and integrated, in order to add value to the data and transform it into a product or service for customers. Stakeholders at this steam include: Raw data provider; Data reseller; Data processing company.

2.5 Small Satellites Development Trends & Challenges

Small satellites are still an immature field, new developments every year provide new opportunities for the market. It's hard to imagine what the future small satellites will look like. Some trends have already emerged as references. Meanwhile, with the creation and implementation of complex functions, the challenge of small satellites follows. The overall trends and challenges of small satellite development are shown following for a glance, more detailed description can be found in Appendix C.

Figure 9. Small Satellites Development Trends & Challenges

Chapter 2 | Conclusion

Small satellite features and commercial utility

The small satellite is an artificial satellite with a mass below 1,000 kg. Compared with conventional large satellites, small satellites have lower R&D costs, faster iterations, higher risk tolerance capabilities, and powerful data collection capabilities. Increased the opportunities for satellites to enter the commercial market and expand applications.

Big data is the trend

It can be seen from the value chain that the core of small satellite is the data it provides. However, satellite data is not valued until it becomes a service/product. To better process the huge volumes of data and make it more readable, the satellite industry must be more closely integrated with AI technology and big data technology in the future.

Capabilities with commercial potential

The current capabilities of small satellites include earth observation, satellite communications, asset tracking and management, awareness of the earth's environment, defence and security, space science and education, etc. Among them, the first four capabilities can be more oriented to users other than government and research institutions and applied in more fields, which have higher commercial potential.

Privacy will remain a hot issue

Besides other technical challenges, privacy concerns will become the biggest obstacle to the development of the satellite. Because high-resolution satellites may obtain clear images including area or passers-by without them notice. Concerns about national security and personal privacy may hinder commercial use of satellites.

Following

This chapter provides a comprehensive understanding of small satellites, which clarifies the background, capabilities and future development of this technology. Based on this information, the following chapter will conduct a Strategic Trend Scanning to explore potential business markets that StarDetect can enter.

Chapter 3

LOOKING FOR POTENTIAL MARKET

The goal of this chapter is to explore a potential commercial application market for StarDetect, so as to define specific research directions and design opportunities. Strategic Trend Scanning will be conducted to obtain signals of the future business environment in China based on social, economic and demographic development, scientific and technological inventions, ecological and political changes. Then explore innovative opportunities from the strong signals to define a new market for StarDetect to enter.

Content

3.1 Strategic Trend Scanning

If the organization wants to make innovative strategic decisions, it is important to observe and discover the initial and emerging signs of the potential future, thereby expanding the organization's vision and discovering innovation opportunities outside the current market from these signals (Simonse et al.,2018).

"Early identification and fast response to important trends and event which impact on the firm."
—— *IGOR ANSOFF (1980)*

At the aim of discovering new business opportunities for small satellites, Strategic Trend Scanning is an insightful method that can obtain relevant information of the organization's business environment, to ensure that the organization does not miss early signals of environment change (Simonse et al.,2018).

To systematically obtain information about the business environment, the trend technique DESTEP was used to detect trends from six domains: Demographic, Economic, Sociocultural, Technological, Ecological and Political. The strong or interesting trends found in these domains were listed to clarify their meaning (see Appendix D).

Then, all the identified trends were then reclustered into groups to discover common features of the trends to perceive strong market signals. Each cluster group was named to describe the market signal, including "Smart" everything, Value privacy, Online life and experience, Resource sharing, Pay attention to environmental impact, Experience consumption has great potential, Embody yourself, Visit nature, Focus on environmental protection and climate change.

Finally, in order to direct the results to potential commercial markets that Star Detect could enter, all market signals and small satellite capabilities are aggregated into themes to extract keywords that represent leading trends in the future commercial environment and from which possible new markets can be captured. The outcome of this Strategic Trend Scanning can be seen in figure 11.

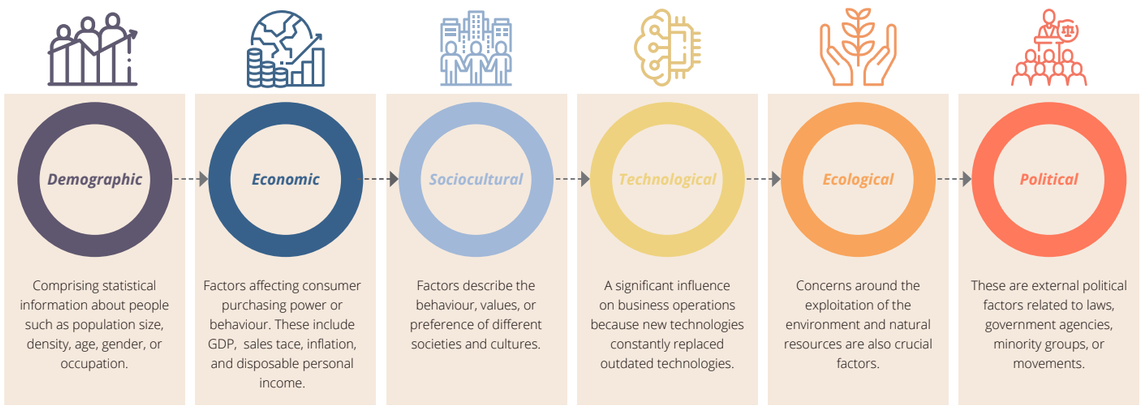


Figure 10. The six categories of the DESTEP analysis (Cuofano, 2021)

3.2 Essential Future Trends

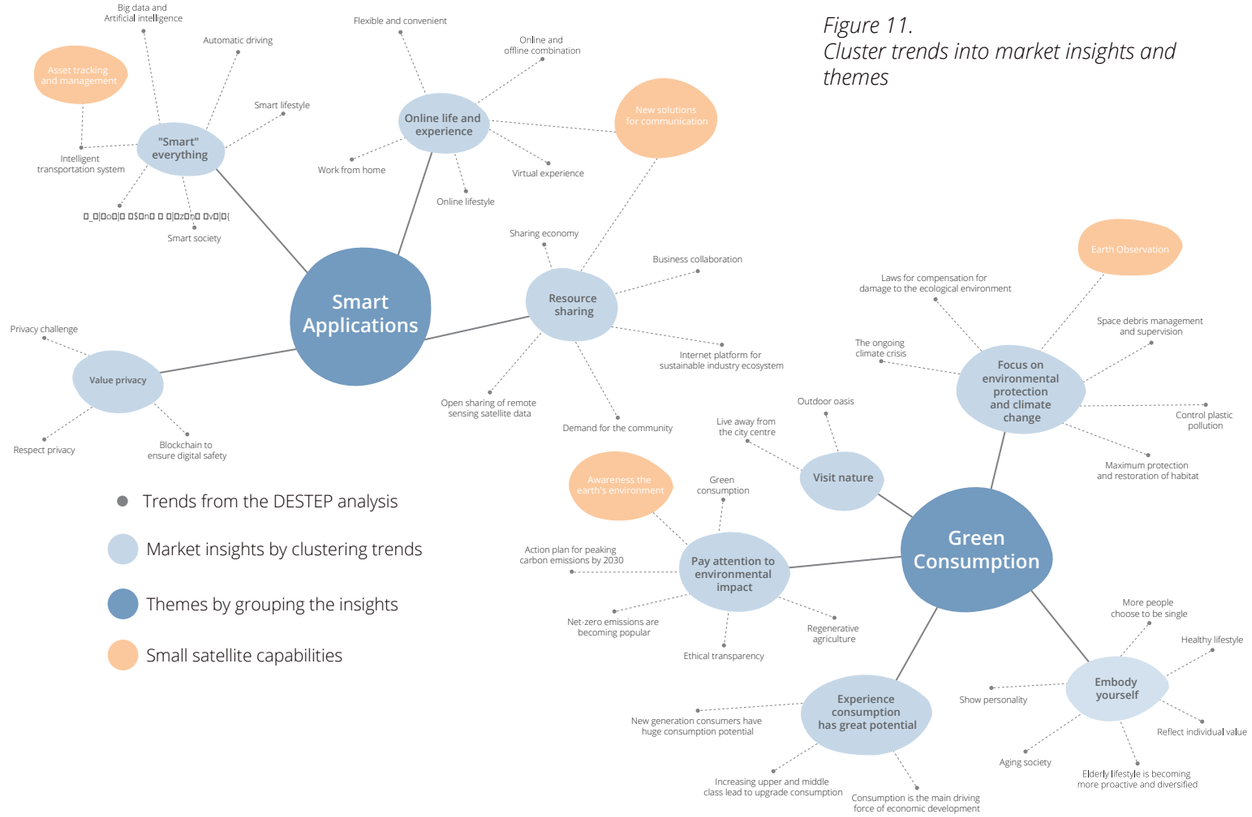


Figure 11.
Cluster trends into market insights and themes

Smart Applications

From Smartphones To Smart Everything.
With the popularization of the Internet and the continuous development of big data analysis and artificial intelligence, smart technology is rapidly entering various fields, such as smart home, smart city, smart agriculture, and so on. Smart technologies have led to a revolution in various industries and entrepreneurial processes, changing people's daily lives (European Commission, 2013).

Satellite technology also contributes to this smart revolution, for example, tracking vehicles and monitoring traffic conditions for smart transportation; providing ubiquitous internet to ensure IoT and data sharing anywhere. In addition, small satellites play an important role in smart agriculture and smart disaster prevention.
There are strong signals in the market that the trend of smart everything will continue to expand and grow, which is considered as one of the biggest technological changes in the world, bringing changes and providing new opportunities for many traditional fields (Shaping tomorrow, 2015). Small satellite should seize these currents of change to expand its application in various fields.

Green Consumption

The frequent occurrence of extreme weather has caused people's attention to global environmental protection and climate change, and raised the awareness of human activities impact on the environment (Restorick, 2020). Thereby, more and more environmental protection measures have been implemented, such as actively maintaining and restoring natural habitats; requiring companies to achieve net-zero emissions and so on (Energywatch, 2021).

All these measures require a deep understanding of the earth environment, and satellites are an ideal solution for monitoring the global environment. Because satellites can 24 hours reveal and monitor the remote area, hidden features, and even events that the human eye can't detect, such as detecting atmospheric phenomena; monitoring marine oil spills; supporting research on global temperature changes and melting ice, etc.

Meanwhile, with the growing awareness of global environmental issues, there is a strong trend that people hope that their consumption can be less harmful, and even beneficial to the environment (Wei et al., 2017). This provides satellites with the opportunity to expand their applications on environmental protection, to improve and support customers' consumption behaviours by providing the required information.

3.3 Potential Market for StarDetect

Two essential future trends emerged from the trend scanning, Smart Application and Green Consumption. To be inspired by these two strong market signals and other trends such as "Live away from the city centre"(more and more people are eager to temporarily escape from daily life and gain some new experiences from other cities or remote places), "Outdoor oasis"(people who leave the reinforced concrete city will hope to go to places that are more intimately connected with nature.), "Embody yourself " and "Experience-driven consumption", the smart tourism market that seems worth exploring emerged from the trends. To figure out whether Smart Tourism is a suitable new market for Star Detect, the following two questions will be answered to make a decision.

> *Are there demands for small satellites in the smart tourism market?*

> *Does the smart tourism market have commercial prospects?*

The answers are shown in the next page.

Figure 12. Emerged Smart Tourism concept (Peinador, 2020)

Smart tourism is in demand for small satellites

As an activity that brings people new experiences, tourism has always been loved by everyone. And with the increased expectation of a better travel experience, the demand for information services is gradually increasing, which aims to help tourists better deal with the uncertainty and unpredictability in the journey by obtaining information anytime and anywhere (Wang et al., 2019). Therefore, the concept of Smart Tourism has emerged to provide tourists with more innovative and personalized services (Shafiee et al., 2019).

In recent years, with the popularization of information and communication technology (ICT), smartphones, and the Internet, the tourism industry has begun the digital transformation, and Smart Tourism has gradually come to reality. However, with the development of Smart Tourism, the industry's demand for information also gradually escalate, from satisfying single information development to requiring more detailed and comprehensive information (Wang et al., 2019). This put forward the challenge to multifaceted information collection, but also provide opportunities for small satellite applications. Small satellite can use its capabilities such as earth observation, communication and asset tracking to provide required information that other technologies cannot provide, to support people with decision-making support and tourism service upgrades.

Meanwhile, there is survey shows that with greater attention to environmental and social sustainability, more and more people are eager to experience the beauty of the destination while minimizing the impact of human activities on nature or want to contribute to the environment (Paolinelli, 2021). Small satellite can also apply the capability of monitoring the environment to support customers' environmentally beneficial behaviours and choices, and contribute to destination sustainability.

The tourism market has broad business prospects

According to reports from the Ministry of Culture and Tourism of China (Ministry of Culture and Tourism of the People's Republic of China, 2021), the number of Chinese tourists in 2015 was only 3.99 billion, but only four years later, this number had reached 6.006 billion in 2019. Although affected by the COVID-19 pandemic, the number of tourists temporarily dropped by 52.1% to only 2.879 billion (Ministry of Culture and Tourism of the People's Republic of China, 2021), people's travel enthusiasm quickly recovered after the epidemic eased, the number of travellers exceeded 230 million only during the five days vacation from May 1 to 5, 2021(Zhou, 2021). This shows people's strong demand for tourism in China, and the scale of China's tourism market continues to expand.

2019-2025 China's tourism market scale forecast

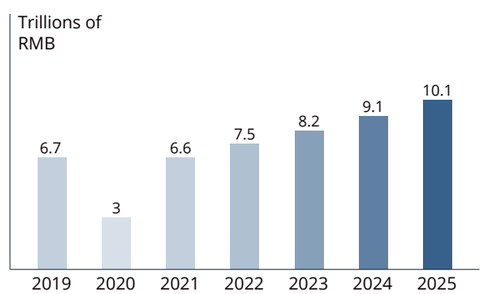


Figure 13. China's tourism market scale forecast (TechWeb, 2021)

Also, the Chinese government strongly support the development of the tourism market, since it is an important part of China's social and economic activities. Only in 2019, the tourism industry directly contributed 10.94 trillion yuan that accounting for 11.05% of the total GDP, and created tens of millions of jobs opportunities, which is an excellent strategy to promote national economic development and provide employment and business opportunities(Government Portal of the Ministry of Culture and Tourism, 2020).

