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Development of STC Corporate Mobile Application

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Development of STC Corporate Mobile Application

Sponsoring Agency: STC Group (Hong Kong Standards and Testing Centre)

Submitted in partial fulfillment of the requirements for the degree of Bachelor of Science to:

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Abstract

The Hong Kong Standards and Testing Centre (STC) is looking to promote itself using a mobile application. Our goal was making recommendations about developing the application. By surveying consumers, interviewing STC employees and clients, and conducting an application assessment with STC employees, we proposed six recommendations. We also created a graphical prototype and functional model that lays the foundation for the STC mobile application.

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Executive Summary

Technology is an important aspect of our lives and it develops daily. With the expansion of technological devices, there has been a major increase in electronic communication, which is beneficial not only for personal use but also for company promotion. With over 1.86 billion people using smart devices (Statista, 2016), increasingly more businesses are using mobile applications to reach consumers and clientele as well as to improve company efficiency. With the increasing number of mobile technologies used by consumers, companies in the testing, inspection, and certification (TIC) industry are attempting to find better ways to promote themselves and their services to clientele and consumers. The Hong Kong Standards and Testing Centre (STC) is no exception as it hopes to expand and communicate with its clientele and consumer audience through the development of a mobile application.

Goals and Objectives

Our goal was developing a mobile application that allows consumers, clients, and employees of the Hong Kong Standards and Testing Centre (STC) to use its barcode scanner for identification of STC certified products and verification of STC test reports in addition to the other features that we found in our research. To achieve this goal, we completed five objectives.

- First, we determined if a mobile application can achieve STC's goals so that we may understand the important reasons behind STC's decision to make a mobile application.
- Second, we determined STC's target audience for the STC mobile application. Analyzing STC's audience will help make a more effective application that STC can market appropriately.
- Third, we identified, compared, and contrasted competitor marketing and client interaction techniques in the TIC industry.

- With the previous three objectives in place, we then determined which features should be included in the STC mobile application.
- Lastly, we built a mobile application functional model with the features we previously determined.

Methodology

To determine if a mobile application can achieve STC's goals, we surveyed 100 Hong Kong consumers outside of malls and shopping areas, asking them about their TIC industry awareness and recommendations for the STC mobile application. Then, to determine STC's target audience, we interviewed five STC/HKCC employees and two STC/HKCC clients to get a better understanding of what kinds of clients and consumers the company wants to reach. We also asked survey participants about their basic demographics as well as preferences on product information, product types, and interest in an STC mobile application. To evaluate competitor marketing techniques, we asked the five employees for their industry knowledge on STC competitors and asked the two clients about their opinions on STC competitor marketing techniques. To decide which features STC should include in the mobile application, we implemented four different methods. First, in our survey that we mentioned earlier, we asked consumers which features they would want in the STC mobile application. Second, we asked our client interviewees to suggest what they would want in an STC mobile application. Third, we asked the five employees to suggest any additional features that they wanted in an STC mobile application. Fourth, we formed epics, scenarios, user stories, and use cases. To build a functional model of the application with the features that we determined, we first designed a graphical prototype and then coded the main features in a functional model. Lastly, we had 12 STC employees assess the graphical prototype and provide us with feedback.

Results

We determined that STC can reach a larger audience and promote itself through a mobile application that contains a variety of features. From our communication with STC employees, we concluded that the target audience of STC's mobile application are general Hong Kong and mainland Chinese consumers, particularly those with lower incomes. STC believes that clients, such as manufacturers and trading companies, will be reached by promoting STC to consumers through the mobile application.

STC and its competitors share marketing techniques such as websites, email newsletters, paper fliers, newspaper advertisements, and sponsor events, but its competitors are better at using social media, mobile applications, and promotion via clients. We found that local Hong Kong consumers, mainland Chinese tourist consumers, and/or STC want the following features in the STC mobile application, in the order of popularity: a product barcode and test report scanner, real-time chat with an STC representative, an STC certified products database, STC news, STC information, and a game-like element.

To implement the product barcode and test report scanner, we found that the scanner should scan product barcodes and test report QR codes to relay relevant information to the user in a tier format. The real-time chat with an STC representative should handle customer and client enquiries and keep a history of the discussion with possible implementation similar to that of the popular messaging app WhatsApp. The database should allow users to search for certified products and to view products of their preferred product types. STC news should allow notifications and show STC news on STC events, product updates, and industry changes such as information posted on the STC website. The STC information feature should include comprehensive information on the TIC industry, STC, HKCC, and the marks used to certify products. The game-like element should keep users coming back to the application by utilizing STC's resources such as certified product coupons or implementing a prize system similar to that of established companies' mobile applications. Finally, our application assessment demonstrated that the

STC employees viewed the graphical prototype favorably and suggested some improvements that a future development team should address.

Conclusions and Recommendations

Based on our research, we propose 6 recommendations that accomplish STC's goals.

1. **We recommend that STC's corporate mobile application include 6 features as displayed in the graphical prototype and partially implemented in the functional model.** The features would help achieve STC's goals of promotion and expand its audience reach. They were requested by consumers as well as STC clients and employees in the surveys and interviews discussed previously and include:
 - certified product and test report scanner
 - real-time chat with an STC representative
 - STC certified product database
 - STC information
 - STC news
 - game-like element
2. **We recommend that STC does further research on how to apply gamification to its mobile application.** Professor Richard Fung, STC Chief Executive, brought gamification to our attention; gamification applies game-related elements to nongame contexts. Since we were unable to research and implement a game-like feature in the functional model, STC should look into gamification and how to apply it to the mobile application. If STC is interested in gamification, it should first consider what systems and respective processes should be gamified and what user behavior it desires. After that, it can decide on what game elements to include, such as a point system or badges. STC can also observe some real-world examples of gamification such as 7-Eleven Hong Kong's promotions and Dunkin' Donuts' mobile application. STC must also be

aware of the obstacles that are a part of incorporating gamification, which include differing user preferences and the risks of monetary rewards.

3. **We recommend that STC hire an external mobile application development team to complete and release the mobile application on Android and iOS using our research.** The development team would be able to enhance the developed features of the mobile application as well as include additional ones based on the feedback provided in the application assessment from STC employees to ensure that STC's goals are met.
4. **We recommend that STC frequently update the mobile application and reevaluate features based on user feedback.** After it is released, the application will need to be regularly updated and maintained in order to make sure it works on all targeted platforms and operating systems as newer versions are released. STC should also consider adding new features and changing the existing features based on reviews, comments, and future evaluations.
5. **We recommend that STC grow its Facebook and Twitter social media accounts by promoting them through the mobile application and posting about STC news, services, and general information.** STC currently has social media accounts on Twitter, Facebook, and YouTube; however, these accounts are not as successful as their competitors' accounts. Our survey data indicates that many Hong Kong residents do not know what STC is. Also, some of the STC employees we interviewed told us that they want more people to know about the company. STC can reach some of the people who do not know about it by growing its social media accounts. This can be done by posting more often, as its competitors do, and promoting its social media through the mobile application, increasing STC's social media exposure.
6. **We recommend that STC perform future research on building a software application focused on clients.** As a company, STC's primary target audience is clients and manufacturers, and the clients we interviewed requested application features that would allow them to communicate with STC and order its services. In addition, some STC employees suggested that the mobile application have a stronger focus on clients. Therefore, we recommend that STC

should perform more research and consider the possibility of developing a client-focused application in the future.

Authorship

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Primary authors provided the main ideas for each section. Then, we read each section together and inserted our revisions, so that we were updated on the state of the paper and could give our feedback. After we wrote the rough draft, we began the final editing process. Each team member independently read and revised the whole paper, in accordance with style elements determined by the team. The last team member had the responsibility of finalizing the paper to make sure that a common voice was heard throughout.

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1 Introduction

In the testing, inspection, and certification (TIC) industry, private companies test, inspect, and certify a wide variety of products from toys to chemicals to medical devices by performing a variety of safety and quality tests depending on the product (Hong Kong Council for Testing and Certification, 2018). Many of these companies have online databases and electronic order forms and market themselves through websites, sponsorships, newsletters, email, and fliers; however, they are always seeking to expand their services to more client companies and consumers (Bureau Veritas, 2018; Intertek, 2018; NSF International, 2018; SGS, 2018; TUV Rheinland, 2018). Some have tried achieving this expansion using mobile applications.

Mobile applications are a popular vehicle for promotion across many industries and consist of features such as QR code scanning, real-time chat, and 3rd-party electronic payment systems (Intertek, 2018; Bureau Veritas, 2018; NSF International, 2018). Not only do they help reach a larger audience due to increased customer engagement and brand visibility but they also assist clients and employees in easily accessing valuable tools and information.

The Hong Kong Standards and Testing Centre (STC) (2018d) is an independent, non-profit TIC company that performs testing and inspection on a wide variety of products and certifies those products that meet strict standards for quality and safety. STC currently has a mobile application in the iOS App Store and Android Google Play Store. According to its description, the purpose of the application is “to help consumers check and verify product quality and safety by providing product safety information which is not printed on the packaging,” using its barcode scanner feature. Despite its description, the application does not contain a functional barcode scanner and only displays augmented reality animations when scanning pages of STC’s corporate brochure.

STC believes that an updated application that contains a functioning barcode scanner, as well as additional features, would promote STC and its reach (A. Mak, personal communication, Nov 16, 2018). To help STC accomplish this, we had to understand who to reach and how to best reach them. Although we were aware that the general audience of the TIC industry consisted of TIC clients and consumers, we were unaware of the specific audience that STC aimed to reach through the development of its mobile application. Specifically, we were not informed of the demographics and product preferences of the target audience. While some TIC companies have developed mobile applications to promote their services, there is no thorough research on how to make a successful mobile application for a TIC company. To be more specific, it is not clear which features would be beneficial to promote STC as well as appeal to STC's audience and keep them using an STC application.

Our goal was developing a mobile application that allows STC consumers, clients, and employees to use its barcode scanner for identification of STC certified products and verification of STC test reports in addition to other features that we found in our research. We identified five objectives that helped us achieve our goal. First, we determined if a mobile application can achieve STC's goals of promoting itself and reaching a larger audience. Next, we determined STC's target audience for the mobile application. Third, we identified, compared, and contrasted competitor marketing techniques in the TIC industry. Then, we determined which features STC should include in the corporate mobile application through the analysis of the surveys and interviews that we administered. Finally, we built a mobile application functional model with some of the features that we previously determined.

2 Background

In this chapter, we provide the background information that we needed to research, design, and develop a mobile application for the Hong Kong Standards and Testing Centre (STC). First, we explain the role of the testing, inspection, and certification (TIC) industry. Then we describe the many aspects of mobile applications, including the demographics of users, mobile application trends, and the effects of mobile applications on a business. Finally, we talk about STC's history, the services it offers, its competitors, its current audience, and some of the features included in the mobile application.

2.1 Testing, Inspection and Certification (TIC) Industry

The TIC industry provides three types of services: testing, inspection, and certification (Hong Kong Council for Testing and Certification, 2018). Testing is the evaluation of products in a laboratory to determine whether they meet industry standards and the claims of the manufacturer. Inspection is the examination of factories or products to determine if they comply with buyer specifications and standards. Lastly, certification is the process of providing a product, system, or service with an official document that attests to its level of quality. Testing, inspection, and certification can improve the confidence that investors and consumers have in the quality of a product or service. Some TIC companies offer additional services, such as calibration, where the company ensures products, instruments, or other items meet special standards.

2.1.1 Clients and Consumers

TIC clients are businesses that hire TIC companies to test and certify their products. They purchase these services to assure investors and consumers of the safety, quality, and reliability of their products, as well as, fulfill industry standards (Hong Kong Council for Testing and Certification, 2018). Clients also use

inspection services to determine whether factories are capable of fulfilling orders. Many of these clients tend to be companies that do not have the resources to visit factories themselves.

In 2014, 82% of consumers conducted research online before purchasing products (Forbes Corporate Communications, 2016). By reading TIC literature or product websites, consumers can identify whether a product is safe, reliable, and meets regulatory standards.

2.1.2 Marketing Techniques

TIC companies use a variety of marketing techniques to reach out to clients and consumers. TÜV Rheinland (2018) uses RSS feeds which allow people to stay up to date on company news in a standardized, computer-readable format. The company also uses online quote request forms, so clients can learn how much the company's services will cost. In addition, TÜV Rheinland maintains online databases where consumers can search for certified products. Bureau Veritas (2018) offers online audit and inspection ordering forms, so clients can request the company's services. SGS (2018) uses e-subscriptions to update people on news for various industries, and manages databases consisting of certified companies and products. Intertek (2018) distributes company and industry news by hosting an online video library. It also sponsors events to reach out to potential clients and consumers. Overall, the majority of TIC companies market themselves through their websites. Many TIC companies have also implemented mobile applications for marketing. We discuss those companies and their applications later in the chapter, as they are competitors to STC.