Conclusion

It can be induced from the above preliminary understanding of smart tourism that Smart Tourism has a demand for the capabilities of small satellites. At the same time, for small satellites, smart tourism is a good entry point to expand applications to the public and obtain its business opportunities.

Therefore, this project chose Smart Tourism as the new market that the worth StarDetect to enter. The strategy to enter the market will be explored in the following chapters.

Chapter 3 | Conclusion

Strong signals of "Smart application" and "Green consumption"

From the trend scanning, two essential trends appear as the keywords for possible new market opportunities, Smart application and Green consumption. Which shows the potential of small satellite to be used as smart technology to facilitate the digital change of traditional industry, and the need of the ability to help people better understand the environment and contribute to environmental protection.

Smart tourism market has potential

Inspired by market signals, the smart tourism market seems to have great potential. StarDetect can promote its satellite applications to the public through Smart tourism, and at the same time obtain more business opportunities from the broad business prospects.

Following

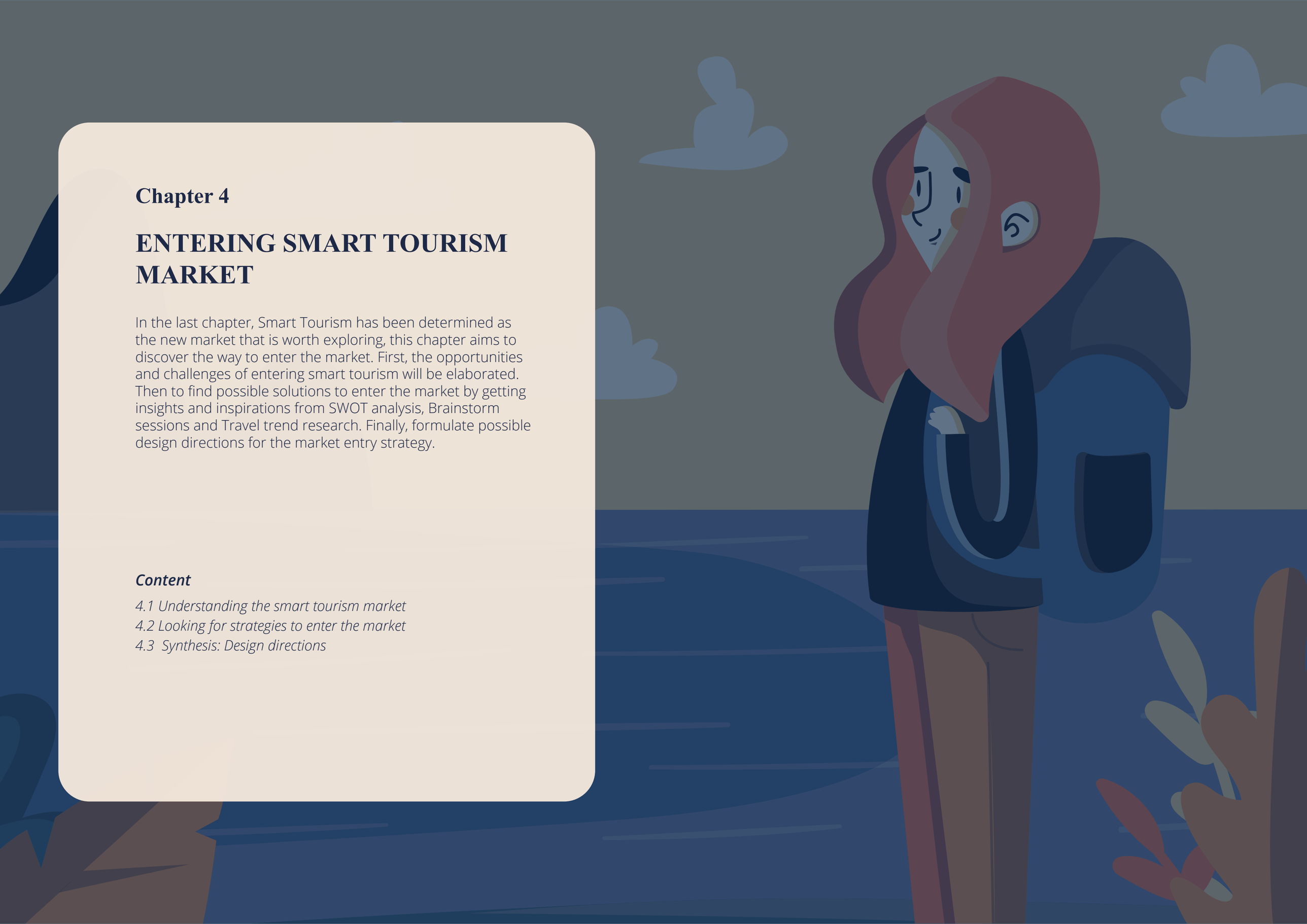
This chapter explored the potential market of StarDetect through a Strategic Trend Scanning, and selected Smart Tourism as an accessible target market. The following chapters will dive into the Smart Tourism market and formulate strategies for entering the market by discovering the application opportunities of small satellites in this field.

Chapter 4

ENTERING SMART TOURISM MARKET

In the last chapter, Smart Tourism has been determined as the new market that is worth exploring, this chapter aims to discover the way to enter the market. First, the opportunities and challenges of entering smart tourism will be elaborated. Then to find possible solutions to enter the market by getting insights and inspirations from SWOT analysis, Brainstorm sessions and Travel trend research. Finally, formulate possible design directions for the market entry strategy.

Content



4.1 Understanding the Smart Tourism Market

The purpose of this section is to have a basic understanding of the Smart Tourism market, and to preliminary explore the opportunities and challenges of entering this market. First, the definition and the framework of Smart Tourism will be explained. Then introduce stakeholders and their needs to initially explore satellite application opportunities. Lastly, the challenge of entering the market will be raised.

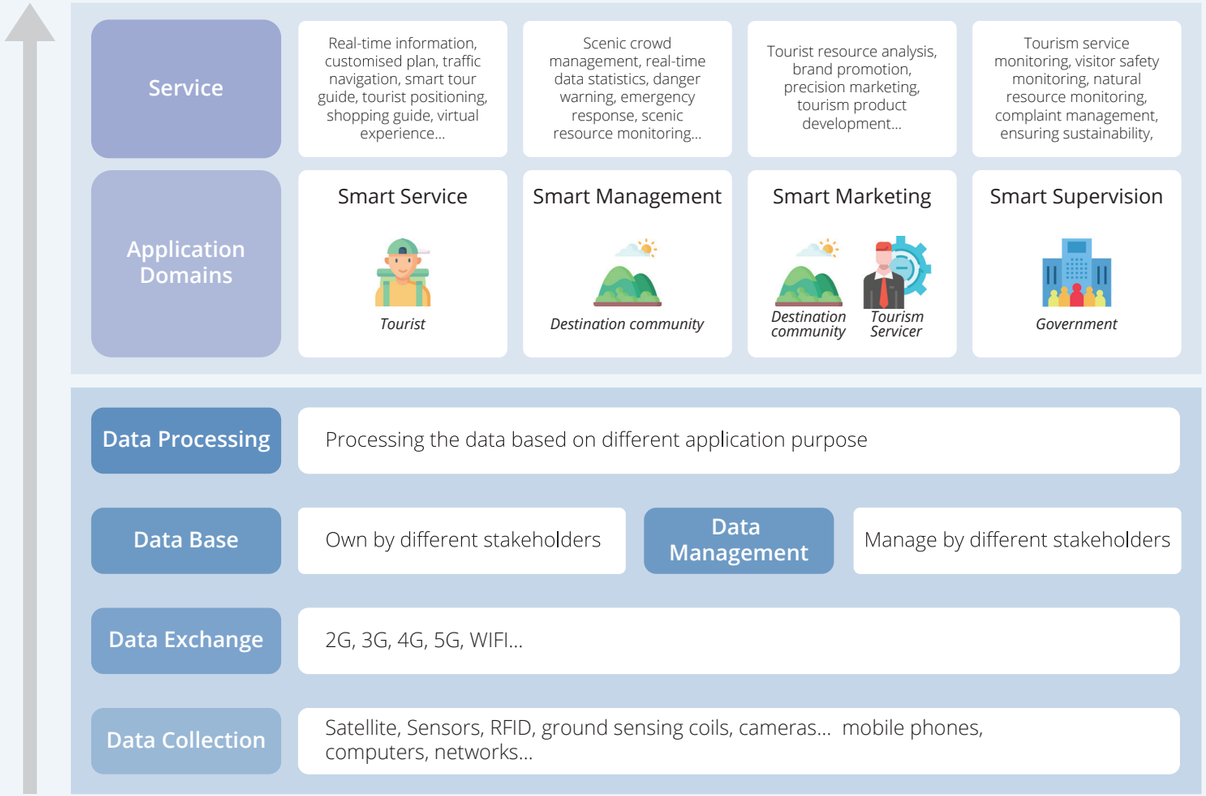
4.1.1 What is Smart Tourism?

Gretzel et al. (2015) describe smart tourism as: The tourism industry is supported under the comprehensive efforts of the destination to collect and aggregate/utilize/derive data from physical infrastructure, social connections, government/organizational sources, and the human body/mind, and combined with the use of advanced technology to transform these data into the on-site experience and a clear focus on efficiency, sustainability and rich experience business value proposition. In short, Smart Tourism is a combination of the tourism field and Information and Communication Technology (ICT), which aims to use destination data to improve the tourist experience, enhance tourism business efficiency, and maintain destination sustainability (Lee et al., 2020).

The framework of Smart Tourism can be seen in figure 14, which includes two parts, Tourism data perception and Data application.
Tourism data perception is to collect data from various sources of the destination, transmit and integrate all the data into databases, and analyse and process the data into insights for decision making or practical application.
Data application is to apply and visualise the insights from Data perception to support different needs of Smart Tourism, such as smart service, smart management, smart supervision and smart marketing, etc. (Han, 2021).

More detailed explanations of the framework can be found in Appendix E.

Figure 14. Smart tourism framework (Lee et al., 2020)



4.1.2 Understanding the Stakeholders of Smart Tourism

Relationship between stakeholders and Smart Tourism

Relationship between stakeholders and Smart Tourism
The main stakeholders of smart tourism include tourists, destination management organizations/companies, tourism companies, governments and local residents. These five stakeholders constitute the three components of smart tourism, smart experience, smart business and smart destination (Lee et al., 2020).

The stakeholder of smart experience is tourist, which aims to improve the user's travel experience by providing the right services to the right users at the right time (Kontogianni & Alepis, 2020).

The stakeholders of smart business include destination management organizations/ companies and tourism companies, which aims to improve the capability to provide suitable services to tourists by promoting cooperation and resource sharing between businesses (Lee et al., 2020).

The stakeholders of smart destinations include destination management organizations, governments and local residents, which aims to facilitate the sustainable development of the destination and improve the quality of life of residents by promoting the interaction between tourists and the destination (Lee et al., 2020).

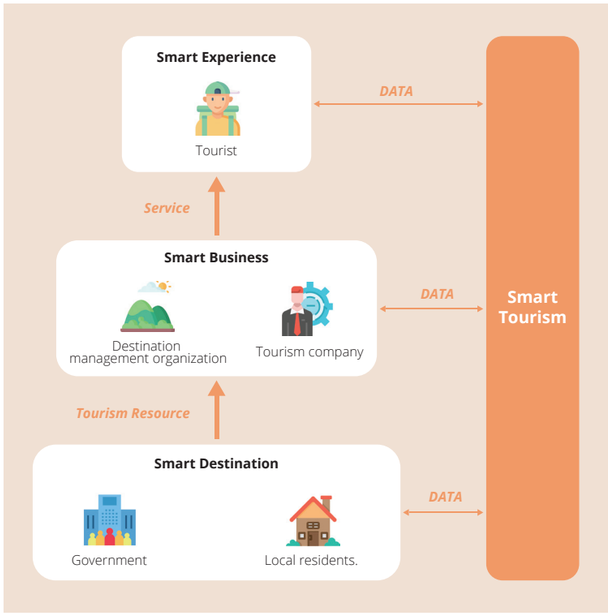


Figure 15. Relationships between stakeholders and Smart tourism (Fuchs et al., 2014)

The relationship between these three components can be described as: Smart business creates good travel experiences for tourists (smart experience) through the tourism resources of smart destinations (Lee et al., 2020), as shown in figure 15.

To better understand the stakeholders and receive some initial insights for satellite possibilities. Following, each stakeholder's main goal in Smart Tourism will be explained, and their demands will be explored by clustering the findings from the literature. Also, initial thoughts of potential satellite applications to meet the stakeholders' demands will be listed out. Both the demands and initial thoughts will show on the folowing pages.

The needs of stakeholders in Smart Tourism

Stakeholder need description

Needs cluster

Tourist

All tourists have a commmon goal, that is, to receive a nice travel experience that meet their expections or even better. The travel journey can be divided into 4 stages, the choice of destination, preparation for the trip, during the trip and after the trip (Fernández et al., 2020). Each stage of the journey plays an important role to achieve a good travel experience and the needs of each stage will be described below.

The choice of destination

- Tourists look for destinations for the next trip, comaring different desination based on his/her motivation and preferences (Riera, 2021).

Preparation for the trip

- Tourists plan their route and methods for travel by searching for destination information and recommendation (Fernández et al., 2020).
- Tourists book or purchase services/ products in advance, such as attraction's ticket, hotel, transportation (Fernández et al., 2020).

During the trip

- Travellers adjust their plan or add unplanned activities with real-time information on transportation, food, entertainment, accommodation, weather, attractions, etc. (Advance 360, 2020).
- Tourists interact with the destination and receive a good experience that meets or exceeds their expectation (Advance 360, 2020).
- Tourists want to share current experiences and feelings with others (Advance 360, 2020).

After the trip

- Tourists evaluate their travel experience, share with others and give travel recommendations (Riera, 2021).

Tourism comany

The goal of tourism companies is to optimize the use of tourism resources, provide better tourism services, enhance their competitiveness and expand the company scale (Lee et al., 2020).

Understand tourist's behaviour

- Explore tourist's potential interest by understanding tourist's motivation and behaviour, to create new service products (Fuchs et al., 2014)
- Understand the behavior and motivation of tourists visiting specific locations (Fuchs et al., 2014)
- Anticipating the needs of tourists (Fuchs et al., 2014)

Effective marketing

- Realise precision marketing and sell the right products to the right customers (Fuchs et al., 2014)
- Verify the effectiveness of marketing activities (Fuchs et al., 2014)

Destination management organisation

The goal of the destination management organisation is to build a good travel experience for tourists through personalized interaction, and ensure the overall sustainability of the destination with efficient management (Lee et al., 2020).

Better manage the destination

- Manage and dispatch vehicles and staff (PGHD, 2015)
- Better management and planning of destination resources (Han, 2021)
- Manage resources to ensure the availability and allocation of resources (Fuchs et al., 2014)
- Management and maintenance of destination public facilities (PGHD, 2015)
- Real-time data collected and processed to decide and take action (Fuchs et al., 2014)
- Obtain real-time information to ensure management consistency (Fuchs et al., 2014)
- Monitor traffic conditions and deal with emergencies such as traffic jam and car accidents (Han, 2021)
- Monitor the traffic situation and parking situation (Han, 2021)
- Ticket or restricted area management (Cui & Yin, 2019)
- Real-time control and monitoring of tourist visits in scenic spots (Cui & Yin, 2019)
- Understanding tourist behavior to define destination boundaries (Fuchs et al., 2014)
- Control the flow of tourists in various areas to relieve area's capacity pressure (Fuchs et al., 2014)

Enhance tourist's experience

- Provide relevant real-time information about the destination and its services to enhance tourist's experience (Fuchs et al., 2014)
- Enhance access to real-time information to meet tourists' demand for tourism information (Fuchs et al., 2014)
- Help tourists arrange their own travel itinerary (Han, 2021)
- Tourists can know their location the route to the place they want to go (Cui & Yin, 2019)
- Provide guide services to help tourists better understand the experience the destination (Cui & Yin, 2019)
- Avoid traffic jams and find parking spaces more efficient (Cui & Yin, 2019)
- Ensure full coverage of the network signal in remote areas of the destination (Han, 2021)
- Predict tourist behavior and provide tourists with personalised services (Fuchs et al., 2014)

Ensuring destination sustainability

- Monitor and analyse all sustainability indicators (Fuchs et al., 2014)
- Monitor and evaluate natural resources and environment, including meteorology, geology, ecology, air quality, water quality, etc. (PGHD, 2015)
- Detect environmental pollution and take timely measures (PGHD, 2015)
- Monitor and protect the heritage resources (PGHD, 2015)
- Avoid excessive load on the destination (PGHD, 2015)
- Monitoring illegal land use (Han, 2021)

Destination security

- Ensure the personal safety of tourists (Liu, 2018)
- Discover potential hazards in time (Liu, 2018)
- Emergency events can quickly notify and evacuate tourists (Cui & Yin, 2019)
- There is emergency network communication for unexpected events (PGHD, 2015)
- Rapid decision-making and emergency response after disaster (PGHD, 2015)
- Disaster monitoring and emergency notification (PGHD, 2015)
- Tourists who are trapped can contact staff in time and get rescue (Cui & Yin, 2019)
- Natural disaster monitoring and early warning (PGHD, 2015)
- Investigate the cause of the disaster (PGHD, 2015)

Government & Local Resident

The goal of government and resident is to develop sustainable tourism to enhance the competitiveness of cities and improve their quality of life (Lee et al., 2020)

Tourism Market supervision

- Dynamic monitoring of tourist destinations (Liu, 2018)
- Effectively integrate scattered tourism resources (Liu, 2018)
- Supervise and manage the tourism market and maintain the order of tourism (Liu, 2018)
- Complaint management (Liu, 2018)
- Deal with natural disasters and public events, quick respond to emergencie (PGHD, 2015)

Ensure sustainable development

- Avoid environmental damage caused by excessive tourism (Lee et al., 2020)
- Supervise the protection situation of the destination (Lee et al., 2020)

Ensure sustainable development

- Avoid excessive tourism to bring troubles to residents' daily lives [106]
- Create more employment opportunities and economic income for resident (Liu, 2018)
- Promote cross-cultural understanding and tolerance (Lee et al., 2020)

Promote data sharing

- Realise resource sharing between different organizations and promote cooperation between stakeholders (PGHD, 2015)
- Enhance data statistical analysis capabilities [106]

Initial thoughts for satellite possiblities

For tourist:

- Provide tourists with the authentic destination information they need to help them make better travel decisions and plans to receive expected travel experience.

For destination management organisation:

- Dynamically monitor destination resources to control the tourism activities impact on the environment.
- Dynamically monitor and manage destination resources, and schedule vehicles and staff.
- Monitor and manage the traffic conditions, control the flow of people in the specific area, and relieve regional pressure.
- Know the location of tourists, and give reminders and warnings of restricted areas.
- Provide real-time destination information, customise routes and guide services for tourists.
- Provide network communication services in remote areas.
- Early warning, discovery, and cause investigation of disasters.

- Provide emergency communication in case of ground network communication failure.
- Accurately locate the location of tourists and provide the best route to rescue tourists.

For tourism company:

- Collect tourist whereabouts data to better understand tourist behaviour.

For government & local residents:

- Monitoring and unified management of tourism resources.
- Assess the environment of the destination.
- Ensure that all parts of the destination are covered by network communication.

4.1.3 Challenge of entering the smart tourism market

Since the first attempt of smart tourism concepts at the 2010 Shanghai World Expo, China has begun to strive to develop Smart Tourism to promote the growth of the tourism industry [62]. So far, the concept of smart tourism has been applied to all aspects of the tourism industry, such as destination development, scenic spot construction, hotel management and so on [62], and outstanding results have been achieved in regions such as Jiangsu, Zhejiang, and Beijing, where are rich in tourism resources [58].

However, judging from the existing cases and literature, the development of Smart Tourism in China is mainly based on Internet of Things (IoT) related technologies, satellite technology is rarely involved [63]. This is because most of the current smart tourism cases are carried out in relatively developed cities, such as Jiangsu, Zhejiang and Beijing mentioned earlier. In these more developed areas, the IoT technology has been well known and widely used, the market participants can easily use mature IoT technology and existing infrastructure to construct smart tourism projects [63]. In contrast, satellite technology is less well-known, and many people don't even know what it's useful for. Meanwhile, due to the low popularity, there are not many existing satellite infrastructures, which increases the investment of users and means higher risks to them [63].

Therefore, to enter the Smart Tourism market, Star Detect needs to face the challenges of introducing the small satellite capability to the public and competing with existing IoT companies in the market.

Section 4.1 | Conclusion.

This section elaborated the concept and framework of Smart Tourism. At the same time, the relationship between smart tourism and stakeholders is clarified, and the possibilities of satellite applications are initially explored by understanding their needs. However, it also found that StarDetect had to face the challenges of competing with IoT technologies and promoting satellite services to enter the Smart Tourism market. Therefore, in order to develop a market entry strategy, the next section will focus on finding solutions to the challenges.

4.2 Looking for Ways to Enter the Market

Having identified the challenges, this section is determined to find ways for StarDetect to enter the market by exploring the unique advantages of satellite technology and suitable application scenarios. First, a SWOT analysis is conducted to explore the strengths, weaknesses, opportunities and threats of satellite technology in smart tourism. Then possible satellite application concepts are generated by taking external ideas from brainstorming sessions. Lastly, future tourism trends are studied to gather insights on potential tourism scenarios.

4.2.1 SWOT Analysis

This section focuses on analyzing and summarizing the advantages and disadvantages of satellite technology to determine the strengths, weaknesses, opportunities and threats of satellite technology in Smart Tourism. The process of the SWOT analysis can be found in Appendix F.

SWOT Analysis Conclusion

Compared with obtaining destination information through the IoT technology, satellite remote sensing can quickly detect large areas, and reach places that are hard for people to access without additional infrastructure. Therefore, satellites can well meet the long-term monitoring needs of more remote and larger areas where the Internet of Things facilities are not yet complete.

Strengths

- Able to quickly explore large areas
- Can be used to explore places hard to reach
- Can be integrated to reflect the relationship between different objects in the area
- Can provide communication and internet conveniently and quickly under the situation of emergency.

Weaknesses

- Not suitable for exploring small areas
- Not suitable for sophisticated detection
- Unable to provide exploration of specific area all the time, there is a lag in real-time data
- The speed of existing satellite networks lags behind terrestrial networks
- Existing universal mobile devices cannot directly connect to the satellite network

Opportunities

- Provide cheaper and more convenient network solutions for areas without Internet.
- Provide solutions that are cheaper and easier to construct and maintain than IoT facilities (need less infrastructure).
- Provide regular monitoring services for remote&wide area to obtain dynamic changes in the region.
- Use satellite communications and positioning services to assist rescue activities in remote areas.

Threats

- Need to compete with other remote sensing technology such as manual field measurement and aerial photogrammetry.
- Lack of professionals to use and maintain satellite ground equipment.
- Users don't have the knowledge to analyse and apply satellite data.

In addition, satellites can also provide communication services from places without Internet access. And compared with more widely used ground solutions such as Terrestrial Radio Wave Communication, Satellite communication not only require lower construction cost but less maintenance and is more flexible to install. Therefore, it is very suitable for providing communication and Internet connection in areas with low population density, or providing emergency communication in areas without internet.

All in all, satellites are more suitable for applications in more remote and less developed areas to provide cheaper and more convenient destination monitoring and communication solutions.

4.2.2 Brainstorm Session

Although after SWOT analysis, the strengths, weaknesses, opportunities and threats of satellite technology in Smart Tourism have been determined. However, defining these four elements is not enough to solve the challenges, there is still a need to clarify what unique role small satellites can play in smart tourism. Therefore, brainstorm sessions were conducted to generate more ideas about possible satellite applications in tourism. The set-up and the result of the sessions can be seen following, and the session records can be found in Appendix G.

Brainstorm Session Set-up

Goal of Brainstorm Session

The goal of this session is to collect external ideas of possible applications of satellites in smart tourism.

Participants

This brainstorm session was conducted twice, and a total of seven IDE master students from TU Delft who age around 25 participate. Since the target market of this project is in the region of China, all the selected participants are Chinese students.

Structure

The session was held remotely on Zoom (online video meeting tool) and Miro (online whiteboarding tool) because participants are located in different places.

For the creative session to take place in a structured manner, the background of the project and the goal of this session was first introduced. Meanwhile, to ensure that all participants have sufficient knowledge of small satellite for creating ideas, the capabilities of small satellite, challenges of entering Smart Tourism market, and the SWOT analysis insights were further explained.

Then, after ensuring that all the participants had no more questions about the background and content of the session, some guiding questions were asked to inspire ideation. Participants could post their ideas in the form of sticky notes for each question. After finishing writing all the ideas, participants were asked to select and explain his/her three favourite ideas and discussed together why these ideas stand out or how they can be combined.

After finished the discussion and thanks to all participants, the session was wrapped up.

Brianstorm Ideas Intergration

Although some ideas were selected by the participants as the top three favourites, they are more like sparking thoughts instead of concepts, meanwhile, other ideas that were not selected were also interesting. Therefore, all the ideas from the brainstorming were clustered into key findings, then integrated into concepts, so as to find possible satellite applications. The analysis process can be found in Appendix G.

The five concepts generated from the ideas are described as following.

Concept 1
Support travel plans for outdoor lovers

Outdoor lovers usually like to visit more remote destinations, such as forests, grasslands, wetlands, icebergs, oceans, tropical jungles and other less developed and underexplored places. These remote destinations are usually large, sparsely populated, and primitive, so people who want to go to these places often find it difficult to obtain enough information to support their travel decisions. Satellites can meet people's needs for information on these hard-to-reach places through remote sensing, such as weather, topography, and routes, so as to support tourists in planning and ensuring their safe and pleasant travel.

Concept 2
Support tourists' expectations of destinations

When planning a trip, people usually have expectations about the travel experience, such as seeing blooming flowers, meeting favourite animals, watching beautiful snow scenes, and so on. If these expectations cannot be met after arriving at the destination, the travel experience will be greatly impacted. Satellites can provide tourists with a real-time view of the destination before they go to help them judge whether the destination can meet their expectations, so as to help them choose the best time to go to the right location and receive a good travel experience.

Concept 3
Support virtual travel at home

The COVID-19 pandemic is still spreading, many places have be locked down and people are stuck at home, which makes people who love travel unable to go outside as usual. However, this has also stimulated the emergence of more virtual travel, allowing people to enjoy the travel experience at home. Satellites can also contribute to the virtual experience by bringing new perspectives and interactions, for example, visiting destinations from the view of space, remotely observing and interacting with animals, using satellite images to make your own documentaries and so on.

Concept 4
Support communication and rescue in remote areas

Although the Internet seems to be everywhere, there are still many places where no access to communication, such as the north and south poles, oceans, mountains, deserts and other remote areas with fewer people. Satellites can provide temporary communications for people visiting these remote places to ensure that companions can communicate with each other, as well as ask for help when in danger, and provide location for quick rescue.

Concept 5
Support destination protection and nature education

The increasing awareness of sustainable development makes people more concerned about the destination environment when travelling. Satellites can monitor environmental issues such as deforestation, forest fires, water pollution, desertification, etc., to promote the maintenance of the destination environment. At the same time, satellites can provide information for educating people about nature, so as to improve their awareness and activities to contribute to the protection of the destination.

Brainstorm Session Conclusion

By generating external ideas from brainstorm sessions and integrating them into concepts for satellite applications, the possible role of satellites in Smart Tourism was explored. But to formulate a strategy to enter the market, the potential scenarios for satellite implementation still need to be determined, which is the aim of the next section.