2.2 Mobile Applications

Containing over 2 billion smart devices, the world has become a more connected place (Statista, 2016). People from all around the world can interact with one another using mobile devices. These interactions include sharing content via social media, communicating with one another via video hangouts, and buying

products online, just to name a few. In response to these phenomena, many corporations want their own mobile applications for promoting their businesses and gaining new customers (NSF International, 2018; Humane Farm Animal Care, 2017; AsiaInspection, 2018). In this section, we discuss the importance of mobile applications in modern society, current mobile application trends, and the effects of mobile applications on businesses.

2.2.1 Demographics of Smart Device Users

In 2015, 1.86 billion people used smart devices, and that number has continued to grow since then (Statista, 2016). With the growing use of mobile devices, the number of consumers who use their mobile devices to make purchase decisions continues to increase. In 2017, 44% of worldwide shoppers used their mobile devices to research products (Statista, 2017).

2.2.2 Mobile Application Trends

In 2008, Apple launched the App Store and Google opened the Google Play Store, which set the foundation for the distribution of mobile applications (Davis, 2008). Mobile applications have evolved over the past 10 years and continue to evolve with new mobile device hardware (Barmpatsalou, Cruz, Monteiro, and Simoes, 2018). In this section, we focus on mobile application trends by exploring modern user interface (UI) design and application advertisement techniques.

UI is what the user sees and interacts with when using a mobile application (Alzahrani, Al-Samarraie, Eldenfria, and Alalwan, 2018). When developing mobile applications, developers implement mobile design methodologies to create simple and easy to understand user experiences. These design methodologies contain different patterns that are used to fit different user scenarios. Google encourages Android developers to incorporate Material Design and its principles to make consistent, simple

applications that work well with the Android operating system, while Apple encourages iOS developers to use Apple's Human Interface Guidelines.

After making an application, the developer must disperse the application to vendors and market the application (Hinarejos, Isern-Deyà, Ferrer-Gomila, and Huguet-Rotger, 2018). Marketing refers to the developer getting the attention of the user and promoting a product, but that task can be difficult.

Traditional advertising methods typically send the same advertisement to as many potential users as possible in the hope of spreading the advertisement's content (Pradipta, Endarnoto, Purnama, Nugroho, and Pawitra, 2011). When a developer markets their mobile applications, however, they need to use many techniques. To achieve this, a developer must understand its audience. A developer can gather audience demographics and statistics from data collection companies such as Google. For example, according to Google, 53% of smartphone users say that they have not installed their favorite brand's application. Of that percentage, 25% say that they did not know it existed, and 42% say that they have never considered downloading it (Vieira and Kumar, 2018). As a result, these statistics may lead developers to invest more money into promotion on social media, online forums, and blogs to accelerate total sales of their mobile applications and the speed of product diffusion (Jang and Chung, 2015).

2.2.3 Effects of Mobile Application Business Implementation

Since industry experts predict mobile device use to increase, companies are seeking to develop mobile applications for promoting themselves (Illingworth, Morelli, Scott, and Boyd, 2015). That promotion can come through the form of interactive data, electronic forms and assessments, and other creative presentations of information. The effects of this promotion are contributing to mobile application markets (MAMs). MAMs are unique in that mobile application users and developers interact with one another on a regular basis via the application or application reviews (Jang and Chung, 2015). This interaction allows for developers to incorporate user opinions and update their applications to suit the needs of users

relatively quickly. Because customers can help change the application to fit their needs, customer relations and product quality are improved, which can increase sales in the long run.

2.3 Hong Kong Standards and Testing Centre (STC)

The Hong Kong Standards and Testing Centre (STC) (2018h) is a testing, inspection, and certification (TIC) company headquartered in Hong Kong that works to ensure product safety and quality. STC's vision is to "become a leading conformity assessment service provider that is recognized and respected worldwide," (para. 4) and it has greatly expanded since its founding. In the following sections, we explore STC's history, various services, competitors, as well as, its current and target audience.

2.3.1 History

STC (2018d) was founded in 1963, becoming the first nonprofit, nongovernmental testing laboratory in Hong Kong. Since then, STC has established testing laboratories for various industries and has expanded its global network beyond Hong Kong. In China, STC has laboratories in Shenzhen, Shanghai, Dongguan, Yiwu, Changzhou, Zhongshan, and Beijing. STC also has laboratories in Vietnam, Japan, Germany, Italy and the United States.

In the 1980s, STC (2018d) became the first Hong Kong laboratory accredited by the Hong Kong Laboratory Accreditation Scheme (HOKLAS). It has also received accreditation from the Hong Kong Inspection Body Accreditation Scheme (HKIAS) and the Hong Kong Certification Body Accreditation Scheme (HKCAS). Additionally, the company was the first ISO 9000 laboratory and China Compulsory Certification (CCC) testing laboratory in Hong Kong. A decade later, STC expanded its services beyond testing with the establishment of the Hong Kong Certification Centre (HKCC) and the Hong Kong Inspection Company (HKIC).

2.3.2 Testing

STC (2018d, 2018e, 2018g, 2018j, 2018k) provides manufacturers with numerous testing services accredited by the HOKLAS, Certified Management Accountant (CMA), Lucideon, Deutsche Akkreditierungsstelle GmbH (DAkkS), Electrical and Mechanical Services Department (EMSD), U.S. Consumer Product Safety Commission (CPSC), China National Accreditation Service for Conformity Assessment (CNAS), Hong Kong Accreditation Service (HKAS), and the Japan Ministry of Health, Labour, and Welfare (JMHW). The products STC tests include chemicals, food, pharmaceuticals, electrical products, children's products, toys, textiles, footwear, furniture, materials, and medical devices. Its various departments are equipped with advanced technologies as well as R&D experts who stay up to date on regulatory requirements. Its quality assurance team ensures the safety, quality, and reliability of all products prior to being launched and provides manufacturers with a trusted brand to promote their products.

2.3.3 Inspection

STC (2018f) holds partnerships with various inspection bodies throughout Asia, Europe, and the United States of America. Its global network allows the company to satisfy the inspection needs of worldwide clientele for a myriad of products. The products it inspects include “apparel, toys, bags, electrical and electronic products, watches and clocks, footwear, cosmetic and sundry products” (para. 3). STC's cooperation with the Hong Kong Inspection Company (HKIC) also provides financial examinations of factories, which comprise of the “Code of Conduct (COC), British Retail Consortium (BRC), Quality Check and Social Audits” (para. 3). Through HKIC, STC can ensure quality inspection by administering primary factory examinations, as well as, random product checks during and after production. Additionally, it can assist overseas companies and arrange the quality management systems of their Chinese supply chains. Although STC mainly focuses on markets in China and Hong Kong, it aims to

broaden its customer base by expanding its onsite financial and product examination services to Vietnam, Thailand, Malaysia, Taiwan, Indonesia, and South Korea.

2.3.4 Certification

STC's (2018b) partnership with the Hong Kong Certification Centre (HKCC) provides manufacturers with an efficient and economical one-stop certification service allowing their products to be adopted into various global markets. HKCC has become a trusted worldwide certification service of product safety and has launched certification schemes such as the Hong Kong Safety Mark. Additionally, HKCC has established the Estrogen Safe Mark Certificate to ensure safe levels of estrogen in cosmetics, skin care, and dairy products.

In addition to the certifications offered through HKCC, STC (2018b) issues five other certifications for a variety of industries. It has received accreditation from the Certification and Accreditation Administration of the People's Republic of China (CNCA) to provide China Compulsory Certification (CCC) testing and distribute the CCC mark on a variety of products. In China, this mark ensures that all requirements are met for manufactured products to be sold, imported or used for commercial purposes. Additionally, STC established the "STC tested" Mark which has been acknowledged internationally by over 30 organizations. It is an independent certification mark granted to products that meet all local and international requirements. The Mark demonstrates and promotes the superior quality and performance of independently tested food products, health supplements, proprietary Chinese medicines, cosmetics and toiletries, household products and detergents, and other consumer products.

In Japan, STC (2018b) provides certification schemes for products produced, imported and commercially used in Japan markets such as the Japan Safe Goods Mark and the Japan PSE Mark. For the assurance of the safety of Category A (Specified Electrical Appliances & Materials) and Category B (Non-Specified

Electrical Appliances & Materials) electrical and electronic products, STC provides PSE Mark certification services. The certification mark ensures products in the industry are free from potential hazards and are suitable for the Japanese market.

2.3.5 Other Services

STC (2018a) has a Calibration Department that provides calibration services to its clients. STC also performs calibration tests to ensure precise results provided by its examination apparatus. Calibration services satisfy all ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories to guarantee exact test and inspection results of consumer products that fulfill ISO 9001 certification requirements.

2.3.6 Competitors

STC's competitors consist of companies in the TIC industry such as Intertek Testing Services Hong Kong, SGS, Bureau Veritas, and TÜV Rheinland. Compared to STC, these companies have more employees and offices around the world. They also provide services, in addition to STC's, which include assurance (Intertek, 2018), verification (SGS, 2018), procurement (Bureau Veritas, 2018), project management (TÜV Rheinland, 2018) as well as training, qualification, and consulting.

STC's competitors are also using mobile applications as a marketing technique to promote their companies. Intertek, SGS, Bureau Veritas, and TÜV Rheinland have released multiple mobile applications that serve various purposes and audiences. Intertek (2018), for example, has five iOS mobile applications that contain features such as Intertek news and events notifications, calculators for Intertek's inspectors, and job status tracking reports for consumers. Bureau Veritas (2018) has mobile applications that provide inspectors with preparation materials and regulatory news. In addition, Bureau Veritas has an application that allows for video streaming and real-time chat for remote services. Similarly, SGS (2018)

has an application that provides SGS staff and clients with the ability to conduct remote inspections through the use of video streaming and document sharing. Lastly, TÜV Rheinland (2018) has two applications to allow consumers to stay in touch with news and regulatory service updates.

In addition to STC's competitors, TIC companies in the United States such as Certified Humane (Humane Farm Animal Care, 2018) and NSF International (2018) have released mobile applications for company and consumer use. Certified Humane's mobile application allows users to locate stores and restaurants where Certified Humane foods are offered. It offers access to the company's social media feeds and gives users the option to donate to the company. NSF International's (2018) mobile application contains features such as QR code/barcode scanning, push notifications for company news and updates, and real-time chat. Other features in the application include a 'Share' function for easy PDF export, a comparison tab to compare products side-by-side, and a favorites tab to save products for later viewing.

2.3.7 Audience

STC (2018e) markets itself to clients and consumers through a variety of traditional methods including promotional fliers, websites, sponsorships, newsletters, shopping guides, and electronic direct mailing. Clients of STC are companies that utilize STC's testing, inspection, certification, or calibration services. Some of STC's clients include Wing Wo Bee Farm, Dr. Health Ltd., LF Asia (HK) Ltd., and San Dynamic Ltd. (STC, 2016). STC also offers testing, inspection, and certification application forms in PDF format on the STC website that are arguably less efficient than electronic application forms. STC consumers are people who have made purchase decisions based on STC certifications. STC wants to help its consumers make those purchase decisions by implementing a mobile application that makes it easier for them to find certified product information. Lastly, STC hopes that the mobile application would promote STC and thus reach a larger audience.

2.3.8 Target Audience

In 2015, 1.86 billion people used smart devices, and in 2017, 44 percent of worldwide shoppers used their mobile devices to research products (Statista, 2016; Statista, 2017). As the world population grows in its usage of mobile, smart devices, Hong Kong is no exception. In 2017, Hong Kong had an estimated 5.53 million smartphone users (Statista, 2018). By 2021, 80.69% of Hong Kong's population is predicted to use a smartphone. STC (A. Mak, personal communication, November 16, 2018) wants to use a mobile application to target this audience. More specifically, STC hopes to reach "local Hong Kong [consumers] and mainland China (e.g. tourists visiting Hong Kong)" who use mobile devices. In addition, as it states in its company vision, STC wants to extend its reach to companies all around the globe. Thus, by developing an engaging mobile application for local Hong Kong and mainland Chinese consumers, STC's services could become more attractive to companies worldwide and satisfy consumer needs.

2.3.9 Mobile Application Features

Mobile applications are made up of features intended to meet users' needs. Developers should consider why they will include each feature and how they will do it before they begin their work. STC has asked us to implement the various features that would be beneficial to the company. Our research gave us insight on which features future developers should include in the mobile application. These features include:

- QR code/Barcode Scanner
- Real-time Chat
- Gamification
- News Notifications

For each feature, we discuss the reasons why STC should implement it and the methods of implementation that STC should consider before it does so.

QR code/barcode Scanner

QR code and barcode scanning are features that allow companies to improve their interactions with consumers (Cata, Patel, & Sakaguchi, 2013). With the ability to scan QR codes or barcodes, consumers can scan the QR code/barcode of any product and learn if that product has been certified by STC.

Due to the importance of this feature, STC (2018k) has already made an iOS application called “STC Scanner.” The scanner scans embedded Augmented Reality (AR) markers in the STC corporate brochure. When an AR marker is scanned, the application displays the content stored in the icon on the mobile device’s screen. It may be possible to incorporate the existing scanner into the new STC application. Alternatively, Google Firebase’s (2018) Machine Learning (ML) Kit and its barcode scanning API could be used to implement QR code/barcode scanning in a mobile application for both iOS and Android devices.

Real-time Chat

Real-time chat, or in-app messaging, has become immensely popular, with the combined user base of the top four messaging applications being larger than the combined user base of the top four social networks (Clark, 2016). Because messaging has become the preferred way of communication for so many people, it needs to be understood before a company incorporates it into a mobile application.

Messaging applications are typically used in two ways: personal use and enterprise use (Eidelson, 2016). The main reason that messaging applications are used for personal use is due to three important factors: asynchronous messages, conversations, and the conversation list. On the other hand, enterprise messaging applications are business focused. One of the main reasons of enterprise messaging is to allow quick communication between consumers and clientele (Eidelson, 2016). Questions asked by consumers and inquiries about the company's services by potential clientele can be answered through a chat conversation.

Real-time chat is better than other communication options because it is better suited for holding back and forth conversations (Clark, 2016). Although SMS texting is used by companies more often than in-app messaging or messaging applications to send critical information to the user, usually these texts are unable to be replied to and are completely automated. In-app messaging can be configured so that it is easy for employees to respond to messages, leading to a better user experience. It can also be configured for features such as sending documents to users and redirecting users to specific websites or other features of an application. Another advantage of in-app messaging is that it supports asynchronous messaging and can persist across devices.

There are many methods of implementing a messaging feature into a mobile application. One method is to use Smooch (2018b). Smooch has a universal messaging Application Programming Interface (API) that allows users to access multiple major chat platforms, such as WhatsApp, Messenger, and WeChat. Smooch Embeddables for iOS and Android could be used to create a functioning chat feature inside the STC application (Smooch, 2018a).

Gamification

Games can help engage users in mobile applications and increase user interaction (Basten, 2017).

Gamification is the application of game-related elements to nongame contexts. Gamification is used in mobile applications to improve the user experience, build trust with companies and their users, and increase user engagement.

Examples include 7-Eleven Hong Kong, which ran a redemption program from 9 January 2019 to 22 February 2019 (7-Eleven, 2018). Customers received one Sanrio character stamp upon a HK\$20 purchase at 7-Eleven, and one more stamp for every additional HK\$10 purchase. They could then redeem a certain number of stamps for a random ceramic bowl featuring one of the Sanrio characters.

Game-like elements are also used in mobile applications, including food or shopping applications. For example, Dunkin’ Donuts, an American fast food coffee chain, has a mobile application that customers can use to submit orders and pay via QR code. Whenever a customer orders or pays using the application, the application adds points to the customer’s account, which can be redeemed for a free drink. The application also notifies users of current promotions and gifts users with a free drink on their birthday.

Companies interested in gamification should first consider what systems and respective processes should be gamified and what user behavior is desired. (Basten, 2017). After that, they can decide on what game elements to include. A point system, such as those used by 7-Eleven and Dunkin’ Donuts, and other commonly used game elements with their descriptions can be found in Table 2.1 below. When companies are evaluating the desired user behavior and game elements, they should refer to three aspects of gamification design, which are Mechanics, Dynamics, and Aesthetics. These are described in Table 2.2 below.

Game Element	Definition
Feedback	Immediate notification that keep users constantly aware of progress or failures
Goals	Activity goals that are adapted as challengers for the user
Badges	Optional rewards and goals outside the scope of a service’s core activities
Point system	Reward for completing actions (that is, a numeric value that’s added to the total points)
Leaderboard	Tracking and displaying desired actions to drive desired behavior through competition
User levels	Indication of the user’s proficiency in the overall gaming experience over time

Table 2.1: Common Game Elements (Basten, 2017)

Design Aspect	Definition
Mechanics	Game components concerning data representation and algorithms (for example, points and badges)
Dynamics	Runtime behavior of mechanics concerning players' inputs and outputs over time (for example, completion and choices)
Aesthetics	The desirable emotional responses evoked in users when they interact with the gamified system (for example, the feeling of being challenged and the feeling of community)

Table 2.2: Gamification Design Aspects Regarding Desired User Behavior and Game Elements (Basten, 2017)

Companies looking to utilize gamification must be aware of the obstacles. There is not a single approach or game element that will suit all users; some may prefer point collecting, while others may favor completing challenges (Basten, 2017). Also, monetary or other concrete rewards should be given with caution, since they may become more important than the core functions of the application. Thirdly, the positive effects of the game elements can wear off if there are not regular updates, such as new challenges or promotions. The previous examples demonstrate this. Dunkin' Donuts offers new deals monthly, and 7-Eleven Hong Kong changes their promotion every few months. Although gamification comes with some hurdles to overcome, it is a promising way to improve user interaction with mobile applications.

News Notifications

Mobile application notifications are a core feature of many applications due to their ability to be received by users anywhere and at any time. Notifications are reported to increase engagement with applications, and application usage time is statistically significantly higher when applications are triggered by a notification (Westermann, 2017).

NSF International's (2018) mobile application, *Certified for Sport* demonstrates how mobile application notifications are used in the TIC industry. This application allows users to favorite tested and certified sports supplements and stay updated on their status. This approach to notifications can also be used to send updates on STC news or even favorited STC products in the STC mobile application to allow users of the application to receive notifications on news articles or the latest industry updates.

3 Methodology

Our goal was developing a mobile application that allows consumers, clients, and employees of the Hong Kong Standards and Testing Centre (STC) to use its barcode scanner for identification of STC certified products and verification of STC test reports in addition to other features that we found in our research.

To accomplish this goal, we focused on five objectives:

1. Determining if a mobile application can achieve STC's goals;
2. Determining STC's target audience for the mobile application;
3. Identifying, comparing, and contrasting competitor marketing and client interaction techniques in the testing, inspection, and certification (TIC) industry;
4. Determining which features should be included in the STC corporate mobile application;
5. Building a mobile application functional model with the features that we previously determined.

To accomplish our objectives, we engaged in the following five tasks:

1. Gathering information on what consumers and clients want in an STC mobile application;
2. Forming epics, scenarios, user stories, and use cases;
3. Designing a mobile application graphical prototype;
4. Building the functional model;
5. Assessing the mobile application;

In this chapter, we will explain the tasks and how they pertain to our objectives.

3.1 Task 1. Gathering Information on what Consumers and Clients Want in an STC Mobile Application

A mobile application must appeal to its users by having relevant features and an intuitive user interface. Therefore, prior to doing any mobile application design, we determined who STC's target audience is, as well as, the best features to include in the application. To find this information, we surveyed Hong Kong consumers and conducted interviews with STC employees and clientele.

3.1.1 Task 1.1. Surveys with Consumers

Using a convenience sampling approach, we surveyed 100 Hong Kong shoppers outside of shopping areas in Tai Po, Sha Tin, Kowloon Tong, Mong Kok, and Tsim Sha Tsui. We distributed surveys on a Monday and Friday in five different three-hour periods. Our team members approached people who seemed to have free time and administered the survey using a paper questionnaire written in English and Simplified Chinese. The questionnaire took about five minutes to complete and asked recipients for their basic demographic information and the brand of their mobile devices. In addition, the questionnaire asked for recipients' awareness of the TIC industry and their usage of certifications in their purchases. The questionnaire also asked for recipients' awareness and opinions of STC and any suggestions that they may have for features to implement in the application. Lastly, the survey asked consumers for their level of interest in an STC mobile application as well as the product types and product information they would like to know about most when making a purchase decision.

We collected information on consumer TIC and STC knowledge and level of interest in an STC mobile application which allowed us to accomplish objective 1: determining if a mobile application can achieve STC's goals. Additionally, questions we asked about consumer demographics and whether consumers check for product certifications helped us to accomplish objective 2: determining the target audience of the STC mobile application. Lastly, we asked questions about consumers' preferred mobile application features, preferred product types, and product information required to purchase a product, which aided us

in accomplishing objective 4: determining which additional features should be implemented into the STC mobile application. With this knowledge, we were able to make realistic decisions on which features to include in the mobile application and the best methods of implementation. We inserted the survey questionnaire that we distributed in Appendix C.

3.1.2 Task 1.2. Interviews with STC/HKCC Employees

Based on interviewee suggestions made by our STC liaisons, we interviewed 5 STC/HKCC employees in the executive, marketing, technology, and laboratory divisions of the companies. Each interview took approximately 20-30 minutes, and consisted of questions about who STC wants to reach with its application, what product information should be in the application, employee knowledge on how STC competitors handle company promotion and enquiries, and additional features that the interviewees want in the application. In addition, we asked the interviewees about STC's scope and budget for future application development. The interview protocol for STC employees is in Appendix D. Summaries of the employee interviews are in Appendix F.

Through the questions about who STC wants to reach with the application, we were able to get a clear understanding of how to accomplish objectives 1 and 2: determining if a mobile application can achieve STC's goals, and determining the target audience of the STC mobile application. Additionally, with information about STC's competitor strategies, we were able to accomplish objective 3: identifying and evaluating competitor marketing and client interaction techniques. Lastly, the features that STC employees recommended helped us to accomplish objective 4: determining which features should be included in the application.

3.1.3 Task 1.3. Interviews with STC Clientele

Since STC clientele make up a portion of STC's audience, we interviewed 2 client representatives suggested to us by our liaisons. We conducted interviews with representatives of Wonderlife Universal Limited and Wickfield Insurance Brokers Limited. The interviews lasted approximately 20-30 minutes and consisted of asking client representatives about their companies' business relationships with STC, relations with STC competitors, and potential features to be included in an STC mobile application. The interview protocol for STC clientele is in Appendix E. Summaries of our client interviews are in Appendix G.

By speaking to STC's client companies and learning more about their business relationships with STC, we accomplished part of objective 2, which was determining STC's target audience for the mobile application. When we talked to clients about their relations with STC's competitors, we asked if they preferred any marketing techniques that STC competitors use. Our questions regarding STC's competitors completed part of objective 3: identifying, comparing, and contrasting competitor marketing and client interaction techniques. Lastly, by asking clients which features would be best for their companies, we achieved objective 4 by determining which features clients want and how those features help them. At the same time, we completed objective 1: determining if a mobile application can achieve STC's goals. STC's goals are promoting itself and reaching more clients through the application, and the features that STC's clients suggested contributed to our understanding of how a mobile application could reach clients and meet their needs.

3.2 Task 2. Forming Epics, Scenarios, User Stories, and Use Cases

After we gathered information on the required features of the application, we performed a requirement analysis. To do this, we created epics, scenarios, user stories, and use cases.

The first step of requirement analysis is the creation of epics, which describe the major requirements or features of a program. After creating the epics for the application, we used them to create usage scenarios which describe specific, real-world examples of how people would use the application. We then used the scenarios to help us generate user stories, which depict specific features of the application, as well as, who would use those features and why. They typically follow the following format: As a (role), I want (feature), so that (reason). We then used our user stories to create use case diagrams, which are visual representations of how different types of users interact with the application. Finally, each use case diagram was used to create a textual use case which describes the specific interactions between the user and the application.

The formation of these epics, scenarios, user stories, and use cases was the bridge between the social and technical aspects of our project. Since epics lay out the goals of the application, we compiled our data, discovered which features STC and users wanted, and produced epics that would accomplish STC's goals. As a result, this task covered objectives 1 and 4: determining if a mobile application can achieve STC's goals and determining which features should be included in the STC corporate mobile application. By writing scenarios and user stories, we specifically used our research on STC's target audience and further solidified objective 2: determining STC's target audience for the mobile application. Since both visual and textual use cases are a technical way to show user interaction with an application, we reviewed STC competitor applications and their implementation of application features, allowing us to revisit objective 3: identifying, comparing, and contrasting competitor marketing and client interaction techniques in the testing, inspection, and certification (TIC) industry.

3.3 Task 3. Designing the Mobile Application Graphical Prototype

After we completed task 2, we designed a series of screenshots that map out the features. Then we uploaded the screenshots into a no-coding-required, prototype web application called Invision to add logic

to the static screenshots. This prototype allowed us to easily demonstrate how features can be included in the coded mobile application. We made four iterations of the graphical prototype, as we updated STC staff on our progress and received feedback from them on each iteration.

The graphical prototype brought together the features of the application to create a replica of the user interface (UI). We then used the graphical prototype to make the UI of the functional model, which helped us to accomplish objective 5: building a mobile application functional model that includes the features that we previously determined.

3.4 Task 4. Building the Functional Model

Based on the graphical prototype that we designed from our surveys, interviews, and research, we built an STC mobile application able to satisfy the requirements of STC. We coded a functional model of the STC mobile application in Android Studio in Java. The functional model was not meant to be a full-fledged application but rather be a proof of concept for the final version of the application. Due to the nature of the software development process, we revised previous prototypes and updated our functional model accordingly.

We were able to convert a portion of our graphical prototype into a functional model, and therefore achieve objective 5: building a mobile application functional model that includes the features that we previously determined. Although the functional model did not include all the features in the graphical prototype, it included the barcode scanner feature requested by STC as well as additional features found in our research.