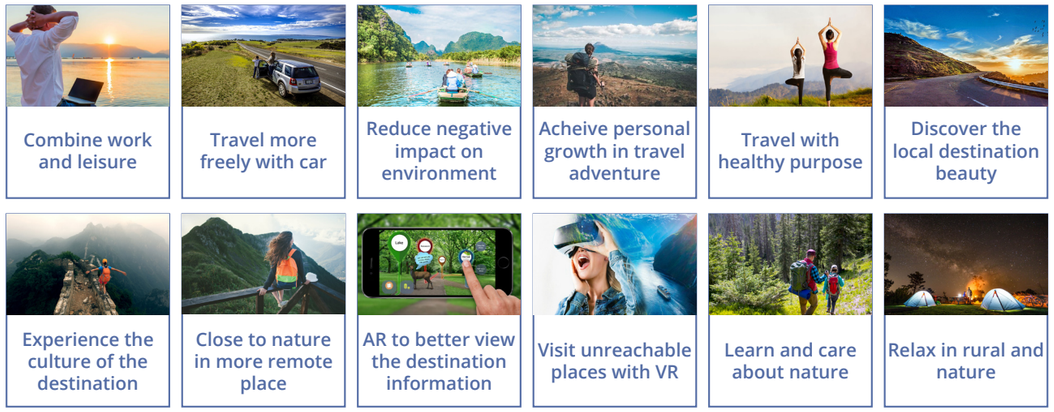
4.2.3 Future Travel Trends

This section focused on researching travel trends to gain inspiration for potential travel scenarios by understanding future tourists' preference travel methods and destinations. First, future trends were identified and listed by looking at the tourism reports. Then searched online for trend keywords to find representative images that reflect trend scenarios. Lastly, put all the images together to generate an inspired moodboard, which can be found on the next page.

Future Travel Trend moodboard

A moodboard composed of all the future travel trends can be seen below. A detailed description of each trend can be found in Appendix H.

Figure 16.Future Travel Trend Moodboard



Insights for potential tourism scenario

Understanding and protecting nature

Various personalised travel motivations can be seen from the trends, such as gaining health, experiencing the culture, self-growing and so on. Among them, the motivation to understand and protect nature is prominent and rising. Around 69% of global tourists want to travel in a more sustainable way that has less impact on the environment (Paolinelli, 2021). And increasing Tourism activities based on the natural environment allow tourists to learn the nature and ecology, so as to enhance protection awareness and better care for nature (Tuliu.com, 2016).

Visiting remote and natural destinations

Besides, it can be seen from the moodboard and trends that remote and natural places have become popular destinations for people. In addition to raising awareness of natural beauty, better relaxation in the wilderness is one of the reasons why nature destinations are becoming more and more popular (Nault, 2020). Also, the COVID-19 epidemic and the social distance limitation also makes people more prefer to stay away from crowded cities and travel to remote areas with fewer people (Paolinelli, 2021).

Section 4.2 | Conclusion

This section concluded the unique advantage of small satellites in providing destination monitoring and communication services for more remote and underdeveloped areas by discussing the strengths, weaknesses, opportunities and threats of small satellites in smart tourism. And explored five potential satellite applications to support travel experience by generating concepts through brainstorm sessions. Besides, researched the future travel trends to gather insights for potential tourism scenarios, including understanding and protecting nature; and visiting remote and natural destinations. In the next section, all the key insights from the above research and analysis in this chapter will be synthesized into possible design directions of the Smart Tourism market entry strategy.

4.3 Synthesis: Design directions

Based on the insights from the research and analysis in the previous sections, this section has formulated three possible design directions for the strategy of entering the smart tourism market. Meanwhile, selected a design direction that can better deal with the challenges of entering the Smart Tourism market, to further develop detailed strategies.

4.3.1 Possible Design directions for strategy

Direction 1
Outdoor planning & adventure

Outdoor lovers always encounter difficulties while travelling in remote and natural areas, this direction aims to provide real-time and reliable destination information to support their journey at two stages, planning the adventure, and during the adventure.

When planning an adventure, satellites can provide outdoor lovers with accurate and reliable route descriptions, topographic maps and weather forecasts. In order to help them better plan a suitable route according to their outdoor ability, and start at the right time and weather conditions to ensure a safe and pleasant trip. Meanwhile, provide outdoor beginners with comprehensive outdoor knowledge and suggestion to support their first adventure.

In addition, during the adventure, satellites can provide real-time data to support temporary decisions and route changes during the journey. It also ensures the safety of outdoor travelers by navigating the correct route and provides emergency communications for quick rescue.

Direction 2
Sustainable Tourism in National Parks

Popular remote natural destinations, such as national parks, face the challenge of maintaining the local environment and ecology while developing tourism. This direction aims to support sustainable tourism in National Park and enhanced the experience for tourists to protect the destination.

For sustainable tourism, satellites can support National Parks in monitoring the sustainability of destinations by obtaining information about environmental conditions. At the same time, identifying areas of excessive tourism pressure provides environmental information to support destination conservation and pressure mitigation measures.

For enhancing tourist experience, satellite can also support National Park in providing visitors with personalized routes and activities for an immersive experience, thereby raising public awareness of nature and biodiversity conservation and encouraging people to contribute to environmental protection.

Direction 3
Destination satellite images website

The COVID-19 pandemic has stimulated demand for at-home viewing of destination information for remote travel experiences. At the same time, the demand for more realistic destination information will continue to expand even after the pandemic to support more discreet travel planning by travellers. The concept is designed to meet the need for remote access to the realities of destinations by providing satellite imagery of destinations across the country.

Meanwhile, data from satellite image databases and tourist browsing websites can be made available to a wider range of stakeholders for decision making. For example, it helps tourism companies to understand tourists' preferences to develop new itineraries; supports destination management agencies to identify and solve destination management or planning problems; and facilitates governments to better manage tourism resources by monitoring the development of each destination, etc.

4.3.2 Direction Assesment

To decide a suitable way for introducing satellite technology into the market, the three design directions described above will be evaluated to determine their potential to meet the project goals and the ability to encounter the challenge of entering the new market. The assessment criteria will be based on four aspects: starting difficulty, competitive ability, market expansion, strategy sustainability. The three directions will be ranked according to these four aspects, and the direction that ranked more at the front will be chosen to go further. In order to simplify the title, D1, D2, D3 will represent the three design direction concepts in the following evaluation (e.g. Direction 1=D1).

The "Starting difficulty" here means how easy it is for the product to sell and acquire users in the market. D3 rank first because it is more like an open platform that can meet the needs of different people. Since it is easier to sell service to the customer than business, D1 ranks second and D2 rank last.

	1st	*2nd*	*3rd*
Starting Difficulty	**D3**	**D1**	**D2**

The “Competitive ability” here means that it is hardly imitated or replicated by competitors. Compare to D2, D1 rank second because consumers usually prefer to obtain information from multiple channels. Once competitors provide the same service, consumers are likely to switch to another brand. Instead, if D1 successfully occupied the market, it is easier to form market barriers. D3 rank the last, because competitors can also easily get satellite images and build the website.

	1st	*2nd*	*3rd*
Competitive Ability	**D1**	**D2**	**D3**

The “Market expansion capability” here means the potential to provide products on a larger scale in existing markets or to provide products in new markets. D2 ranks first here because sustainable tourism services can also be applied to destinations other than national parks and provide service to consumers. D1 is second because it can gradually serve more types of tourists. And since D3 is more like a database than a service, it ranks last.

	1st	*2nd*	*3rd*
Market Expansion Capability	**D2**	**D1**	**D3**

The “Strategy sustainability” here means the positive impact of the business on the environment and society. D2 rank first because it focuses more on environmental protection. Then D1 ranks second because it can help people travel in a suitable way. And D3 rank last.

	1st	*2nd*	*3rd*
Strategy Sustainability	**D2**	**D1**	**D3**

Figure 17. Assessment of three design directions

	1st	*2nd*	*3rd*
Starting Difficulty	**D3**	**D1**	**D2**
Competitive Ability	**D1**	**D2**	**D3**
Market Expansion Capability	**D2**	**D1**	**D3**
Strategy Sustainability	**D2**	**D1**	**D3**

4.3.3 Chosen direction

According to above assessment, D2 ranks in the front and is chosen as the direction to continue. Although D2 is hard to acquire customers at the beginning, once take a position in the market, more commercial barriers can be formed. Meanwhile, D2 has better market expansion capabilities and is one of the three directions that takes sustainability into account. As the company's social responsibility is increasingly valued by the customer, having positive impacts on society will be the key to the company’s continued competitiveness and strong vitality in the future (Chladek, 2019).

Chapter 4 | Conclusion

Challenges of entering the market

At present, most cases of Smart Tourism are carried out in relatively developed cities, and more IoT technologies are applied. In contrast, satellite technology is less known and seldom applied. To enter the smart tourism market, it is necessary to face the challenges of introducing small satellite capabilities to the public and competing with existing IoT companies in the market.

Small satellites are suitable for remote and underdeveloped places

Compared to other technologies, satellite has the unique advantage that it can quickly detect large areas or remote places more easily through sensing technology, while providing cheaper or emergency communication solutions for less developed places without the Internet.

Trend of caring nature and going remote places

From the trend, more and more tourists hope to travel in a more sustainable way, and be able to better understand and experience nature during the journey. At the same time, the COVID-19 epidemic has also led people to choose more remote and areas that are sparsely populated.

Sustainable tourism in National Park as design direction

Due to better market barriers and sustainability considerations, the direction of providing sustainable tourism solutions for National Parks was selected as the strategy to enter the smart tourism market.

Following

This chapter provided an understanding of the smart tourism market and developed the design direction for the market entry strategy. The next chapter will further explore the identified design directions to develop a detailed strategy.

Chapter 5

EXPLORING THE SCENARIO OF NATIONAL PARK

The previous chapter identified the design direction of supporting sustainable tourism in the national park. In order to gain a deeper understanding of the scope of this design and formulate detailed strategy, this chapter will dive deeper into this topic to obtain design insights through literature research and interviews with stakeholders.

Content

5.1 Design Reseach set up

This section describes the research goals and methods used to explore insights into sustainable tourism in national parks.

5.1.1 Research Goal

Although it has been mentioned previously that satellites can obtain environmental information of National Parks and identify areas with excessive tourism pressure to support sustainable tourism, the development of sustainable tourism also contains more factors, such as reasonable planning, ecological construction and low-carbon management. Therefore, the goal of the research is to identify the problems and challenges of National Parks and relevant stakeholders in the process of developing sustainable tourism to explore the possibilities of satellite applications.

5.1.2 Research Questions & Methods

Literature review

First, it is necessary to understand the missions and challenges of National Parks in the development of sustainable tourism. Therefore, the method of literature review was chosen to answer the following questions

- *What are the development goals of the national park?*
- *What challenges will national parks encounter in the process of developing sustainable tourism?*
- *How can satellites support national parks to meet the challenges?*

Interviews

In order to generate a unique value proposition, user research is needed to understand the needs, motivations and values of national park stakeholders. Therefore, based on the following research questions, semi-structured interviews with national park stakeholders will be conducted.

- *What problems will stakeholders encounter during their work?*
- *How can satellites help stakeholders deal with these problems?*

5.2 Literature Review

This section summarizes the definition, background and missions of National Park through literature review, as well as obtain insights from the challenges of developing sustainable tourism to explore opportunities for satellite implementation.

Figure 18. SanJiangYuan National Park (Sohu, 2021)

5.2.1 Definition, Background and Missions of China's National Parks

The International Union for the Conservation of Nature (2017) defines national park as

"Large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities."

Different from generally nature reserves that are strictly protected, national parks advocate rational use of specific areas to carry out travel experience and popular science education under the premise of scientifically protecting large areas of natural ecosystems, so as to achieve harmonious coexistence between man and nature(The Government of China, 2017).

In China, the development of national parks is relatively late, so far there have been only 10 national park system trials (Sun & Ma, 2020). However, the national park is not only a type of protected area, it also represents a higher-level nature reserves management system (Sun & Ma, 2020). Due to a number of problems that exist in China's current used nature reserve management system, such as the chaotic classification of protected areas, no corresponding regulations for strict protection and reasonable utilization, management fragmentation and so on (Kchance, 2017). The current nature reserve management system will gradually be replaced by the complete national park system (Kchance, 2017). This also means that the concept of national parks will become the development direction of all protected areas in China in the future.

With the aim to serve as the bridge between the nature reserve and the public, the **National Park has four missions.**

Preservation of natural ecosystems centred on wild animals and plants.

Maintain the quality of tourist's recreational experience.

Conduct ecological research and natural science education for understanding and protecting nature reserves.

Improve the quality of life of local community residents and inherit the local culture.

However, due to the short development time, China's current national park system is imperfect, the construction and implementation processes are still facing challenges, which will be elavorated in the next section.

5.2.2 Challenges of National Parks

As mentioned in the previous chapter, tourism in National Park needs to be carried out reasonably under the premise of ensuring the natural ecological environment. This poses two challenges for national parks in terms of environmental protection and tourism development, which will be introduced below.

Challenge 1: Lack of overall understanding and precise regional planning

Since the national parks usually cover a large area and complex terrain, it is difficult to conduct detailed environmental background investigations in all areas, resulting in the problem of lack of comprehensive understanding of the park (Y. Li, 2019). This also leads to unclear positioning of different types of regions within the park by the community, and causes the problem of overlapping spaces between different functional regions (Y. Li, 2019). Thereby, the organizer hard to precisely control and manage different regions, which affects the effective protection and overall development of the national park (Y. Li, 2019).

Challenge 2: Management under high pressure due to scattered human activities

Except for tourists, National parks still existing large numbers of local residents with scattered human activities, which increase the difficulty of managing wide national parks (Peng, 2021). Besides, as national parks are usually located in remote and underdeveloped areas, the protection and supervision tasks mainly rely on manpower such as rangers or local residents, which is difficult to detect all illegal activities and monitor all regions, and put high pressure on the management (Peng, 2021).

Challenge 3: Ecological restoration of destroyed nature reserves

In the past, the lack of environmental awareness and the pursuit of rapid economic development led to the destruction of the environment and ecological threats in nature reserves (Jie, 2018). Shrinking lakes, desertification, reduction of biodiversity, these leftover environmental problems have brought great challenges to the development of national parks (Jie, 2018). Which requires effective measures to restore the destroyed regions and avoid secondary damage by tourism activities (Jie, 2018).