3.5 Task 5. Assessing the Mobile Application

Once we coded the functional model, we asked STC employees to test the graphical prototype and share their feedback. For each feature in the prototype, we asked them to rate the feature on a scale of one to nine and note their likes and dislikes. Additionally, we asked them to rate the application as a whole and write down anything that could be improved. The mobile application assessment form helped us determine the advantages, disadvantages, and potential improvements of the graphical prototype, which we provided to STC.

Using the employees' feedback, we were able to determine if the mobile application had features that were appealing to users and how other features could be included based on improvements that users suggested. This task satisfied objective 5 as it pertained to the future development of the mobile application. The task also revisited objectives 1 and 4 as it examined what STC's goals are and which features should be implemented into the mobile application.

4 Results

By analyzing the information that we gathered, we determined that STC can reach a larger audience and further promote itself through a mobile application. Our research showed that STC aims to target local Hong Kong and mainland Chinese consumers who use mobile devices. STC hopes that targeting this consumer base will attract clients who are part of STC's general audience. We found that STC and the target audience are interested in a barcode scanner, as well as additional features such as a real-time chat with an STC employee feature, STC certified products database, STC news feature, STC information feature, and a game-like element to varying degrees in the STC corporate mobile application. Lastly, our team also found that both STC and its competitors share many of the same marketing techniques; however, some competitors use techniques that STC does not use.

In the following sections, we discuss our findings.

4.1 Determining If a Mobile Application Can Achieve STC's Goals

After conducting surveys with consumers, as well as interviews with STC clients and employees, we concluded that STC can reach a larger audience and promote itself with a mobile application.

From our interactions with STC liaisons and interviews with STC employees, we were able to gain a better understanding of the company's goals. We learned about STC's goal to make a mobile application with a scanner feature, which would be able to scan a product barcode to check if it is tested and certified in accordance to product safety standards and certification schemes. In addition, the scanner would be able to confirm the validity of STC test reports by scanning an identification marker on the test report. We also learned more about STC's goals from our interviews with STC employees. STC Marketing Communication Assistant Fox Tsui and HKCC Certification Officer Amy Lee mentioned that STC wants to reach consumers. STC Chief Executive Professor Richard Fung explained that the application should

spread awareness of STC and the importance of certification. Also, HKCC Sales and Marketing Executive Ethan Chan revealed that STC also wants to reach manufacturers who are STC's clients.

After conducting 100 surveys of Hong Kong consumers, we analyzed the survey data and concluded that a mobile application can achieve STC's goals. We found that 99% of the survey participants had a smartphone. Although our sample might not accurately represent the entirety of Hong Kong's population due to the small sample size, it suggests that a majority of Hong Kong's population has a smartphone that may be able to run the STC mobile application. Secondly, we found that Hong Kong consumers may be interested in an STC mobile application with a scanner feature as we summarize in Figure 4.1. This is supported by our survey data, which show that 69.6% of survey respondents were at least somewhat interested in an STC mobile application with a scanner feature.

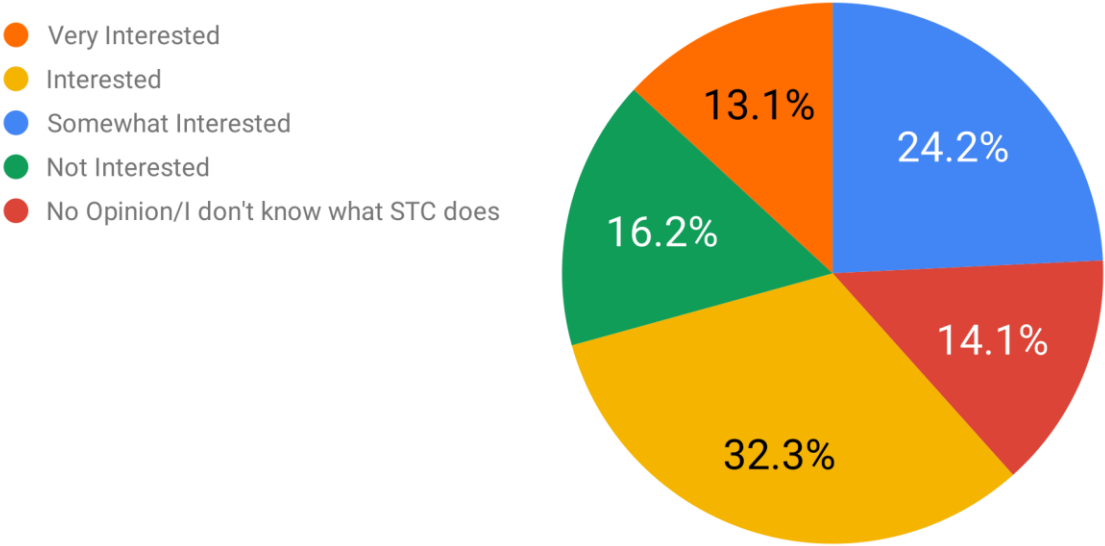


Figure 4.1: Survey Results on Interest in STC Mobile Application

Respondents also demonstrated interest in other features, such as a real-time chat, STC certified products database, and STC news. A graph of these data can be found below, in Figure 4.2.

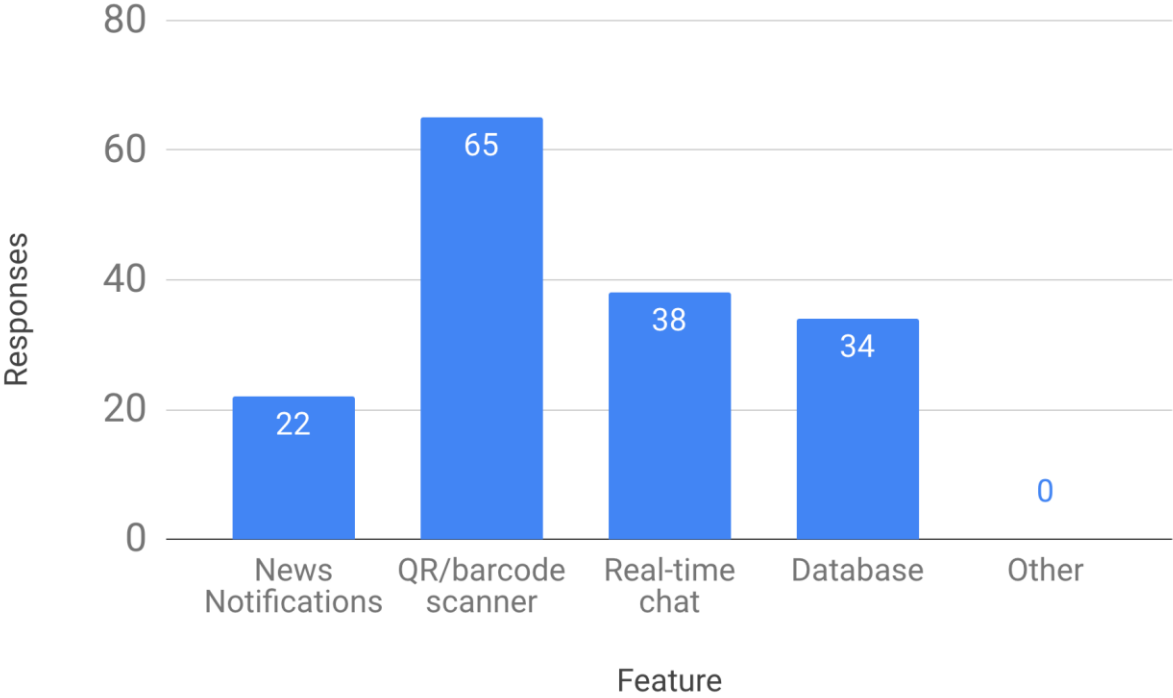


Figure 4.2: Survey Results Distribution of Preferred Features

We determined that there are Hong Kong consumers who do not know what STC is or what the TIC industry does. Our data showed that the majority of consumers we surveyed did not know about either the TIC industry or STC, and the majority of respondents had never checked if a product was certified by a TIC company or STC. This group of consumers can learn about STC and the TIC industry through the mobile application, which would raise awareness of STC.

To summarize, our survey data reveal that a mobile application from STC can achieve STC's goals because the application can reach a majority of Hong Kong consumers through their smartphones, Hong Kong consumers are interested in an STC mobile application with a scanner feature and other features,

and the application can spread awareness of STC to the large number of Hong Kong consumers who are not aware of the TIC industry or STC.

4.2 Determining STC's Target Audience for the Mobile Application

STC's target audience for the mobile application is local Hong Kong and mainland Chinese consumers who use mobile devices. STC hopes that targeting this consumer base will attract potential clients. The target audience showed interest in a scanner, as well as additional features such as real-time chat, database, and news notification features. They also showed interest in the certification information of various product types and product information of various products when making a purchase decision, as we discussed in objective 4.

Before the research and development process, our team spoke with Anthony Mak, a former STC employee, who informed us that the mobile application is intended for local Hong Kong and mainland Chinese consumers. As part of our research, we interviewed Professor Richard Fung, Fox Tsui, and Amy Lee and conducted consumer surveys which also helped us to determine the target audience of the mobile application. Fox Tsui told us that the mobile application will be used by the public to allow STC to connect with customers by promoting product safety, as well as, STC's services. Amy Lee mentioned that STC and HKCC would like the public to be able to recognize their marks and logos so that they see STC and HKCC as reliable testing and certification companies.

In our interview with Professor Richard Fung, he stated that STC's audience consists of both clients and consumers; however, the company wants to use the application to reach consumers as it believes that reaching more customers will help reach more clients. Professor Fung also stated that STC aims to reach "low level consumers" and that an average income housewife was an example of a "low level consumer." Therefore, we interpreted "low level consumers" to be consumers with middle to low incomes that buy

products for themselves and for their families. Additionally, in our survey, we asked consumers about their income level, and the results showed that a majority of consumers were in the lower monthly income range (\$0-\$19,999). Our survey also asked consumers how interested they are in an STC scanner application. These questions allowed us to determine if there were any relevant correlations between interest level and income of consumers. We found that more consumers in the lower income range (\$0-\$19,999) were at least somewhat interested in the mobile application compared to the consumers in the higher income range (\$30,000+). With this information, we understood that the mobile application could focus on lower income consumers as they are more interested in the application.

4.3 Competitor Marketing Techniques in the TIC Industry

Both STC and its competitors share many of the same marketing techniques; however, some competitors use techniques that STC does not use or does not use well as its competitors. Many of STC's competitors have a larger social media presence, applications of their own, and well-known clients to promote them.

STC currently uses many common marketing techniques. From our background research, we learned that STC uses its website, as well as email newsletters, paper fliers, newspaper advertisements, and sponsor events to reach out to potential new clients and consumers. During our interview with Ethan Chan, we learned that HKCC also hosts a publicity event for its clients once a year. These are all common marketing techniques used by the majority of companies in the TIC industry. In our interview with Fox Tsui, we learned that TIC companies frequently copy each other's marketing techniques.

Although STC and its competitors use many of the same marketing techniques, there are some competitors that do a better job marketing themselves using social media and mobile applications.

According to both Ethan Chan and Amy Lee, STC and HKCC should improve their promotion on social media. HKCC's Facebook page only has about a thousand followers, and STC's page has less than five

hundred followers, less than six hundred likes, and only contained fifteen posts in 2018. Meanwhile, the Facebook pages of some of STC's competitors have over ten thousand followers as stated by Lee. In addition, SGS' and Bureau Veritas' Twitter accounts have over nine thousand followers and send multiple tweets a month, while STC's Twitter account has fifty-five followers and sent out only eight tweets in 2018. We observed that SGS and Bureau Veritas tweet mostly about company news, services, and other general information, and their tweets almost always contain an image or infographic. Some of STC's competitors, like Intertek, SGS, Bureau Veritas, and TÜV Rheinland, have already released mobile applications with a variety of features for their clients, consumers, and employees. Some features of these applications include news and event notifications, real-time chats, video streaming, document sharing, and tools that help employees conduct tests and inspections.

In addition to using social media and mobile applications, some of STC's competitors have also promoted themselves by making marketing deals with notable clients. Both Amy Lee and Ethan Chan mentioned that some TIC companies have well-known clients that promote them. For example, one of STC's competitors, SGS, certifies McDonald's products, and McDonald's in turn inserts SGS' logo in its advertisements. As a result, SGS is exposed to, and gains the trust of, more potential clients and consumers.

4.4 Determining which Features should be Included in the STC Corporate Mobile Application

In the following sections, we discuss which features STC should implement and the possible implementation plans for each feature.

4.4.1 Features

Based on our surveys, interviews, communication with STC, and prior mobile application research, we found that local Hong Kong consumers, mainland Chinese consumers, and/or STC want a product

barcode and test report scanner, real-time chat with an STC employee, STC certified products database, STC news feature, STC information feature, and a game-like element in the STC corporate mobile application.