Challenge 4: Hard to balance the environmental protection and tourism development

There are two extreme phenomena in national park tourism. One is the excessive development of protected areas into tourist attractions, which has a greater impact on the environment and ecology (Su & Su, 2018). The other is excessive restrictions on tourism, strictly controlling available areas to access and external visitors, which also lose National Park's significance as a bridge between humans and nature (Peng, 2021). Both of these situations are far away from the initial goal of achieving harmony between man and nature. The cause of the contradiction between development and protection lies in the lack of funds and professional talents. Therefore, it is difficult for organizers to conduct professional analysis of the characteristics of national parks, and design reasonable tourism development methods that are suitable for the ecological environment (Sun & Ma, 2020).

Challenge 5: The current form of tourism in national parks lacks characteristics

At present, the tourism services and activities provided by national parks are still in a traditional way, mainly in the form of ordinary sightseeing, which means no different from normal destination experiences for tourists (X. Li, 2018). In the absence of characteristic tourism forms, National Park not only fails to attract tourists by providing unique natural experiences, but is also not able to achieve the goal to promote public environmental awareness and behaviour through nature education (He, 2019).

5.2.3 Opportunities for satellite applications

Inspired by the understanding of the National Park, here are some ideas of possible satellite applications to facilitate National Park organizers better face the challenges of protecting the nature reserve and developing tourism. The challenge corresponding to the idea will be mentioned in the abbreviated form (e.g.Challenge1 = C1).

Idea 1

C1 C4 Applying remote sensing technology to facilitate the background surveys of the National Park, so as to have a better understanding of the different areas and make reasonable division. Meanwhile, develop reasonable tourism projects that are suitable for the ecological environment according to the characteristics of different regions.

Idea 2

C2 Use satellite remote sensing to detect illegal use of land and other prohibited behaviours that can cause damage to national parks.

Idea 3

C2 Assist rangers in their daily patrol work with satellite communication, navigation functions, to improve the efficiency of their monitoring tasks.

Idea 4

C3 Use satellite remote sensing to analyse the causes and current conditions of the destruction of the protected area, so as to formulate an effective restoration plan.

Idea 5

C3 C4 Satellite remote sensing can be used to regularly monitor the environmental indicators of National Parks, so as to identify areas with excessive pressure due to tourism activities and implement protective measures in a timely manner. In addition, the effectiveness of measures can also be dynamically evaluated based on indicators and adjusted in time according to the situation.

Idea 6

C2 C5 The information of National Park obtained by satellites can be used to provide tourists with more personalized travel routes, and combined with voice and augmented reality technology to support immersive smart guide services. At the same time, the satellite positioning function can be used to guide the travel route of tourists and prompt them when they are about to enter the forbidden area.

5.3 Interview

This section aims to use the insights from interviews to understand the needs, motivations and values of various national park stakeholders in order to generate unique value propositions and explore satellite application opportunities.

5.3.1 Interview set-up

Interview Structure

The semi-structured interview was used to obtain target information while gaining some unexpected insights(Adams, 2015). Due to participants located in different places in China, the interviews were conducted remotely through phone calls for about half to one hour.

First, the interviewees were asked to introduce themselves and their work. Open-ended questions were then used to gain more insight into the mission and process of their work and led to the topic of the challenges they face in relation to national parks. The last question asked the interviewee to imagine how the satellite could help them in their work. The interview guide can be found in Appendix I.

Interview Participants

The selected interview participants included landscape designers, tourism destination management organizations, and tourism companies, in order to cover all aspects of developing tourism in National Park from planning to service. Brief introduction of the 6 interviewees can be seen below.

Destination management department staff

Female, age 36
Worked at Langshan Tourism Authority, responsible for the development of local tourism industry.

Male, age 41
Worked at Nanshan Tourism Authority, responsible for managing the comprehensive affairs of the destination.

Tourism company staff

Female, age 28
Worked in a tourism project planning and promotion company, responsible for marketing and promotion of tourist destinations.

Male, age 39
Worked in a travel agency company, responsible for formulating travel routes.

Landscape designer

Male, age 25
Worked in a landscape design company and participated in the design project of urban nature reserve.

Male, age 28
Worked in a landscape design company and participated in many tourism destination design projects.

5.3.2 Interview Result Conclusion

All six interviews were transcribed into scripts and key insights were generated by clustering the statements. The codebooks used for analysis can be found in Appendix I.

Insight 1: Need for accurate destination information

All interviewees mentioned in the interview that one of the biggest challenges they face in their work is that due to the lack of sufficient knowledge of the destination in the early stages of the tourism projects, there is a large gap between the assumption and the actual situation. This makes the planning or design of the project difficult to achieve, or is later found to be so different from the reality that it needs to be overturned altogether. Currently, the only solution to this challenge is to manually survey destinations to get the most realistic picture. However, such an approach is laborious, time-consuming, and difficult to implement in a wider range of destinations. Therefore, interviewees mentioned that having more accurate information about tourist destinations in the pre-project phase could greatly reduce their work and improve the progress of tourism projects.

Insights 2: Need for a better form of communication

The process of a tourism project usually involves stakeholders from different aspects. How to communicate to let other parties understand and recognize the results of the work is one of the challenges faced by all stakeholders. The actual situation is that due to the differences between majors, the communication between stakeholders is usually not close enough, and it is difficult to obtain the required information in the first place. At the same time, difficulties in understanding and loss of information often occur when communicating results due to differences in presentation. Some interviewers mentioned that if the results could be presented in a more data-based manner, it could help them communicate and understand better.

Insights 3: Need for simplify complex things

Interviewers mentioned many possibilities for satellite applications, such as monitoring plant growth; protecting heritage; monitoring land use; understanding target tourists, and so on. Although the purposes were different, the interviewees all expressed the same expectation during the description, which was to make things that were originally complex more intuitive, simple and easy to operate.

Insights 4: Need for cheaper solutions

Interviewees from destination management mentioned that although the use of more advanced technology is important for the development of tourism, the development of tourism does not come first as governments in less developed regions usually have insufficient financial resources and can only address the most pressing and urgent issues of the destination with limited funds. Therefore, low cost is also one of the important conditions to promote satellite applications.

5.3.3 Opportunities for satellite applications

Inspired by the insights from the interview, here are some possible satellite application ideas to provide National Park stakeholders with the services they need. The insights corresponding to the ideas will be mentioned in abbreviated form (e.g. Insight 1 = I1).

Idea 1

I1 I3 By detecting the destination data through satellite remote sensing, and combining 3D digital model technology, the destination one to one scale digital terrain model can be formed quickly to show the real situation of the destination. As a result, destination information can be displayed more visually on the digital model, thus helping users to have easy access to the information they need.

Idea 2

I1 I2 I3 Without the need for professional detection of third parties, users can apply satellite remote sensing technology to detect destinations independently and quickly and obtain the required data. At the same time, the situation and changes of the destination can be more visually digitized and visualized on a digital model or map, thus helping different stakeholders to communicate.

Idea 3

I3 I4 Satellites can provide cheaper and more convenient solutions than other technologies, so as to obtain customers who cannot get technical support due to limited funds.

Chapter 5 | Conclusion

National park positioning as the bridge between human and nature

National parks advocate the rational use of specific areas under the premise of scientifically protecting a large area of natural ecosystems to carry out tourism experience and popular science education. This is the development direction of all protected areas in China, which will be the trend of sustainable tourism in China. The tasks of the national park include protecting the ecological environment, improving the tourist experience, conducting natural science research and education, and improving the quality of life of local community residents.

The challenges of protecting the environment while developing tourism

The challenges of national parks mainly come from two aspects: environmental protection and tourism development. Including lack of overall understanding and precise regional planning; management under high pressure due to scattered human activities; Ecological restoration of destroyed nature reserves; Hard to balance the environment protection and tourism development; The current form of tourism in national parks lacks characteristics.

The problems of project delay and the demands for higher efficiency

While contributing to the tourism development of National parks, stakeholders such as landscape designers, destination communities, and tourism service companies, often face the problem of project delay due to hard to reach accurate destination information and inefficient communication. Besides, they have demands for simplifying complex things and cheaper technical solutions to help them work more efficient.

Following

This chapter dived into the design scope of sustainable tourism in National park, and obtained insights for possible satellite application and value proposition. In the next chapter, all the insights and key findings discovered in this thesis will be gathering together into a design brief for developing the strategy.

Chapter 6

DESIGNING THE STRATEGY

This chapter introduces the process of designing the strategy. First, a design brief is determined, including synthesis of all insights from previous research and analysis, the future vision for StarDetect, and important design requirements. Then develop the strategy by iterative analysis of the satellite application insights in this thesis. Finally, the three horizons for the strategy is elaborated.

Content

6.1 Design Brief

The aim of this section is to formulate the vision and requirements that need to be considered when designing the strategy. Therefore, the insights synthesis from previous research and analyses will be explained firstly, which lead to the generation of the future vision. Then, the design requirements will be specified based on the research question at the beginning of the project.

6.1.1 Insights synthesis

This section synthesized and discussed the key insights from literature review, analysis, and design research. The following design perspectives will be used for formulating the future vision for StarDetect and the strategy to reach the vision.

Insights for entering the Smart Tourism Market

- ***Applied in natural and remote tourism destinations***

  As noticed from the SWOT analysis, small satellite is suitable to be applied for larger, remote and underdeveloped areas with less technical support. Meanwhile, it can be seen from the travel trend that remote and natural destinations will become popular destinations for people, which provide satellite opportunities to be implemented. Thereby satellite has the ability to compete with IoT technology to enter the Smart Tourism market.

- ***Provide cheaper and easier-to-use services***

  The SWOT analysis also discovered the weakness of small satellite that users may lack professionals to maintain satellite equipment and analyze the data obtained. This issue is also mentioned in the interview. The interviewee expects that technology can be used to make complicated things simpler, not more complicated. Thereby, the product satellite provide should be easy to use by non-professionals.

  Meanwhile, the interviewee also mentioned concerns about not being able to use technology due to insufficient funds. As noticed from SWOT analysis, satellite can provide cheaper options for destination monitoring and communication service than other technology, so offering cheaper solutions can also become the unique selling point for satellite service.

Main applications of satellites in smart tourism

- ***Monitoring the environment condition of the destination***

  The research showed that maintaining destination sustainability is one of the most important goals of smart tourism. And satellite can play an important role in destination protection by applying remote sensing to monitor the environmental indicators. The capabilities include identifying areas that are under excessive tourism pressure, detecting illegal activities that will damage the environment, and monitoring the ecological restoration of destroyed nature reserves, and so on. Meanwhile, compared with on-site monitoring, satellites require less equipment and manpower and can be performed regularly at a higher frequency.

- ***Provide destination information for different needs of stakeholders***

  From the research, it is clear that all the stakeholders have strong demands for destination information. For example, destination management organizers need to better understand the destinations to formulate reasonable regional division and management; tourism project planners and designers need to obtain the real situation of the destination to ensure that their plan can be realized; tourists need destination routes and weather information to make personalised travel plans, and so on. Satellites can satisfy all these needs through remote sensing technology to collect destination data. Compared with other technologies, satellites have the advantage of being able to detect places that are difficult to access.

- ***Communication, positioning and navigation service to improve tourism experience and ensure safety***

  It can be known from satellite capabilities and SWOT analysis that satellites can provide cheaper communications support for areas without networks. Meanwhile, combined with positioning and navigation functions, satellites can provide tourists in remote areas with personalized route support and smart guide services to help them get a better travel experience. This is one of the main tasks of smart tourism.

  In addition, Interviewee has mentioned that there are a lot of vacancies in the rescue market, and satellites can play a role in supporting rescue. For example, satellites can support tourists to locate and communicate with their companions or outsiders when exploring sparsely populated areas to ensure that they can be rescued quickly in the event of danger.

6.1.2 Design Goal: Future Vision

According to Simonse et al. (2018) “A future vision is an expression of a desired future where it provides a strategic reference point for actionable innovations.” To set up a goal for the strategy, the future vision will be defined.

Combining StarDetect's goal of using satellites to promote world progress and the insights in this article, the future vision formulated for StarDetect is as follows:

> **" StarDetect supports sustainable and safe travel with reliable and affordable satellite services. "**

6.1.3 Design Requirement

In order to make sure the outcome of this thesis can address the design goal of the project. The design requirements are defined below as the criteria for the delivery strategy.

Viability

- The designed strategy can lead Star Detect to enter the field of smart tourism and develop new business

- The new business can allow Star Detect to occupy a unique market position in the smart tourism market to distinguish it from other competitors

- Star Detect can continuously expand the application scenarios and target groups of satellites in the field of smart tourism to ensure business growth and expansion

Desirability

- Be able to facilitate the destination management organizations to manage the destination and protect nature reserves more efficiently, and ensure the sustainability of destinations

- Meet tourists' needs for destination information to help them make personalised travel decisions and get a better travel experience

- Meet the needs of tourism companies for destination information to ensure the feasibility of their designed project, so as to reduce the workload.

- Help the government and residents solve the problems they face when developing destinations

Feasibility

- The first horizon of the strategy can be realised within 1-3 years by using existing technology and readily available resources

-The technology and resources required for the three horizons are in line with the development plan of StarDetect satellite technology.

Profitability

- Each horizon of the strategy has a corresponding profitable business model.

6.2 Iterative design

6.2 Iterative design
In order to formulate the strategy to enter the market, it is necessary to transform the previously obtained satellite application insights into strategic decisions. Therefore, the 2x2 matrix was adopted to integrate the insights of satellite application opportunities explored in Chapter 4 and Chapter 5, thereby, the three main stages of the strategy can be distinguished.

To define the position of each satellite application in the matrix, two aspects should be considered, the time required to implement the application (vertical axis, from one to ten years), and the urgency of users' demand for the application (horizontal axis, high required to low required).

Then, based on the position in the matrix, the priority of the satellite application to the market can be determined. Applications that require less time and are more urgently needed will receive more attention, and the products and value propositions at different stages of the strategy will be determined accordingly.

To ensure that the application is placed at the correct position of the matrix, the CEO of StarDetect was invited to complete the matrix together, at the same time, some extra feedback on the applications are obtained.

Finally, all satellite application insights are placed in the matrix, and be divided into 3 phases to realise according to the implementable time. Thereby providing insights into the three horizons of achieving the future vision. The finished matrix can be seen in figure 19 on the next page.

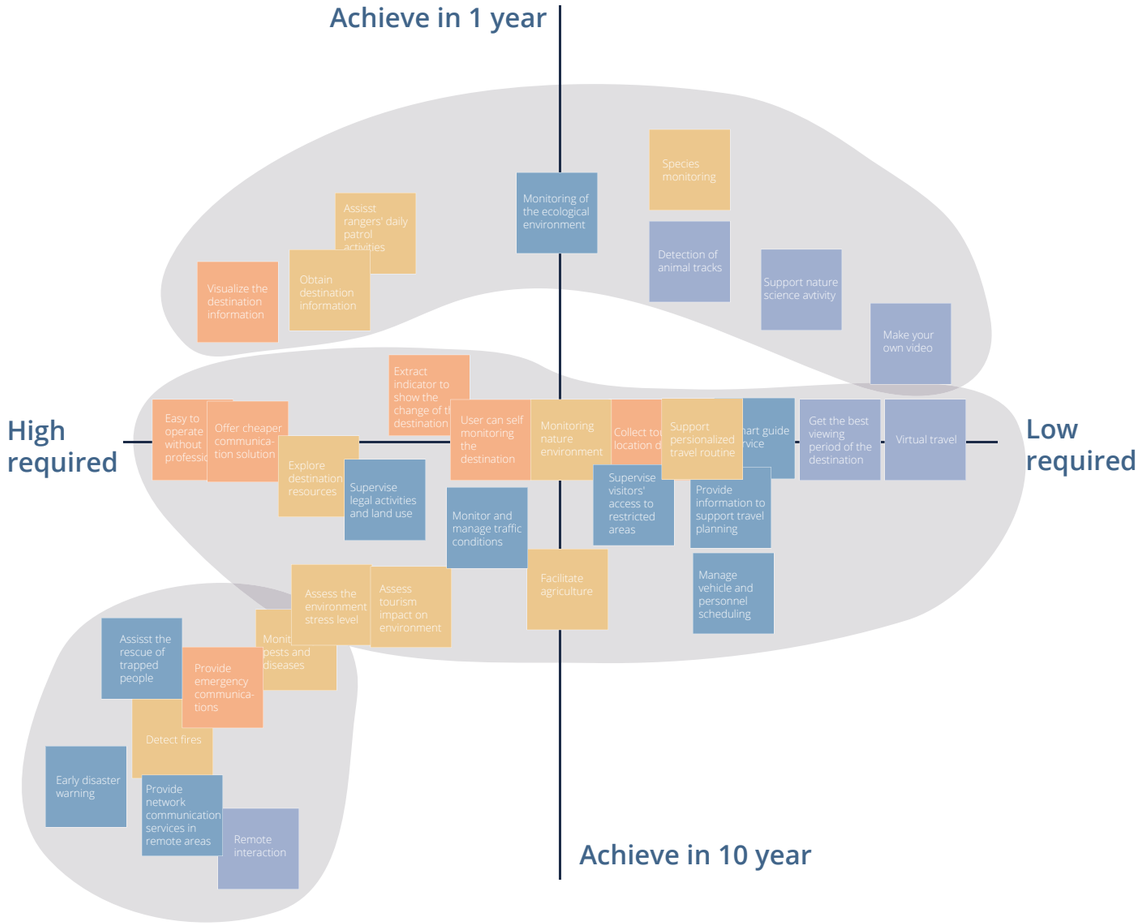


Figure 19. Matrix for intergating ingishts of satellite applications

6.3 Develop strategy

The strategy for entering the Smart Tourism market takes the future vision as the goal. In order to visually present the way to achieve this goal, the roadmap is used to describe the strategy. This roadmap will adopt the Three Horizons model of Curry and Hodgons (Curry & Hodgson, 2008), including three parallel scenarios based on three different life cycles of strategic business innovation. Each life cycle is projected to the future timeline and is accompanied by new business development (Simonse et al.,2018). Based on the matrix in above chapter, the three horizons for the roadmap are determined and elaborated below.

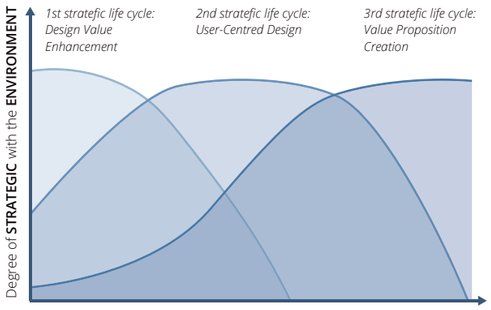


Figure 20. Strategic Life Cycles model of Three horizons (Simonse,Whelton & Iwanicka,2018)

Horizon 1 - Enter the Market

The goal of Horizon 1 is to start StarDetect's new business in the Smart Tourism market. Considering that there are certain risks in entering a new market, the products provided at this stage should require less investment and be easier to implement, meanwhile, introduce the capabilities of the satellite which meets the other urgent needs. Therefore, the target group and product provided at this stage will be developed around the applications in the upper left corner of the matrix. The scenario and the product proposition of this horizon are as follows.

- ***Destination Exploration Service***

  Starting a new tourism project is a complex and long task that requires the cooperation of multiple professionals. Especially when developers want to place the tourism project at an unfamiliar destination, accurate and reliable destination information, such as topography, weather, and natural resources, is the key to reasonable planning of the destination and ensuring the smooth progress of the project. However, it is usually very time-consuming, costly, and inaccurate for developers to obtain information with existing background survey solutions in a destination with a large area and complex terrain such as the national park.

  Therefore, this horizon will target to facilitate the progress of tourism projects in large areas and complex environment destinations, by providing Destination Exploration service to meet the needs for destination information of different stages of tourism project development, including tourism resource evaluation, planning land use, planning tourism products, designing landscape, supervising construction progress, etc.

Figure 21. Scenario of Destination Exploration service & 3D Digital Modeling service

Compared with existing solutions, the destination detection services provided by StarDetect are able to obtain a large amount of accurate destination information with shorter time and less workload, furthermore, the price is much cheaper. This means for developers that can conduct more frequent detections to obtain more updated destination information to meet the needs of various professionals at different progress stages. So as to ensure the feasibility of planning and the progress of the project could reduce development costs.

- ***3D Digital Modeling Service***

  In addition, by combining digital modelling technology, the destination information obtained by the satellite can be transformed into a visualised 3D digital model on the screen. So that users can intuitively feel the real situation of the destination even if they have not arrived at the scene, and make decisions that are more in line with the actual situation. Besides, visualized information can also assist in solving the communication problems between different professionals involved in the tourism project, such as information delay, communication barrier, not close cooperation and so on. Through the visualized 3D digital model of the destination, the work results of different professionals can be better presented to help them better understand each other and communicate more smoothly, thereby improving the quality of cooperation and work efficiency.

In conclusion, in horizon 1, StarDetect will start the journey in the tourism field by providing fast and reliable destination information acquisition and presentation services, and laid the foundation for the subsequent expansion of the product portfolio.

Horizon 2 - Enlarge the Sales

The goal of Horizon 2 is to expand StarDetect's product portfolio and increase sales. The second phase in the matrix shows that there is strong need for destination environment monitoring, which is also one of the key findings summarized in Insights synthesis. Therefore, new service scenarios and product propositions at this horizon will be developed around the destination environmental monitoring.

- ***Destination Environment Observation Service***

  As natural tourism destinations become popular in China, the pressure on the protection of the ecological environment and cultural heritage of the destinations has gradually increased. In particular, tourism destinations based on natural resources, such as national parks, need to monitor and evaluate the impact of tourism activities on the environment frequently to ensure destination sustainability. However, the most frequently used ground surveys are usually costly and lack accuracy. The managers of natural destinations interviewed in this project have stated that they usually conduct ecological assessments of the destinations every 5 years, this frequency is definitely not enough for detecting the pressure of the destination on time and take action to prevent negative environmental results.

Figure 22. Scenario of Destination Environment Observation service

Therefore, for destination management organizations that focus on the sustainability of destinations, StarDetect can provide Destination Environment Observation service to obtain reliable information about the destination's environmental conditions, and convert it into visual environmental indicators to help managers perform sustainable decision-making. By regularly obtaining key indicators of the destination, such as the quantity and quality of vegetation, the water capacity and quality of rivers and lakes, the biodiversity of animal habitats, and human construction and activities, etc. It is possible to detect the changes of the destinations and assess environmental trends to identify potential stress areas and identify the causes of stress. Thereby, the destination management can take effective protective measures before the environmental pressure becomes too high, to prevent irreparable damage to the environment.

In addition, the acquired historical data and indicators of destinations can be used as basic data to help destination management organizations and local governments formulate more reasonable planning for the development of sustainable tourism, and assess the new tourism projects in advance, to avoid negative impacts on the destination and economic losses caused by project failure.

The 3D digital model of the destination developed in Horizon 1 will also be applied in this service to present the environmental indicators of different regions of the destination in a visual way, to help managers have an overall view of the environmental situation of the destination and carry out comprehensive protection and management measures.

- ***Sustainable tourism information platform***

  In addition, with the increase of environmental awareness, sustainable development has become one of the important considerations for more and more tourists in choosing tourist destinations. For travellers who care about the destination environment and like to visit natural destinations, StarDetect can offer a sustainable tourism information platform to support their responsible travel choices. The platform can provide responsible travellers with sustainable information about each destination in the form of a website, such as the current environmental conditions of the destination and the pressure indicator due to excessive tourism, to support travellers to travel with less pressure destination.

  In addition, the website can also provide information about environmental protection activities in different destinations to encourage travellers to participate in, and obtain special travel experiences by contributing to the environment. Similarly, the 3D digital model of the destination can also be applied to the website to better present the destination information to support travellers in making suitable travel plans. Ultimately, the user data generated by the website can be used to research and understand the preferences and behaviours of the target group of the third horizon.

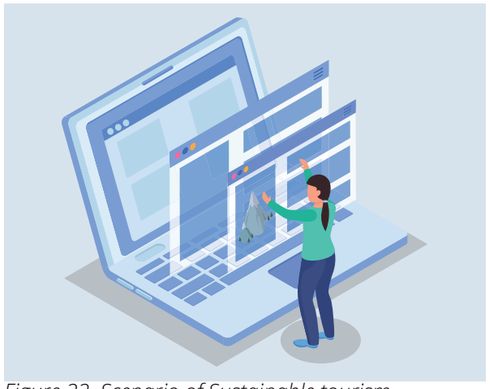


Figure 23. Scenario of Sustainable tourism information platform

In conclusion, in horizon 2, StarDetect will gain more business opportunities to take a step forward in the tourism market by providing destination environmental monitoring services. In addition, the website that provides sustainable tourism information for responsible tourists has built a channel for direct communication with end consumers, to prepare for the B2C business in Horizon 3.

Horizon 3 - Expand the Market

The goal of Horizon 3 is to further expand the product portfolio and extend market segmentation, meanwhile, begin the first B2C business. It can be seen from the third phase in the matrix that there are urgent needs for the safety of the destination, this horizon's new service scenarios and product propositions will develop around this theme.

- ***Disaster warning and Security monitoring Service***

  As an activity highly dependent on weather, tourism is often vulnerable to sudden natural disasters. Extreme weather such as strong winds, heavy rains, and high-temperature will threaten the safety of tourists and local residents at destinations, and may cause damage to the local natural landscape and property. In addition, there may be other unexpected events, such as forest fires, landslides and even man-made tree felling. Being able to foresee or discover potential safety hazards and deploy them in advance is essential to ensure the travel safety of the destination and reduce property losses. However, the most common solution currently is quite primitive, that is, 24-hour human patrols to detect potential hazards after obtaining extreme weather forecasts, which is very labour cost and not enough to cover all regions of large-area destinations.

  In this regard, StarDetect can provide Disaster warning and Security monitoring services to help tourist destination management organizations and governments better deal with the challenges of security threats brought by extreme weather. The real-time weather data and destination data collected by satellites can be integrated and analysed by big data and deep learning technology, thereby predicts the potential safety hazards of the destination that may caused by the coming weather.

  Then provide automatic early warning to the local destination management and government with information of risky locations, possible happen incidents, risk degree assessment and some corresponding suggestions to deal with the potential accidents, so as to help them identify and understand potential risk areas in advance, and take timely disaster prevention measures based on corresponding information, meanwhile making plans and prepare for the possible incidents to minimize the impact of extreme weather on the destination.

  In addition to preventing potential risks in advance, for sudden security incidents or man-made damage, such as fires and forest logging, satellites can also detect these emergencies in time in the daily real-time sensing of the destination and alert the destination manager. And after the incident happens, satellites can continually provide detailed information on the progress of the disaster to support rapid response decisions and measures, so as to control the scope and impact of disasters as much as possible. Besides, the 3D digital model of the destination can also support this product portfolio to visualise information.

- ***One-Stop Service Platfrom for Outdoor traveller***

  Meanwhile, in Horizon 3, StarDetect will begin to provide services directly to end consumers base on the information platform created in Horizon 2, to support outdoor travellers to visit unfamiliar remote areas. The platform will continually provide service to the traveller from planning to taking adventure. At the planning stage, users will be able to access the contextual real-time data of the destination, including high-quality 3D outdoor maps, and detailed descriptions of the environment, terrain, and routes. This information is usually mastered by professionals such as map and geography experts, which is difficult for normal travellers to obtain, therefore the usual outdoor maps are either of low quality or difficult for non-professionals to read.

  Through more visualized and detailed destination information from the StarDetect, users can better develop their own adventure plans based on the actual situation to ensure a good experience and safety. In the pre-adventure preparation phase, the platform will integrate weather forecasts with users' travel plans, and provide users with personalized recommendations on the best time to take an adventure by analyzing historical and real-time weather data. During the adventure, the platform will provide users with guidance and decision support through the mobile application of the satellite phone, including detailed route navigation precise location positioning, distress call in emergencies and accidents, and quick response rescue service. And after the adventure, the platform will encourage users to share their experiences with other travellers, and provide photos and records during the trip as extra research data to support destination researchers. and accidents, and quick response rescue service. And after the adventure,

Figure 24. Scenario of One-Stop Platfrom for Outdoor adventure

the platform will encourage users to share their experiences with other travellers, and providing photos and records during the trip as extra research data to support destination researchers.