In our survey of 100 local Hong Kong and mainland Chinese consumers, we asked participants what features they would like to see in an STC corporate mobile application. Our team showed participants four features which were mentioned in the STC documents that we received from Anthony Mak. We also provided participants with additional space to write in their own response. Figure 4.2 shows the distribution of their responses. The scanner received the most selections with 65% of the consumers selecting it. This finding aligned with our STC liaisons' goals and Professor Richard Fung's statement that the scanner was intended to be the main feature of the mobile application. After the scanner, the consumers selected the real-time chat, and more than a third of the consumers wanted it. A database was the next most popular feature, chosen by approximately a third of the consumers. More than a fifth of the consumers selected STC news, and it was the least selected feature in our survey. While some participants wrote responses in the other category, the responses were repeats of the given features or misinterpretations of the question and, thus, our team excluded them from the results.

In our interviews with STC employees and STC clientele, we asked interviewees if they wanted any specific features in the mobile application. Professor Richard Fung wanted to see users learn more about STC and the TIC industry. Amy Lee and Fox Tsui spoke about the need for users to understand what STC does and how certification works. According to our survey, only 28.3% of the survey respondents were aware of the TIC industry, and only 19.2% of the respondents knew about STC. As a result, the majority of the consumers were not aware of either the TIC industry or STC, and thus may require information on both. Since our goal is developing an application that promotes STC, which includes communicating what STC is and what it does, we found that an STC information feature would align with the responses.

During our interview with Professor Fung, he said that the mobile application should include a game-like element to attract and maintain users. Professor Fung did not discuss the details of this element, but his description of it was unlike any other features that we mentioned.

4.4.2 Implementation

When developing mobile applications, developers need to not only understand what features to make, but how to make them. From the features we listed above, we discuss possible implementations of each feature based on our research.

Scanner

In our discussions with our liaisons and our interview with Professor Fung, all requested that the scanner be able to display product information. The liaisons also requested that the scanner be able to determine the validity of STC test reports, due to the creation of false test reports by product companies. After analyzing the format of STC test reports, we found that the front page contained unique test report information, and our liaisons told us that this information was accessible to customers. Based on our background research on scanners, we knew that the scanning ability could be implemented using Machine Learning Kit for Google Firebase. Also, when looking at different mobile application scanners, we found that the majority of applications included a scanner history and favorite sub feature.

Regarding the display of product information, Professor Fung suggested that we show tiers of information, so users can view information in order of importance. The first tier would show safety information such as what standards the product complies with and if the product failed its tests. The second tier would show specific product information such as nutrition information for food items or recommended dosages for pharmaceutical products. He also described adding more general information in the second tier such as tutorials on how to use the product. He added that pictures could be included to help people know that they have the right product.

In our interview with Ethan Chan, he suggested that we include the product company's logo, testing marks and their expiration date, testing standards, country of production, and nutritional information if applicable. Fox Tsui also suggested that we list a product's certification marks and expiration dates, as well as the product name and which tests it passed. He mentioned that many people are not familiar with certification marks and said that we should include a description of the certification. To further educate users, Tsui said that showing additional certifications at the end of the product screen could help raise awareness of the different certifications. Amy Lee noted that many people will not understand testing information and suggested that we display a comprehensive conclusion of the test report or attach a link to the report. In talks with Fox Tsui and our liaisons, however, we learned that STC does not typically release reports to the public because they contain confidential information.

We conducted our survey of local Hong Kong and mainland Chinese consumers and asked participants what information they look for when making purchase decisions, since the scanner is to help them make purchase decisions. We gave participants several options to choose from, and participants could select more than one item or write in their own response. None of the participants wrote additional responses. Figure 4.3 shows the distribution of the participants' answers. More than 75% percent of the participants selected price, which was the most common answer. While displaying product prices in the mobile application would be helpful to the user, we understand that prices could be difficult to accurately display given varying prices at different retailers. More than half of the participants selected brand, and it was the second most common response. More than half of the participants selected description as important information for making a purchase decision. A little below half of the participants selected image as important information. Less than a third of the participants chose product testing results, product certification, and reviews as information that they look for. Only 14% of the participants looked for product availability at retailers, and less than 10% of the participants selected that they look for information regarding its supply chain.

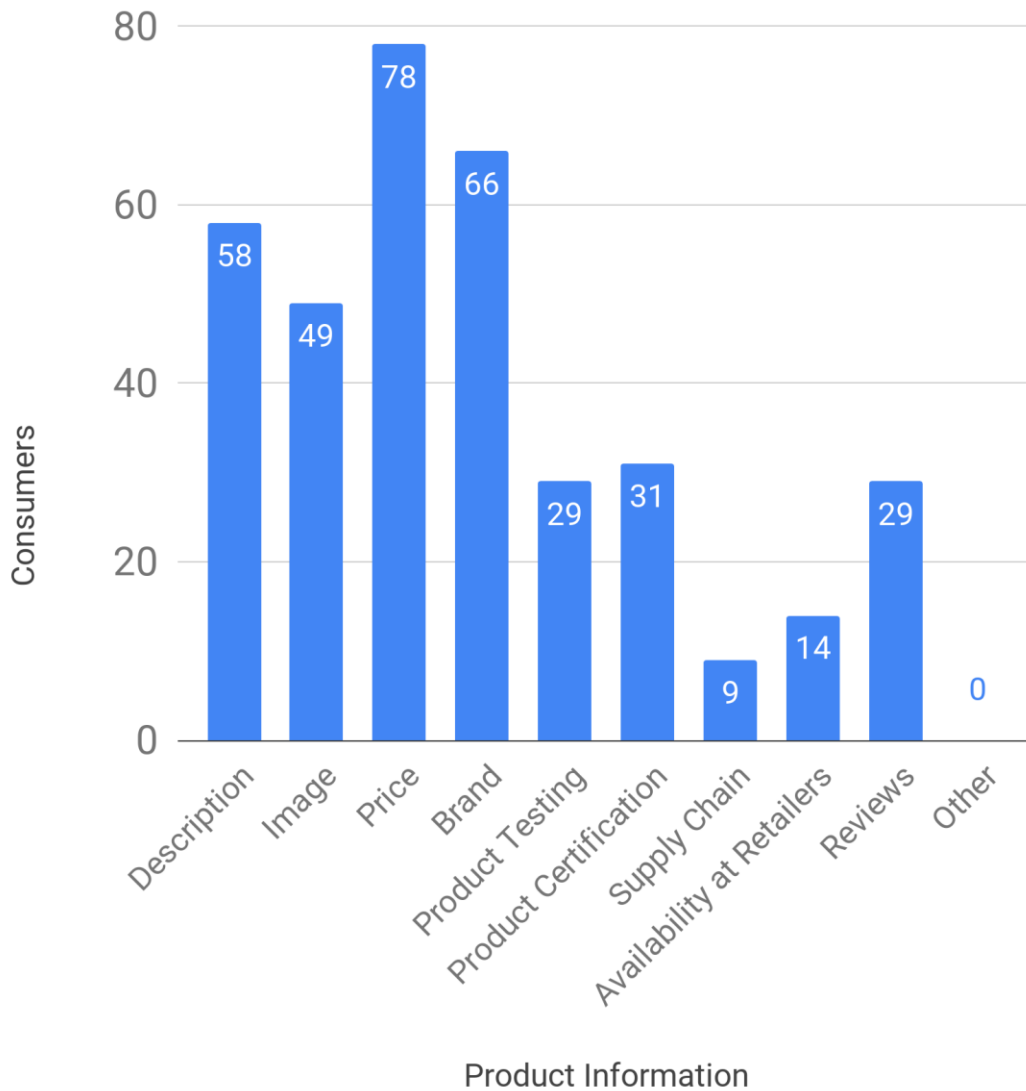


Figure 4.3: Survey Distribution of Preferred Product Information

Real-Time Chat

Our initial liaison Anthony Mak suggested that we implement a real-time chat with an STC employee that could handle customer enquiries from clients and consumers.

Ethan Chan discussed how clients tend to call STC or HKCC to handle their STC services application forms. While forms are available for download on the STC website, most clients call about their enquiries

and have STC or HKCC fill out their forms. By implementing a real-time chat that handles client enquiries, STC and HKCC representatives could document client messages and reference them later.

Amy Lee said that the real-time chat system was a good idea, but she thought that a form would better suit STC. Instead of hiring a person to manage a real-time chat at all times, STC representatives could email the enquirer at a later time. According to Professor Richard Fung, if we determine that the real-time chat feature will be valuable to the company, then STC would hire additional employees to maintain it. Bureau Veritas, an STC competitor, has an enquiry form on its mobile application that implements a system similar to the one described by Amy Lee. The form asks for the user's name, company name if applicable, email, and enquiry.

Many companies such as Discover implement a real-time chat system in their websites to handle customer enquiries. Other companies such as Domino's Pizza or American Eagle also use Facebook Messenger, a real-time chat application, to communicate with customers. In discussions with our liaisons, we learned many Hong Kong businesses use WhatsApp, a popular messaging app, in their customer service systems to handle customer enquiries. WhatsApp integrations exist for both Android and iOS systems, so a developer could implement WhatsApp or similar messaging system into the STC mobile application.

STC Certified Products Database

STC advertises its list of products through paper catalogs and stores the complete database of products on external storage not available to general consumers, according to Fox Tsui. In comparison, STC's competitors, such as SGS, store product databases on their websites, so that clients or consumers can view certified products and certified companies. STC Technology Department Representative Alex Wong spoke about the database system used by the STC group. In order to have the full list of STC and HKCC

certified products, STC would have to make an additional database that contains the product certification information from its departments and combine it with HKCC's certified product database.

In our survey, we asked the participants what types of products they would want to know are certified. Figure 4.4 shows the distribution of those product types. More than 50% of the participants selected food, pharmaceutical products, electrical products, and medical devices. Less than 30% of the participants selected toys and children's products, footwear, furniture, and textiles. We received two other responses: makeup products and supplements/vitamins. This information shows consumer preferences and could suggest that the database feature offer quick access to products of popular types and include these product types in the search algorithm.

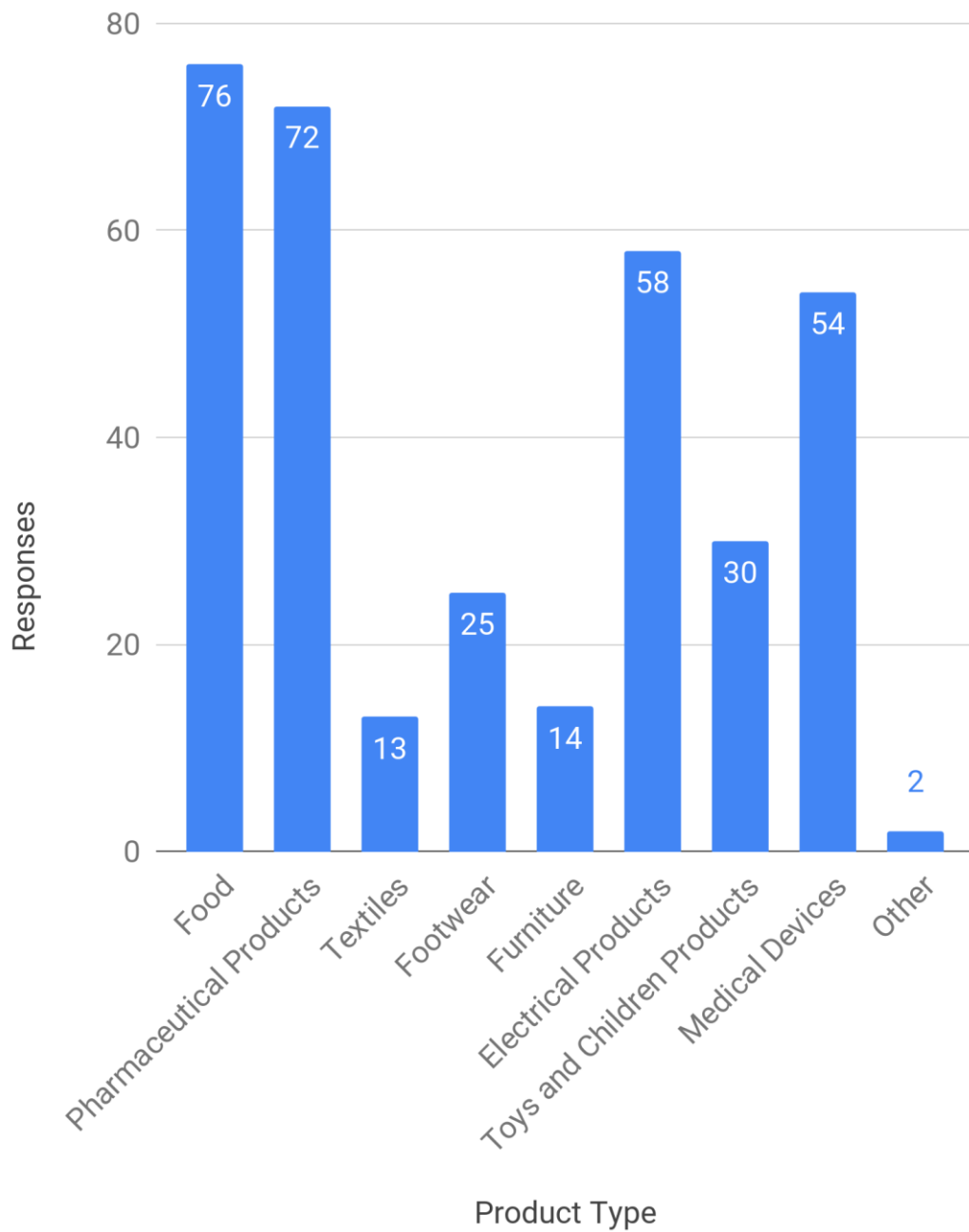


Figure 4.4: Survey Product Type Distribution

STC News

Our initial liaison, Anthony Mak, suggested that we implement an STC news feature for the mobile application that broadcasts company news and updates via push notifications or other means.