In Horizon 3, StarDetect has established a firm foothold in the tourism market and expanded the market segment with disaster warning and security monitoring services, meanwhile, the one-stop service platform to support outdoor travellers. As result, the future vision can be reached.

Chapter 7

FINAL DELIVER

This chapter will present the strategy for StarDetect to enter the Smart Tourism market, consisting of a Strategic roadmap and a Tactical strategy map. The Strategic roadmap will present the overview strategy by describing the three horizons toward the future vision. Besides, the Tactical roadmap will explain the strategy in more detail, including the goal, time, market and business model of each horizon.

Content

7.1 Strategic Roadmap

The strategic roadmap will outline the three horizons for realizing the future vision, and serve as a guide for innovative business propositions and strategy decisions on different timelines.

HORIZON 1
ENTER THE MARKET
2022

B2B **Tourism project developer**

Vast, complex and unfamiliar destinations

Horizon 1 will focus on using existing mature technologies to open new businesses in the field of smart tourism at a relatively low cost and risk. For tourism project developers, StarDetect offers Destination Exploration Service that is affordable, reliable and fast, to meet the user's need for quick access to precise destination information. And 3D Digital Model services to present the destination information in a more visual way. By bringing the services to the market, the capability and value of StarDetect can be introduced to the market, as well as acquire initial business customers. Meanwhile, build a foundation for the next horizons product portfolio expansion.

HORIZON 2
ENLARGE THE SALES
2025

B2B **Destination management organization**

Natural destinations

B2C **Responsible traveller**

Natural destinations

Horizon 2 will focus on expanding product portfolio and increase market sales. The Destination Environment Observation service will be launched to create new user value segmentation, to support sustainable tourism by providing key environmental indicators to meet the needs of destination management organizations for regular environmental stress assessment. Besides, a website will be created to provide sustainable tourism information for the responsible travellers who like visiting natural destinations, so as to form a platform to directly communicate with the end consumer and prepare for the B2C business in the next horizon.

HORIZON 3
EXPAND THE MARKET
2028-2031

B2B **Destination management organization**

Destinations frequently affected by extreme weather

B2C **Outdoor traveller**

Remote destinations

Horizon 3 will focus on continuous introduce product portfolio to expand the market segments, and start business directly to consumers. For B2B business, StarDetect will continue to bring new value propositions, that is, providing Disaster warning and Safety monitoring services to meet the needs of destination management organizations to ensure the safety of tourists, local residents, property and the environment. For the B2C business, StarDetect will provide a one-stop service platform to support outdoor travellers' adventures in unfamiliar and remote areas by providing professional-grade destination information and real-time data services. The website formed in Horizon 2 can be used as a starting point for launching a new platform, as it already establishes a connection with consumers and introduces brand values. At the end of the third horizon, the vision of supporting sustainable and safe travel with reliable and affordable satellite services can be reachable.

FUTURE VISION 2031

StarDetect supports sustainable and safe travel with reliable and affordable satellite services.

7.2 Tactical Roadmap

HORIZON 1
ENTER THE MARKET
2022

HORIZON 2
ENLARGE THE SALES
2025

HORIZON 3
EXPAND THE MARKET
2028-2031

Target Groups

Location

HORIZON 1

B2B — **Tourism project developer**

Vast, complex and unfamiliar destinations

HORIZON 2

B2B — **Destination management organization**

Natural destinations

B2C — **Responsible traveller**

Natural destinations

HORIZON 3

B2B — **Destination management organization**

Destinations frequently affected by extreme weather

B2C — **Outdoor traveller**

Remote destinations

Service

Destination Exploration Service & 3D Digital Modeling Service

Destination Environmental Monitoring Service

Sustainable Tourism Information Website

Disaster warning and Security monitoring Service

One-Stop Service Platfrom

Value Proposition

StarDetect offers Destination Exploration Service that is affordable, reliable and fast, to meet the Tourism project developer's need for quick access to precise destination information. And 3D Digital Model services present the destination information in a visual way.

StarDetect offers Destination Environmental Monitoring Service that is affordable, reliable, to meet the Destination management organization's need of regular monitoring the destination environmental conditions to ensure destination sustainability and tourism development.

The Sustainable Tourism Information website created by StarDetect can provide responsible travellers with sufficient information about natural destinations to support their sustainable travel decisions.

StarDetect offers Disaster warning and Security monitoring service that is affordable, reliable to meet Destination management organization's need for early detection of potential security threats and rapid response to unexpected security incidents.

StarDetect offers a One-stop service to meet Outdoor traveller's need for access to professional-level destination information and real-time data support at different stages of the adventure.

Revenue Steam

- Charge per time
- First modelling & update subscription
- Subscription
- Free
- Subscription
- Subscription & Charged special service

Marketing

- Price penetration
- Maintain customer relationships
- Participate and sponsor community events
- Launch advertisements
- Influencer advertising

Technology

- Satellite remote sensing technology
- Digital modeling technology
- Data processing technique
- Real-time remote sensing technology
- Artificial Intelligence technology

Cooperator

- 3D imaging companies
- Forestry experts
- Meteorology, Geology experts

7.2 Tactical Roadmap

In contrast to the abstraction of the strategic roadmap, the tactical roadmap is more concrete, focusing on the relationships between specific elements and the implementation of the strategy (Simonse et al.,2018). Therefore, this section will present the relationship between market, product, technology, resources, and business model in a visual way in the previous page tactical roadmap, and described them in detail as the following.

7.2.1Horizon 1 - Enter the Market

The goal of the first horizon is to start new businesses in the smart tourism market with a product portfolio that is easy to realize and need less investment.

Time

The first horizon is set to be 2022 to 2024.

Market

Target group
The target customer of the first horizon is the developers of tourism projects. These developers are developing tourism projects in vast, complex and unfamiliar destinations, and need to provide detailed destination information to the different professionals involved in the project.

Positioning
For tourism project developers, StarDetect offers Destination Exploration Service that is affordable, reliable and fast, to meet the user's need for quick access to precise destination information. And provides 3D Digital Model services that present the destination information in a visual way. More detailed descriptions of the services provide in this horizon can be found in Chapter 6.3.

Business Model

Value proposition
Compared to existing time-consuming, costly and inaccurate destination background research solutions, StarDetect's Destination Exploration service makes it easier and faster for users to obtain accurate destination information, which will increase their productivity and speed up the progress of tourism projects development. In addition, due to the cheaper price, users can get more StarDetect services at the same price, so they can frequently update the latest destination information to support all stages of the tourism project.

On the other hand, StarDetect's visualization services can transform the acquired destination information into a 3D digital model and present it on the screen, thereby users can better understand the destination and make more realistic plans and designs that fit the real situation. Meanwhile, with the constantly updated 3D model, different professionals can better present the results of their work to help them understand and communicate with each other, so that they have more smoothly cooperation.

Key activities
The key activity of Horizon 1 is to develop the initial product portfolio and find the first customers.

1 **Develop product portfolio**

Two main technologies are needed to develop the product portfolio of Horizon1, the satellite remote sensing technology for acquiring destination information, and the data analysis and digital modelling technology for generating 3D digital models.

As known from StarDetect, they have already implemented space sensing and data acquisition solution, so the Destination Exploration service can be easily realised with exiting technology without extra investment.

In contrast, digital modelling is a completely new domain for StarDetect. Considering the difficulty of applying new technology, StarDetect can cooperate with existing data processing and 3D imaging companies in the market to jointly develop solutions to convert satellite data into 3D digital models.

2 **Find first customers**

StarDetect can use the price penetration strategy to enter the target market, use the price advantage to attract customers who would not otherwise buy the product (Sales Focus Advisory, 2016). The reason for this strategy is that previous research found the existing market destination exploration solutions are too expensive for many underdeveloped destination communities with limited funds, lack of access to destination information has hindered local tourism development. So when cheaper option becomes available, destination communities with limited funds will adopt the new service faster. Therefore, at the beginning of entering the market, StarDetect can actively seek out these customers and demonstrate the value StarDetect's service can offer. To reduce the worry of trying something new, StarDetect can offer special discounts to first-time customers to attract them to use the service. At the same time, encourage the used customers to recommend the service to others with special offers.

Revenue Stream
During this horizon, StarDetect can make profit by providing services to customers. The Destination Exploration service will be priced according to the area of the destination and charge according to the times of services required. The 3D Digital Model services will be charged differently for initial modelling and subsequent updates. Initial modelling will be priced according to the size and complexity of the destination data. Subsequent updates will be charged in the form of subscription, the destination model will be updated by StarDetect periodically within the duration of the subscription.

7.2.2 Horizon 2 - Enlarge the Sales

The goal of the second horizon is to expand the product portfolio and increase market sales.

Time

The second horizon is set to be 2025 to 2027

Market

Target group
The target customers of the second horizon business are the management organization of natural destinations. These destination management organizations need to take the dual responsibility of environmental protection and tourism development.

And the target users of the sustainable information website are responsible travellers who like to visit natural destinations.

Positioning
For destination management organizations, StarDetect offers Destination Environmental Monitoring Service that is affordable, reliable, to meet the user's need for regular monitoring of destination environmental conditions to ensure destination sustainability and tourism development.

The Sustainable Tourism Information website created by StarDetect can provide

responsible travellers with sufficient information about natural destinations to support their sustainable travel decisions. More detailed descriptions of the services provide in this horizon can be found in Chapter 6.3.

Business Model

Value proposition

Compared with the existing expensive, time-consuming and labour-intensive ground surveys for environmental assessment, StarDetect's Destination Environmental Monitoring services can automatically capture destination environmental indicators to help destination managers easily monitor changes and assess trends in the destination environment with visualised data, and enable them to identify and understand potential pressure areas in a more timely manner so that effective protective measures can be taken before conditions deteriorate.

For travellers who enjoy visiting natural destinations but are concerned about the travel impact on the destination, and have no valid information to support their responsible travel choices, the Sustainable Tourism Information website created by StarDetect can provide them with information about the current environmental conditions and stress levels in each destination to support their travel choices, as well as offer information about local environmental initiatives and activities to meet their desire to become environmental contributors.

Key activities

The key activities of Horizon 2 include developing a new product portfolio, conducting market activities and formulated the website.

1 Develop new product portfolio

Three main technologies are needed to develop the product portfolio of Horizon 2, the satellite remote sensing technology for acquiring destination data, the data processing techniques to transform satellite data into valuable environmental indicators, and the 3D digital modelling technology for visualising data.

The remote sensing technology has already been implemented in Horizon 1 and has become much mature in Horizon 2, therefore no additional investment is required to obtain destination data.

The data processing techniques also align with StarDetect technology R&D Plan. However, translating satellite data into specific valuable environmental indicators requires collaboration with forestry experts to identify key indicators and specific algorithms to process the raw data.

The 3D digital modelling technology has also been mastered in the process of cooperation with 3D imaging companies in Horizon 1, so from Horizon 2, StarDetect no longer needs to work with the external company, instead, recruit the appropriate professionals to maintain the 3D service and keep pace with the technology progress.

2 Conduct marketing activities

One of the goals of Horizon 2 is to increase sales by launching a new product portfolio. The following marketing methods can be implemented to acquire more customers.

The first is to focus on maintaining the relationship with customers in Horizon 1, they could also be the target customer of Horizon 2 service, as they trust in the brand has been built through good service in Horizon 1. Meanwhile, their good word-of-mouth will have a positive value on the business.

The second is to enhance the relationship with the destination community. StarDetect can participate in and sponsor environmental events in the destination where the potential customer is located, which increase the presence and visibility of the StarDetect brand in the community and stimulate sales.

The third is to launch advertisements on the platforms frequently visited by target groups, such as professional websites, tourism exhibitions, social media, to enhance the exposure of the brand.

3 Set up website

Setting up a website that provides sustainable travel information to travellers requires investment in purchasing a domain name, page design, website maintenance, etc. The sources of information on the website could be StarDetect's own data and publicly available information from different destinations. Meanwhile, StarDect can also work with NGOs that support eco-conservation or sustainable tourism to obtain information on activities that tourists can participate in to help the environment.

Revenue Steam

In Horizon 2, StarDetect can profit from the customer's subscription to the Destination Environmental Monitoring service. The price of the service will be determined according to the time length of the subscription, as well as the size of the area to be monitored and the complexity of the destination environment.

Besides, although the website to travellers cannot directly profit, StarDetect has gained a platform to communicate directly with the end consumer. Meanwhile, user data can be collected from the website, which can be used to study consumer's preferences and behaviour. And the data can also be sold to tourism companies hoping to develop new portfolios for responsible travellers. In addition, the website can facilitate the development of StarDetect's brand and increases its reputation among consumers, so as to acquires potential customers for the B2C business in the next horizon.

Horizon 3 - Expand the Market

The goal of Horizon 3 is to further expand the product portfolio and extend market segmentation, meanwhile, begin to provide service directly to consumers.

Time

The third horizon is set to be 2028 to 2031

Market

Target group

The B2B target consumers of the third horizon are the management organization of destinations locate in places prone to extreme weather. These destination management organizations frequently face the threat of natural disasters to the destination, and need to ensure the safety of tourists, local residents, property, and the natural landscape.

The B2C target consumers of the third horizon are outdoor travellers who like to go to unfamiliar destinations for adventure. These travellers need detailed destination information and real-time data support to obtain pleasant and safe journeys.

Positioning

For destination management organizations, StarDetect offers Disaster warning and Security monitoring service that is affordable, reliable to meet user's need for early detection of potential security threats and rapid response to unexpected security incidents.

For outdoor travellers, StarDetect offers a

One-stop service platform to meet their need for access to professional-level destination information and real-time data support at different stages of the adventure.

More detailed descriptions of the services provide in this horizon can be found in Chapter 6.3.

Business Model

Value proposition

Early deployment is the most effective way for destinations to deal with the impact of natural disaster threats. However, it is difficult to cover all areas of a vast destination in a short time with existing Manual patrol methods. On the other hand, StarDetect 's Disaster warning service can automatically identify risk areas by acquiring weather and destination data, which could help destination managers efficiently anticipate possible safety hazards and take measures in advance to reduce the danger and damage caused by extreme weather. In addition, by real-time sensing of the destination, StarDetect's Security monitoring service can help destination managers be aware of unexpected security events in a timely manner and make quick decisions and measures based on the real-time information of the event.