Professor Richard Fung told us that STC news and updates could include information on Hong Kong events. During our interview with him, he explained an incident where the local tap water was unsafe to use. STC tested Hong Kong residents' tap water and let them know if it was safe or not. He suggested that the STC news feature could broadcast information such as this occurrence and help users stay up to date on safety information. The STC website already contains recall information and STC promotional events. The website is frequently updated, so a developer could transfer this information into the mobile application.

STC Information

Due to the low awareness of the TIC industry and STC, Professor Richard Fung suggested that we include TIC industry and STC information. Ethan Chan and Fox Tsui suggested that we display explanations of the various certification marks.

Game-like Element

Professor Richard Fung stated that a game-like element could encourage the user to continue using the application. In our discussions with our STC liaisons, we learned about STC's coupons in the back of their paper brochures. Since coupons are associated with the price of items and used traditionally to draw customers into stores, they could be used to draw customers to use the mobile application and thus be exposed to STC and its certified products.

4.5 Building the Functional Model

Based on our surveys and interviews, our team determined the best features for the STC mobile application. We included them in a graphical prototype which we used for the application assessment by STC employees. These features included a scanner, real-time chat, database, news, and STC information

feature, and were assessed by STC employees. Of those that we mentioned, our team included the scanner, database, news and STC information features in the functional model.

When we conducted the assessment, we found that the application received an overall rating of 6.7 out of 9, and contained some suggestions to improve the final mobile application. Employees mentioned that the overall application should include fewer words and more graphic media such as videos and photos.

For the scanner feature, employees gave it an average rating of 7.2 and liked its convenience; however, one employee suggested that, when a product is scanned, users should also be given information on where they can buy the product.

58.3% of employees rated the real-time chat feature with an 8 out of 9 and suggested that the feature allow users to attach documents and favorite messages. Additionally, they asked that the feature include a chat bot in the case that there are no STC representatives available to answer a user's question immediately. One employee also suggested that the feature include a place for users to leave their contact information such as email or phone number.

The database feature received an overall rating of 7.1 and most employees liked that there was a way to search for a product. The employees also mentioned that they would like to be able to search for products by their testing reference number or company that produced it. Other employees suggested that the feature include more categories of products as well as a way to sort the products in alphabetical order.

53.8% of employees rated the news feature with a 7 out of 9 and believed that it was a good way to promote STC. Some employees mentioned that they would like the feature to include when coupons are released as well as registration of seminars and standards updates. The employees also suggested that the news feature be sorted into categories for different departments, locations, or months.

Lastly, the STC information feature received a mean rating of 6.5. A majority of employees liked how informative the feature was, but some mentioned that they would like the feature to also include animations such as pictures and videos. Additionally, one employee stated that information on the TIC industry was not necessary to include in the feature. Another suggested that the feature should also include information on HKIC, as well as additional information on each STC mark. Lastly, one employee stated that there should be more “subfunctions.” For example, the testing category should be separated into the different types of testing done on various products.

5 Conclusions and Recommendations

Our team analyzed the findings from our surveys and interviews to make significant conclusions about the data that we collected. With these conclusions, we came up with recommendations for 6 tasks that STC should carry out in the future to help accomplish its goals of promotion through the development of a mobile application. The following sections discuss the conclusions and recommendations we made.

5.1 Conclusions

We learned that STC can reach a larger audience and promote itself through a mobile application that contains a variety of features. Through our communication with STC employees, we have concluded that the target audience of STC's mobile application are general Hong Kong and mainland Chinese consumers, particularly those with lower incomes. Furthermore, manufacturers and trading companies will also be reached by promoting STC to consumers through the mobile application. In regards to promotion, we have concluded that STC and its competitors share marketing techniques such as websites, email newsletters, paper fliers, newspaper advertisements, and sponsor events, but its competitors are better at utilizing social media, mobile applications, and promotion via clients. Therefore, the development of a mobile application can assist STC in marketing itself better to its audience of clients and consumers. We found that local Hong Kong consumers, mainland Chinese tourist consumers, and/or STC want the following features in the STC mobile application, in order of priority: a product barcode and test report scanner, real-time chat, STC certified products database, STC news, STC information, and a game-like element.

To implement the product barcode and test report scanner, we found that the scanner should scan product barcodes and test report QR codes to relay relevant information to the user in a tier format. The real-time chat with an STC representative should handle customer and client enquiries and keep a history of the

discussion with possible implementation similar to that of the popular messaging app WhatsApp. The database should allow users to search for certified products and to view products of their preferred product types. STC news should allow notifications for, and show, STC news on STC events, product updates, and industry changes such as information posted on the STC website. The STC information feature should include comprehensive information on the TIC industry, STC, HKCC, and the marks used to certify products. The game-like element should keep users coming back to the application by utilizing STC's resources such as certified product coupons or implementing a prize system similar to that of established companies' mobile applications.

Finally, our application assessment demonstrated that the STC employees who viewed the graphical prototype took it favorably and suggested some improvements that a future development team should address. Our team analyzed the suggestions made and concluded that a future development team should incorporate more videos and images throughout the mobile application, as well as additional sorting methods in the STC information and database features.

5.2 Recommendations

Based on our conclusions, we have come up with six recommendations for STC to take moving forward. We recommend that STC include specific features in the application, conduct additional research about gamification, and hire a development team to release the application. We also recommend that STC maintain and reevaluate the application, grow its social media accounts, and explore options for a client focused mobile application. We explain these recommendations in the following sections.

Recommendation 1: Suggested Features of the Application

We recommend that STC's corporate mobile application include 6 features as displayed in the graphical prototype and partially implemented in the functional model.

The features that our team included in the graphical prototype and functional model are the features that consumers, STC clients and employees preferred. We determined that these would be the best features as they were the most attractive to potential users based on our surveys and interviews. They will ensure that the mobile application achieves STC's goals by promoting the company and attracting a large consumer and client audience. The 6 features include:

- certified product and test report scanner
- real-time chat with an STC representative
- STC certified product database
- STC news
- STC information
- game-like element

Recommendation 2: Future Research on Gamification

We recommend that STC does further research on how to apply gamification to its mobile application.

Incorporating gamification in the mobile application can engage users in the application and increase user interaction (Basten, 2017). To begin its research, STC should refer to Background section 2.3.9, which contains a detailed explanation of gamification, real-world examples, aspects of gamification that STC should consider, common game elements, and obstacles that should be addressed. We also encourage STC to explore other methods of implementing gamification in order to ensure that it is applying gamification to fit its needs.

Recommendation 3: Development Team for Release

We recommend that STC hire an external mobile application development team to complete and release the mobile application on Android and iOS using our research.

The functional model that we developed is solely meant to be a proof of concept and STC should not consider it as complete. A development team would be able to enhance the features in the functional model according to the graphical prototype and feedback received from the mobile application assessment, add the features we did not have the resources to complete, and optimize the application for faster performance. They would also be able to populate a database with the product information, test reports, and other relevant information from the existing STC and HKCC databases that we did not have access to. The development team would, then, be able to include this database in the mobile application. In addition, the development team would be able to release the mobile application in the Apple and Google Play store. Lastly, a development team would be able to maintain the application after release by making sure that the database is up to date and the application works with future smart device updates.

Recommendation 4: Maintenance and Reevaluation of the Application

We recommend that STC frequently update the mobile application and reevaluate features based on user feedback.

Maintenance is one of the essential steps of the application development process, Once the application is released, it is necessary to ensure its interface and platform remain compatible with all operating systems as they are updated. Additionally, STC may want to ensure the mobile application is meeting the needs of its audiences to promote itself effectively. We decided which features to implement into the functional model and how to implement them based on the results of our surveys and interviews, but it is possible that people's preferences may change once they actually have access to the application. Therefore, it is important that STC reevaluate the application after its release. This can be achieved by checking the application's usage statistics and evaluating user reviews and comments in the app stores.

In addition to reading reviews and comments, STC could also reevaluate the application by performing additional application assessments. By compiling the results of these assessments, STC may find that there are more features that should be included in the application, or that the features that are already there should be implemented in a different form.

Recommendation 5: Social Media Expansion

We recommend that STC grow its Facebook and Twitter social media accounts by promoting them through the mobile application and posting about STC news, services, and general information.

STC currently has social media accounts on Twitter, Facebook, and YouTube; however, these accounts are not as successful as their competitors' accounts, as shown by their small amount of followers or subscribers and confirmed by Ethan Chan and Amy Lee.

Our survey data indicates that many Hong Kong residents do not know what STC is. Also, some of the STC employees that we interviewed told us that they want more people to know about STC. By growing its social media accounts, STC can reach more people. One way STC can grow its social media is by posting more often. We observed that SGS and Bureau Veritas tweet mostly about company news, services, and other general information, and their tweets almost always contain an image or infographic. STC can start by following what SGS and Bureau Veritas post, since they have more successful social media accounts. Another way STC can grow its social media accounts is by promoting them through the mobile application which will increase STC's social media exposure.

Recommendation 6: Future Research on a Client-Targeted Application

We recommend that STC perform future research on building a software application focused on clients.

Our previous point of contact, Anthony Mak, asked us to implement client-targeted features, such as an electronic order handling feature, as well as a mobile payment feature. In addition, Bill Chu of Wickfield Insurance Brokers Limited told us that the features he would like to see most in the mobile application are an electronic application form and a simpler way for clients to communicate with STC. Ethan Chan told us that although the target audience for the application is consumers, the main target audience for STC and HKCC are clients. Similarly, a participant in the application assessment wrote that the mobile application's target users should also contain manufacturers and show standards updates for factories which would mainly concern clients instead of consumers. Finally, successful TIC companies like Intertek, SGS, and Bureau Veritas have released mobile applications targeted towards their clients. Some of our research indicates that a client focused application may be beneficial, but we don't have enough information to conclude that STC should make one. Therefore, we suggest that STC conduct more research before it decides whether it should invest in a client focused application.

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Appendix A: Sponsor Description

Established in 1963, The Standards and Testing Centre (STC) (2018d) is Hong Kong's first private, non-profit organization that is committed to "serve the community, including manufacturers, consumers and the Government, by continuously improving product quality and safety" (para. 5). Originally a part of the Federation of Hong Kong Industries (FHKI), STC's initial funding came from FHKI but became a self-sustaining independent company over the years (A. Mak, personal communication, November 21, 2018).

STC (2018h) provides manufacturers with product assessment services. Its services include the testing, inspection and certification of chemical and pharmaceutical products, food, electrical products, textiles, footwear, furniture, materials, toys, medical devices, and calibration services. STC's vision is to "become a leading conformity assessment service provider that is recognized and respected worldwide" (para. 4). Competitors of STC include other companies in the product certification company such as Intertek, SGS, Bureau Veritas, and TUV Rheinland (A. Mak, personal communication, November 16, 2018).

STC (2018d) is a nongovernmental laboratory whose executive management team consists of 7 members led by Chief Executive Professor Richard Fung. STC is organized into five general departments: sales & business development, operations, corporate finance & administration, corporate quality & information technology, and chief executive [Figure A.1]. Each of these departments is made up of smaller departments that deal with specific aspects of the company. With over 600 employees, STC manages six operations in Mainland China, Vietnam, Japan, Italy, Germany and the United States that also provide testing and certification services for a variety of products. Its headquarters are located in Hong Kong and consist of 200 colleagues (A. Mak, personal communication, November 21, 2018).

The organization is comprised of several sections that are relevant in the development of a corporate mobile application, including the information technology, customer service, sales & business

development, and operations departments (STC, 2018d). These divisions have valuable resources such as database, information on order processing, statistics on mobile application usage, and expertise on mobile application development to possibly produce and maintain such an application.

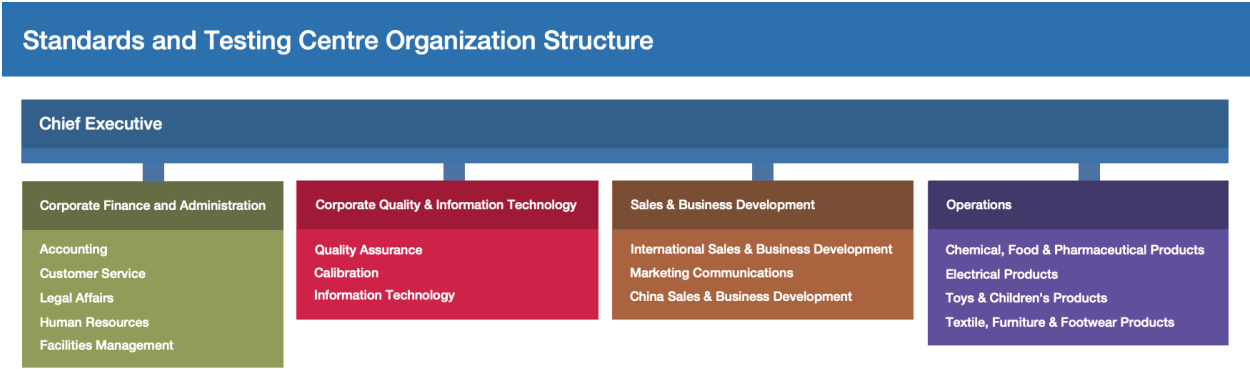


Figure A.1: STC Organizational Structure (STC, 2018d)

Appendix B: IQP Description and Relevance

The Interactive Qualifying Project (IQP) is a general education requirement for every undergraduate student at Worcester Polytechnic Institute (WPI). It is one of the most distinctive elements of the WPI Plan and WPI's signature project-based curriculum, giving every WPI student the experience of working in interdisciplinary teams to solve a problem or need that lies at the intersection of science and society. Through the IQP, WPI students work together to solve problems that matter to people and communities. They bring ingenious approaches to an astounding array of challenges—and the projects fundamentally change the students, building leaders who can solve problems and make decisions with an understanding of and appreciation for the social and humanistic context of their work. Students can work in an IQP on WPI's campus, in local communities, or at one of many Project Centers around the globe.

Our project, the Development of STC Corporate Mobile App, is an IQP that takes place at the Hong Kong Project Center. The goal of our project, which is the development of a mobile application prototype for the Hong Kong Standards and Testing Centre (STC), requires us to solve problems that contain aspects from science and society. Our team, consisting of students from multiple disciplines, seeks to use our skills to help STC's clients and consumers interact with the company through the mobile application. We desire to focus on achieving the goal of our project while demonstrating an understanding of the project's technical, social, and humanistic context.

Appendix C: Sample Survey Questionnaire

Mobile App Survey 手机应用程序调查

We are four university students from the United States of America who study at Worcester Polytechnic Institute (WPI). We are doing research on mobile applications in collaboration with the Hong Kong Standards and Testing Centre (STC), which was established in 1963 as Hong Kong's first independent and not-for-profit Testing, Inspection and Certification organization. The purpose of this survey is to learn about the opinions of the Hong Kong people on mobile applications, STC, and a potential STC mobile application. Your answers will remain anonymous and only be used to generate a statistical picture of people's opinions.

我们是来自美利坚合众国的四名大学生,与香港标准及检定中心(STC)合作开展关于手机应用程序的研究。本次调查的目的是了解香港人对手机应用程序,STC 和潜在的 STC 手机应用程序的想法。您的答案将保持匿名,仅用于生成统计数据图型。

1) How old are you? 您的年龄?

- <= 18 Years/岁 19-29 Years/岁 30-39 Years/岁 40-49 Years/岁
 50-59 Years/岁 60+ Years/岁

2) What is your gender? 您的性别?

- Female/女 Male/男 Other/其他: _____

3) What is your monthly income? 您的月收入是多少?

- \$0-\$19,999 \$20,000-\$29,999 \$30,000-\$49,999 \$50,000+

4) When purchasing any product, what information do you look for? Check all that apply:

购买任何产品时,您需要哪些信息? 请对所有适用的打勾:

- Description/ 介绍 Image/ 图片 Price/ 价格 Brand/ 品牌
 Product testing results/ 产品测试结果 Product Certification/ 产品认证
 How is it made/ 制作流程 Availability at retailers/ 在哪些零售商可购买 Reviews/ 评价
 Other/其他: _____

5) If you have a smartphone, what brand is it? Write your answer below.

如果你有智能手机,它的品牌是什么?在下面写下你的答案。

- Apple Samsung LG HTC Huawei OnePlus Google XiaoMi Nokia
 I do not have a smartphone/我没有智能手机
 Other/其他: _____

6) How many times do you use corporate mobile applications each week? (A corporate mobile application is a mobile application meant to allow its users to interact with a company or business.)

您每周使用企业手机应用程序的频率是多少?(企业手机应用程序是一种旨在允许其用户与企业进行交流的手机应用程序。)

0 1-2 3-5 5-10 10+

7 a) Are you aware of the services provided by the testing, inspection, and certification (TIC) industry?

您是否了解测试,检验和认证(TIC)行业提供的服务?

Yes/是 No/否

b) Have you ever checked if a product has been certified by a certification body?

您是否确认过一个产品有没有通过认证机构的认证?

Yes/是 No/否

8) Which products from the types listed below would you want to know are certified by a certification body? Check all that apply:

对于下列哪些类型的产品您想知道是否经过认证机构的认证?请对所有适用的打勾。

Food/食品 Pharmaceutical Products/医药产品 Textiles/纺织品

Footwear/鞋 Furniture/家具 Electrical Products/电子产品

Toys and Children Products/玩具及儿童用品 Medical Devices/医疗设备

Other/其他: _____

9 a) Are you aware of the services provided by the Hong Kong Standards and Testing Centre (STC) and/or the The Hong Kong Certification Centre (HKCC)?

您是否了解香港标准及检定中心(STC)和/或香港认证中心(HKCC)提供的服务?

Yes/是 No/否

b) Have you ever checked if a product has been certified by STC/HKCC?

您有没有确认过一个产品是否已经过 STC / HKCC 的认证?

Yes/有 No/没有

c) What is your opinion about a mobile application that would allow you to scan a QR code / product's barcode to check if it is certified by STC?

如果一个手机应用程序允许您扫描 QR 码/产品的条形码以确认它是否经过 STC 认证并咨询 STC 的工作人员,您对它感兴趣么?

Very Interested/很感兴趣 Interested/有兴趣 Somewhat Interested/有点兴趣

Not Interested/没兴趣

No Opinion/I don't know what STC does/没有意见/我不知道 STC 的业务

**d) What features, if any, do you think would be useful in an STC mobile application?
Check all that apply.**

您认为哪些功能在 STC 手机应用程序中 useful?请对所有适用的打勾。

Notifications for broadcasting company news/公司新闻的通知

QR code / Barcode scanning for determining if a product is certified with STC
码/条形码扫描,用于确认产品是否通过 STC 认证

Real-time chat for handling consumer enquiries/用于处理消费者查询的实时对话

Database of STC certified products / STC 认证产品数据库

Other suggestions/其他建议:_____

Thank you for completing this questionnaire!

感谢您填写此问卷!

Appendix D: STC Employee Interview Protocol

Introduction

- Introduce interviewers
 - *Hello, my name is interviewer name.*
- Thank interviewee for taking time for interview
 - *Thank you for taking the time to interview with us.*
- Ask interviewee about recording interview (given that we have asked beforehand)
 - *Before we begin, we asked you in an earlier email about recording the interview. Is it still okay for us to record it?*

Purpose

- *Our project is to develop a corporate mobile application for the Standards and Testing Centre, a product testing and certification company in Hong Kong, that hopes to expand its consumer and client base. As part of our project, we must conduct research on current market trends regarding mobile applications and compare competitor marketing techniques. The app's goal is to promote STC, handle order forms, and allow users to pay for various testing, inspection, and certification services.*

Transition

- Interest in interviewee work
 - We are interested in your work for STC, your insight into the testing, inspection, and certification (TIC) industry, and preferences for the mobile application.
- Interview expectation
 - We hope to learn more data on who STC wants to reach through a mobile application, STC's competitor's marketing techniques, and preferences for additional features that should be included in the STC mobile application.

Question #1

- Permissions to use in final paper
 - *May we quote you from this interview? We can provide you an interview transcript and a final version of the paper.*

Question #2

- Who does STC, as a company, want to reach through a mobile application? Does this audience differ within the different company divisions? If so, what are the differences?
- Does STC have any statistics or helpful data on this specific audience? If so, are you able to share them with us?

Question #3

- What are the different marketing techniques that STC's competitors use for company promotion, enquiries, and order application forms?
 - Do you have statistics on these techniques? If so, are you able to share them with us?
- What techniques both from STC and STC's competitors stand out to you and have been successful? Please provide as much detail as possible.

Question #4

- Based on your division and the company's interests, are there other features that we should be sure to include in the app?
- To produce an app, a company requires a development team, time, and resources. Does STC already have the necessary resources? If so, what are those, so that features may be planned within the given constraints and scope of the project?

Conclusion

- Thank interviewee for time and helpful information.

- *Thank you once again for your time and for giving us valuable information to assist us in our project.*
- *If we have follow up questions, would it be ok if we email you?*

Appendix E: STC Client Interview Protocol

Introduction

- Introduce interviewers
 - *Hello, my name is interviewer name.*
- Thank interviewee for taking time for interview
 - *Thank you for taking the time to interview with us.*
- Ask interviewee about recording interview (given that we have asked beforehand)
 - *Before we begin, we asked you in an earlier email about recording the interview. Is it still okay for us to record it?*

Purpose

- *Our project is to develop a corporate mobile application for the Standards and Testing Centre, a product testing and certification company in Hong Kong, that hopes to expand its consumer and client base. As part of our project, we must conduct research on current market trends regarding mobile applications and compare competitor marketing techniques. The app's goal is to promote STC, handle order forms, and allow users to pay for various testing, inspection, and certification services.*

Transition

- Interest in interviewee work
 - *We are interested in your business interactions with STC and if a mobile application could benefit both STC and your company.*
- Interview expectation
 - *We desire to know what your company does, how you work with STC, your opinion on that system, how likely your company is to use an STC mobile app, and how a mobile application could benefit both companies.*

Question #1

- Permissions to use in final paper

- *May we quote you from this interview? We can provide you an interview transcript and a final version of the paper.*

Question #2

- How does STC play a role in your supply chain?
 - Is the testing, inspection, or certification of your product required or extra? Why or why not?
- How does your company view STC?
 - Is STC considered to be helpful or unhelpful? Why or why not?
- How did your company come to use STC?

Question #3

- Does your company test, inspect, or certify your products with other testing, inspection, and certification companies? If so, do those companies perform certain marketing techniques that makes your company more inclined to work with them? If so, what are those techniques?
 - Perhaps the companies use mobile applications to reach their consumers or provide clients with helpful features? If so, what are these features?

Question #4

- How does your company arrange for testing, inspection, or certification done in the STC system?
 - Please give us some examples of the products you produce and walk us through the process.
- Many companies in the testing, inspection, and certification industry have mobile applications for their consumers and clientele. If STC were to make a mobile application for their customers and clientele, what features would your company *need* in the mobile application to be successful?

- How likely would your company be to use an online order form on a mobile application?
How likely would your company be to use an online database of STC's different international standards documents on a mobile application? Currently these features are on the STC website.
- What other features would your company *want* to use in an STC corporate mobile application? If so, please describe.
 - Perhaps a notification system to inform customers of new products from your company?

Conclusion

- Thank interviewee for time and helpful information.
 - *Thank you once again for your time and for giving us valuable information to assist us in our project.*
- *If we have follow up questions, would it be ok if we email you?*

Appendix F: STC Employee Interview Summaries

STC Chief Executive Professor Richard Fung

Our team conducted a brief interview with the Chief Executive of STC, Professor Richard Fung. Based on our interview questions, we were informed that STC is looking for a simple mobile application that aims to reach “low level consumers.” Professor Fung told us that an average income housewife was an example of a “low level consumer.” As a result, we interpreted a “low level consumer” to be a consumer with a middle to low income that buys products for themselves and for their families. Professor Fung also said that the application should be easy to use and accessible on small screens. In regards to the features, the QR code/barcode scanner should be the main feature of the application. When a product is scanned, key safety information such as which standards the product complies with or whether it has failed any tests should be displayed to the user. Professor Fung suggested that the information be displayed in a tier system. Tier 1 would include basic safety information and tier 2 would include basic product information. Additionally, images of the product should also be included. Examples of basic product information include nutritional facts for food products or recommended dosage intake for pharmaceutical products. In addition to the barcode scanner feature, the mobile application should include a feature that presents general product information and tips. A guide on how to use a rice cooker or an article regarding diseases related to different foods would be some examples that the feature would include. Professor Fung also discussed potentially incorporating a game or some form of entertainment into the mobile application. He believed a gamification feature would encourage consumers to continually use the application and increase STC recognizability. When asked about STC competitor marketing techniques, Professor Fung did not comment as he did not have specific information on the current market. Lastly, Professor Fung said that STC will be able to gather the necessary resources needed to further develop and maintain the application in the future, as it seemed to be a beneficial marketing strategy.