When exploring unfamiliar natural destinations, travellers often have little experience with the challenges, restrictions and possible threats they will face. Accurate and detailed destination information and professional guidance are key to ensure a safe and enjoyable trip, and protect sensitive natural environments. However, it is difficult for non-professional travellers to get this information and services from the market. StarDetect's platform will fill this gap by providing travellers with one-stop service to support all stages of the adventure from planning to sharing, including professional real-time destination contextual data and satellite navigation and communication services, and communication channel for people who share common interests.

Key activities

The key activities of Horizon 3 include developing a new product portfolio, expanding the market, developing the one-stop service platform and acquiring platform users.

1 Develop new product portfolio

Three main technologies are needed to develop the product portfolio of Horizon 3, real-time remote sensing technology to continuously perceive the destination, big data processing and artificial intelligence technology to predict and identify potential dangers, and the 3D digital modelling technology for visualising data.

Compared with the previous vision, the service of Horizon 3 needs to obtain the destination information in more real-time, so StarDetct needs to further invest in real-time sensing technology which is on its R&D plan.

Additional R&D investment is required for big data processing and artificial intelligence technologies used to predict and identify potential hazards. StarDetect can work with experts in meteorology, geology, and forestry, etc. to better process critical data and develop deep learning algorithms.

The 3D digital modelling technology has been fully mastered in the previous horizons, so no additional investment is needed.

2 Market Expansion

In addition to maintaining ongoing relationships with customers from the previous two horizons, and encouraging them to become users of the new product portfolio, StarDetect can also begin to implement the product portfolio to other domains that have similar needs, such as forestry and agriculture, which are also vulnerable to weather.

Existing products can be modified to meet the needs of new target customers so as to expand the market.

3 Develop the one-stop service platform

The source of the information provided by the one-stop service platform will base on the already acquired and constantly updated database of StarDetect. The route navigation, outdoor communication, and location rescue functions can be developed on satellite phones. In addition, the one-stop platform will base on different channels to serve users, such as websites, smartphone mobile applications, and satellite mobile applications. Therefore, it is necessary to develop the corresponding software for different systems.

4 Acquire platform users

Although it is a brand new experience for StarDetect to provide service to consumers, the website set up in Horizon 2 already make StarDetect has the experience of communicating with customers, meanwhile, obtain many potential customers on it. After some customers try the new platform, StarDetect should encourage them to share their experience on the website or social media to enhance the brand's reputation and attract more users.

In addition, in order to acquire users beyond the website, StarDect can conduct marketing campaigns through multi-platform of social media to meet the target group. For example, cooperate with well-known outdoor travel bloggers to film their experiences of using StarDetect services to explore new destinations, and publish short videos on social media platforms to attract their followers who also love outdoor travel.

Revenue Stream

Similar to Horizon 2, the Disaster warning and Security monitoring services at horizon 3 also profit from customer's subscriptions. The price of the service will be priced according to the length of the subscription, as well as the size of the destination monitoring area and the complexity of the environment.

The one-stop platform for consumers will provide regular and pro versions, the regular version is free, the pro version will be profitable through subscriptions and additional services purchased by users. In addition, the destination data and the user data StarDetect collected from the platform could be sold to other businesses. Meanwhile, StarDetect can be profited by providing advertisement positions on the platform for some outdoor product brands.

Chapter 8

CONCLUSION

The final chapter provides a brief conclusion of the thesis, along with recommendations for future implementation and a discussion of the project's limitations. Finally, it ends with personal reflections.

Content

8.1 Conclusion

As a startup company focusing on small satellite technology, StarDetect is currently taking its first steps into the commercial market and they hope to provide competitive satellite data and services to their customers. As the small satellite commercial market in China is still immature and the service targets are limited, like most other satellite companies, government and research institutions are the main customers of StarDetect. Bringing satellite technology to new markets and expanding application scenarios will be the key for the company to grow. Therefore, the goal set up for this thesis is to design a strategy for StarDetect to enter a new business market.

After fully understanding the small satellites and exploring the future trends, the Smart Tourism market has been taken as a new market with potential. Therefore, an extensive study of the Smart Tourism market was conducted. After a preliminary analysis of the needs of the possible users of satellite services in smart tourism, the possibility of satellite technology applications in smart tourism is identified. Furthermore, the challenge of bringing satellites to market was also identified, which need to compete with IoT technologies that are widely used in the market. The market entry strategy will be particularly critical.

In order to find possible directions for market entry, a SWOT analysis was first used to identify the strengths, weaknesses, opportunities, and threats of satellite technology in smart tourism, which concludes that satellites are more suitable for more remote and less developed areas, and can provide cheaper and more convenient solutions for destination monitoring and communication. Then, three design directions for market entry strategies were generated based on the insights from brainstorm sessions and future travel trend research. After assessed the three directions, the choice was made to enter the smart tourism market by supporting sustainable tourism in National parks. To further define the specific steps of the strategy, the National park design direction was further investigated through a literature review and interviews, from which opportunities for satellite applications were further identified. Finally, all insights of satellite applications were placed in a 2x2 matrix for integration. In the finalized matrix, the applications were divided into three phases based on the achievable time, from which three horizons of the roadmap to enter the market were identified. And the strategy for StarDetect to enter the Smart Tourism market can be determined.

Considering the risk involved in entering a new market, the product portfolio that StarDetect use to start new businesses should be easy to implement and not require much investment. Therefore, the first Horizon's service will be based on StarDetect's already mature remote sensing technology, which is designed to meet the needs of tourism project developers for quick access to destination information. In order to differentiate StarDetect's service from existing similar solutions, StarDetect can adopt a price penetration strategy to bring the service to market at a lower price. In addition, information visualization is offered as a value added service.

After successfully acquiring the first customers, StarDetect can move to the second horizon of the roadmap, by launching a new product portfolio to increase marketing sales. In this horizon, the transformation of destination data into valuable information will be the main value proposition, thus aiming at transforming destination data into visual environmental indicators to meet the needs of management organizations for monitoring the sustainability of natural destinations. In addition, in order to expand the market further in Horizon 3 and start offering services directly to consumers, a website will be created in this horizon to communicate directly with consumers to extend StarDetect's brand reputation and build trust and connection with potential consumers.

As StarDetect has a position in the travel market, it can further expand its target market in Horizon 3. StarDetect will go directly to consumers, by providing a one-stop service platform to support outdoor travellers' adventures in remote destinations. At the end of the third horizon, StarDetect can profit steadily from the Smart Tourism market and can sustainably launch more innovative products to further expand the company size. This will be discussed later in the recommendation.

8.2 Recommendation & Limitation

8.2.1 Recommendation

After the Horizon 3

Horizon 3 is not the end of the roadmap, but a new starting point for the next phase. After Horizon 3, StarDetectis firmly established in the market, and has a lot of steps to make it more powerful. Although not mentioned in the roadmap, the research in this thesis found that satellites can also contribute to or even reform the way of managing resources over large areas. Therefore, after the implementation of Horizon 3, StarDetct can further expand its product portfolio by developing a real-time resource monitoring service, to meet the needs of users for comprehensive and precise property management with a macro view. The potential users are not limited to the tourism industry, but also include agriculture, forestry, fishing, factory management and even urban management. So StarDetect can use this portfolio to start other new business fields, meanwhile, apply it to improve the B2C service and get more customers.

Minimum Viable Product

Trying something new usually means risk, especially when entering a completely new market. To avoid excessive investment and higher risk is essential. StarDetect should test the assumptions behind the product by using the Minimum Viable Product approach to validate the market demand for the product before fully developing the portfolio and bringing it to market. For example, during the development phase of the Horizon 1 product portfolio, StarDetect can cooperate with a tourism project developer to provide various types of information free to test his response, and get feedback on the price he willing to pay, so as to verify the effectiveness of the service and the viability of the business model.

Continuously updating the roadmap

It is important to note that the roadmap needs to be constantly reviewed and updated. Instead of a stable plan, it is more of a collaborative tool for developing strategies

and actions toward the desired future, meanwhile, help company members keep on the same page in terms of objectives, steps and timeline. Therefore, during implementation, the roadmap delivered in this thesis should be continuously iterated to ensure its feasibility, based on the actual situation and the changing business environment.

Adopt design approach

In addition to the satellite services described in detail in the roadmap, many other possibilities for satellite applications in smart tourism are also mentioned in the thesis, such as facilitating unified management of tourism resources; assisting rangers in their daily patrol work; supporting virtual travel at home and so on. Instead of finding how user's needs can be satisfied by the developed technology, those insights could be used early at the R&D phase for more demand-oriented technology development. In this regard, design methods and tools can be adopted in the development process to make user value play a prominent role from the beginning.

8.2.1 Recommendation

Limited understanding of satellites

Despite a detailed study of satellite technology was done in Chapter 1, the writer still has insufficient knowledge of the technology due to its overwhelming complexity. Therefore, there may be inaccuracies in the description of the satellites technology in this thesis.

Limitations of roadmap implementation

Although the roadmap in this thesis has been described in detail by specifying each element, it may be an estimate of the possible scenarios. It is possible that the actual situation is inconsistent with the designed plan, or necessary activities are not covered in the roadmap. Therefore, for the implementation of the strategy, further research is needed to make each horizon more specific and clarify all the factors and steps.

Lack of validation meetings

Due to time constraints, the results of the thesis were not discussed and evaluated with the company before the end of the project. As a result, the roadmap was lack of iteration, which may lead to inconsistencies between the strategy and the company's planning.

Lack of face-to-face communication

The program was conducted entirely remotely due to geographical constraints. As a result, there was no opportunity for company visits and face-to-face meetings, perhaps limiting in-depth communication. Furthermore, the project's brainstorm sessions and interviews were also conducted exclusively online, although the expected result is achieved, it may affect the quality of the data and insights.

8.3 Personal Reflection

8.3.1 Reflection on the Project Result

Look back to the Design Brief in Chapter 6, the design requirements were set up for designing the outcome of this thesis. Therefore, the criteria in the design requirements will be used to briefly evaluated the result of this project.

Viability

Viability indicates whether the strategy will enable the company to sustainably grow in the market.

The strategy designed in this thesis allows StarDetect to enter the new market with low risk and investment while continuing to expand sales and market with increasing product portfolios. Besides, the plan to provide service directly to consumers can make StarDetect differentiate itself from other B2B brands, resulting in a better competitive and innovative ability to step into the next vision.

Desirability

Desirability indicates whether the result offered the solutions that consumers really need or want.

All the services mentioned in the roadmap have been designed from the research or analysis insights of customer need. Therefore, when StarDetect brings these services to market, they can be well positioned to acquire customers by meeting the needs of their target groups.

Feasibility

Feasibility indicates whether the planned steps can be performed or completed.

Since the product portfolios of three horizons are aligned with StarDetect's own technology strategy, these services are technically feasible. In contrast, it is still more or less unclear how the product or service will be presented to the consumer, which still needs to be explored further.

Profitability

Profitability indicates whether the outcome can form a sustainable business model. Due to the adoption of price penetration to enter the market, Horizon 1's product portfolio will be less profitable, meanwhile, it is always hard to get a large number of customers in the initial stage, therefore during Horizon 1, StarDetect may be hard to make profit. But after Horizon 2, StarDetect will be able to obtain more stable profit by acquiring more consumers who keep subscribing to the service. Meanwhile, by providing service directly to consumers in Horizon 3, StarDetect will have access to more innovative business models that provide the company with greater dynamism.

8.3.2 Reflection on the Project Progress

Looking back on the whole process, this project can be regarded as the most difficult one I have done in the past two years, but I learn much from it.

At the beginning of this project, I spent a lot of time to understand satellite and explore its possible market due to the wide scope project brief and the unfamiliar field. Although many possibilities were found, it was difficult to determine which market would be more valuable to StarDetect, which led to the stagnation of the project progress. At this time, advice from the supervisor team brought me out of the struggle, that is, choice with my designer's intuition. Be inspired by the suggestion, I chose the strategic trend scanning approach to better sense market signals and finally made the decision with Smart Tourism market for the next step. From this dilemma, I learned that choice is sometimes much important than comprehensive exploration, because the situation can be more complicated by over-analyzing, which can make it difficult to make progress.

Another thing I've learned is that I should be more proactive to communicate with outsiders about the project. After identified the Smart Tourism market, the new challenge is to clarify who the satellite could serve in that domain and how to serve to them? Different from typical design projects that start with the target user's need to find solutions, this project was more of an attempt to match satellite capabilities with user needs. Therefore, at the beginning I chose to study all the stakeholders in the tourism field, while satellite applications could be found, a new question was raised: In which scenarios would satellite applications be more need? I also struggled with these questions for a long time until I was inspired by my classmates through brainstorming. At first, I was just looking towards brainstorming for more possible applications of satellites, but in talking with participants, I saw their love and care for nature, which had an important impact on my later choice of design direction.

The last and the most important thing I learned from the project is about setting deadlines. I always used to explore all the possibilities for one question, but in fact, it is impossible. So setting a finite amount of time will better help me synthesize the insights I gain and move on to the next step, rather than endlessly exploring.

8.3.3 Reflection on Personal Ambitions

Finally, I will briefly review some of the personal ambitions that I set in at the beginning of this final project.

Through this final project, I have learned how to perform as a strategic designer to apply design thinking to gather insight into business resources and market opportunities and translate it into a strong product portfolio. Meanwhile, have a better understanding of the connection between people, technology, and business, and how to integrate them to innovate and develop solutions that benefit society. In addition, I felt a sense of personal growth by expanding my research, design methods and skills in the project, and making better use of visualization to communicate.

In addition to the learning goals, one of the other ambitions I mentioned is to make the outcome be meaningful to society. In the end, I am happy the project results show the possibility of using satellites to help people better protect and understand nature by carrying out sustainable tourism. I hope StarDetect will also enjoy the result of this thesis, and make it a reality in the future.

Lastly, I would like to say that despite the COVID-19 has placed many restrictions on my study and life, I am very proud of completing this meaningful project, and being able to reflect on my strengths and weaknesses. I will use all the knowledge gained in this project to further develop myself and look forward to meeting people face-to-face again to establish more and deeper connections.

Thanks for reading!

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