HKCC Sales & Marketing Executive Ethan Chan

The team interviewed HKCC Sales & Marketing Executive, Ethan Chan, who gave us a better understanding of STC's relationship with HKCC, as well as, additional information that was useful for the development of the mobile application. Chan explained to us that STC is a laboratory that tests consumer products and distributes test reports. HKCC is, then, able to certify those consumer products based on the test results gathered by STC. As a result, STC and HKCC's target audience is manufacturers whose consumer products are tested and certified before being released to the market. Although consumers are not perhaps the main audience of STC/HKCC, according to Chan, they should still care about a product's testing information when making purchase decisions. Chan said that the company logo, STC/HKCC marks, testing standards, and where the product is made are key testing and certification information that the consumer should know about a product. Additionally, since testing standards change all the time, the test date of the product should also be displayed to ensure the consumer that the product certification mark is not outdated. Basic nutritional information about food items, such as chemical information, sugar, calories, etc. may also be useful for the consumer. When asked about marketing techniques, Chan discussed how certifying products produced by international clients would result in successful company promotion. For example, SGS is a competitor company of STC who certifies McDonald's products. In return, McDonald's promotes SGS and has made it a well-known TIC company. Chan also mentioned that, as of right now, STC and HKCC promote their companies using social media platforms such as Facebook. Compared to other companies, however, STC and HKCC's social media platforms do not currently reach a large audience. Therefore, STC/HKCC would like to find a way to promote their social media and expand its audience reach. He believes that developing an STC mobile application would be beneficial and would also be able to provide clients with services that make certification applications feasible.

STC Technology Department Representative Alex Wong

Our team interviewed a representative from STC's technology department, Alex Wong, who informed us that there are limitations on accessing the company's database. He stated that, when a product is scanned, the mobile application should display key information such as the product's test report number, whether the product has passed or failed any tests, and the product's certification marks. Wong also mentioned that specific testing data cannot be displayed due to security reasons. Additionally, Wong explained that different departments within STC have their own marks. For example, the STC tested mark and the HKCC safety mark are from different departments. However, he mentioned that it would be possible for the IT department to export data from each department's database and combine it into one database. When asked if STC's IT department has the necessary resources to produce a mobile application, Wong stated that although STC does not have in-house staff to further develop the application, they do have the knowledge.

HKCC Certification Officer Amy Lee

We interviewed an HKCC Certification Officer, Amy Lee, whose position entails her to check conformity assessments for various products. According to Ms. Lee, HKCC and STC want the public to be able to recognize their marks and logos and see them as reliable testing and certification companies. She mentioned that commercial advertisements are one of the key marketing techniques used by competitor companies which help promote and make the company more recognizable. Additionally, certifying large, well-known companies helps with promotion as well. These companies are typically able to successfully promote a TIC company as they already have a large consumer audience. Lee stated that smartphones are very common in today's world and believes developing a mobile application would be a worthwhile investment for STC/HKCC; however, she believes that the mobile application would need to be promoted through various social media platforms to reach its target audience. Although Lee believes a real-time chat feature would be helpful, she stated that it may be difficult for STC to respond quickly to all consumer questions. As an alternative, she suggested that the mobile application contain a section where consumers can leave comments. This would allow STC representatives to then respond to these

comments via email. Additionally, Lee gave us suggestions on the type of information that should be displayed to a user when a product barcode is scanned. Since testing results may be hard to understand for the general audience, the application should present the user with a test report number. Therefore, if the user is interested, the mobile application can take them to another website to view the specific test reports of the product. Additionally, the mobile application should display the product's name, model, and model number. Lastly, the user should be able to easily view the conclusion of the product's test reports within the application. The conclusion should include the standards and requirements passed when the product was tested.

STC Marketing Communication Assistant Fox Tsui

Lastly, our team interviewed STC Marketing Communication Assistant, Fox Tsui, who informed us that the target audience of the STC mobile application is the public. Fox Tsui also discussed how the company wants to connect with customers by promoting their services and the importance of product safety. When asked about statistics on STC's audience, Tsui stated each department has its own database and that his department does not have access to the database of statistics. Our team also asked Tsui about any suggestions he may have on what features and information to include in the application. Tsui stated that the mobile application should include a description on testing services. Additionally, when a product is scanned, the application should display the product name, certification marks it has received and their descriptions, any tests the product has passed, and the date it was certified so consumers can make sure its not outdated. Tsui also informed us that each certification mark has different expiration dates and that certifications typically expire in approximately 2 years. When asked about marketing, Tsui mentioned that the TIC industry is small so most companies use the same techniques to promote themselves. As of right now, STC uses the STC Tested Mark and the HKCC mark to increase consumer awareness of the company and would like an STC mobile application to be developed to promote their company. He also mentioned that the department heads may have more information on specific marketing techniques used by other companies. Lastly, our team asked Tsui if STC has the necessary resources to develop and

maintain the mobile application. Tsui informed us that the STC IT department does not, currently, have the resources, but STC will be able to find another company to develop for them.

Appendix G: STC Client Interview Summaries

Wonderlife Universal Limited Marketing & Sales Director Jackie Jiang

We interviewed Wonderlife Universal Limited Marketing & Sales Director, Jackie Jiang. Wonderlife Universal Limited is a condom supply company. He mentioned that his company learned of STC from a newspaper advertisement and now uses STC services for testing and certification of its products.

Although the company's products do not require certification, it differentiates their product from competitors' products and also serves as a way of promotion. When asked about the application process for testing and certification services, Jiang said that STC sends Wonderlife an application form, the company fills it out, and sends it back to STC in the mail. Jiang believes that implementing an application form feature on the mobile application may be useful; however, he also believes that filling an application via mobile device may be difficult. Additionally, he thinks that including information on whether or not a scanned item is "counterfeit" or not, may be useful for the user. He also thinks that implementing a database feature in the mobile application would be beneficial. When asked about marketing techniques, Jiang stated that he was not aware of any specific competitor marketing techniques used. He also stated that Wonderlife currently uses Facebook and YouTube commercials as promotional methods for their company.

Wickfield Insurance Brokers Limited Representative Bill Chu

Our team interviewed Wickfield Insurance Brokers Limited representative, Bill Chu. He informed us that his company is not required to associate with STC but chooses to do so as STC has a good reputation in Hong Kong. Chu also mentioned that Wickfield often refers other companies to STC for TIC services. When asked about suggestions on features to include in the STC mobile application, Chu recommended a

feature that allows clients to submit electronic order handling forms. Additionally, he suggested a feature that allows users to talk to STC representatives. Lastly, Chu mentioned that the application should be user friendly, include icons to make the application clear to the user, and should have a way of being linked up with high tech products.

Appendix H: STC Mobile Application Assessment

STC移动应用评估

Thank you for participating in the STC Mobile Application Assessment. As you might know, STC has a current mobile application and would like to update it with useful features for a public consumer audience. Our team from Worcester Polytechnic Institute has performed social science research in Hong Kong for the development of the STC mobile application. Based on our research, we have made a graphical prototype of the application and would like your input on its various features.

感谢您参与STC移动应用评估。您可能知道，STC希望升级现有的移动应用程序，并增加对大众消费者更有用的功能。我们伍斯特理工学院的团队为此在香港开展了社会科学研究。根据我们的研究，我们制作了应用程序的图形原型，并希望您对其各种功能进行评价。

Please note that the graphical prototype is not a functional mobile application and is a progression of static photos. As a result, content that seems to extend off the screen indicates the implementation of a scrollable section.

请注意，图形原型不是具有完全功能的移动应用程序，而是静态照片的演示。那些从屏幕延伸出去的内容将以滑动屏幕来实现。

Scanner

扫描仪

How to Use:

Press the large circle button in the bottom center of the screen to enter the scanning screen. Once on the scanning screen, press the button again to scan a product barcode. Then, interact with the various buttons on the STC certified screen to learn more about the product. Return to the scanning screen by pressing the down arrow in the top left section of the screen. Press the clock button below the newspaper button to view the scanning history screen. Exit the screen and press the star button to view the scanner favorites screen.

如何使用：

按屏幕底部中央的大圆圈按钮进入扫描屏幕。进入扫描屏幕后，再次按下按钮扫描产品条形码。然后，使用STC认证屏幕上的各种按钮，以了解有关该产品的更多信息。按屏幕左上方的向下箭

头返回扫描屏幕。按报纸按钮下方的时钟按钮可查看扫描历史记录屏幕。退出屏幕并按星形按钮以查看扫描仪收藏夹屏幕。

Purpose:

After scanning an STC certified product barcode, users can receive relevant product information. If the scanner is given an STC test report QR code, users will receive information on an official test report to compare to the given test report for verification. If the scanner is given a product that is not certified, then the device will perform an internet search on the scanned barcode. Users can keep track of the products that they've scanned via the history button, and users can keep track of their favorite products by favoriting the products in the product information screen and then viewing them in the favorites screen.

目的：

扫描STC认证的产品条形码后，用户可以收到相关的产品信息。如果扫描仪获得STC测试报告QR码，用户将收到有关测试报告的信息，以与给定的测试报告进行比较和验证。如果扫描的产品未经认证，将对扫描的条形码执行互联网搜索。用户可以通过历史记录按钮跟踪他们扫描的产品，用户可以通过在产品信息屏幕中收藏产品然后在收藏夹屏幕中查看产品来跟踪他们喜欢的产品。

Please select a rating for the corresponding feature.

请为相应的功能选择评级。

1	2	3	4	5	6	7	8	9
Poor								Excellent!
差劲								优秀

What do you like about this feature? Please explain.

你对这个功能有什么看法？请解释。

What do you dislike about this feature? Please explain.

你对这个功能有什么不满意的？请解释。

Real-Time Chat

实时聊天

How to Use:

Press the chat button in the bottom right of the screen to enter the chat screen. Once on the chat screen, press the info button to learn about the different buttons.

如何使用：

按屏幕右下方的聊天按钮进入聊天屏幕。进入聊天屏幕后，按信息按钮以了解不同的按钮。

Purpose:

Users can talk to an STC representative about any questions, comments, or concerns that they may have.

目的：

用户可以与STC代表讨论他们可能遇到的任何问题，评论或疑虑。

Please select a rating for the corresponding feature.

请为相应的功能选择评级。

1	2	3	4	5	6	7	8	9
Poor								Excellent!
差劲								优秀

What do you like about this feature? Please explain.

你对这个功能有什么看法？请解释。

What do you dislike about this feature? Please explain.

你对这个功能有什么不满意的？请解释。

Certified Product Database

认证产品数据库

How to Use:

Press the database button in the bottom left of the screen. Then, press the food category button for the purpose of this demo. Lastly, press the product that comes up to see its product information.

如何使用：

按屏幕左下方的数据库按钮。然后，按下食物类别按钮以进行此演示。最后，按下出现的产品以查看其产品信息。

Purpose:

Users can search for STC certified products using the search bar or the category buttons and click on any products to learn more about them.

目的：

用户可以使用搜索栏或类别按钮搜索STC认证产品，然后点击任何产品以了解有关它们的更多信息。

Please select a rating for the corresponding feature.

请为相应的功能选择评级。

1	2	3	4	5	6	7	8	9
Poor								Excellent!
差劲								优秀

What do you like about this feature? Please explain.

你对这个功能有什么看法？请解释。

What do you dislike about this feature? Please explain.

你对这个功能有什么不满意的？请解释。

STC News

STC新闻

How to Use:

Press the scanner button in the bottom center of the screen to enter the scanning screen. Once in the scanning screen, press the top news article to view the article. Press the share button in the right top corner of the screen to see the available sharing options.

如何使用：

按屏幕底部中央的扫描仪按钮进入扫描屏幕。进入扫描屏幕后，按顶部新闻文章查看文章。按屏幕右上角的共享按钮以查看可用的共享选项。

Purpose:

Users can learn about STC and any updates that STC posts regarding products and the TIC industry.

目的：

用户可以了解STC以及STC发布的有关产品和TIC行业的任何更新。

Please select a rating for the corresponding feature.

请为相应的功能选择评级。

1	2	3	4	5	6	7	8	9
Poor								Excellent!
差劲								优秀

What do you like about this feature? Please explain.

你对这个功能有什么看法？请解释。

What do you dislike about this feature? Please explain.

你对这个功能有什么不满意的？请解释。

STC Information

STC信息

How to Use:

Press the large circle button in the bottom center of the screen to enter the scanning screen. Once on the scanning screen, press the button with the STC logo in the top left. Press any of the buttons in the information screen to read information about STC and its services, or press the marks button at the bottom of the screen to enter the marks screen. Press any of the buttons in the marks screen to read information about the certification marks offered by STC.

如何使用：

按屏幕底部中央的大圆圈按钮进入扫描屏幕。进入扫描屏幕后，按左上方带有STC徽标的按钮。按信息屏幕中的任何按钮可读取有关STC及其业务的信息，或按屏幕底部的标记按钮进入标记屏幕。按标记屏幕中的任何按钮可读取有关STC提供的认证标记的信息。

Purpose:

Users can learn more about the TIC industry, STC, HKCC, and the services they provide.

目的：

用户可以了解有关TIC行业，STC，HKCC及其提供的服务的更多信息。

Please select a rating for the corresponding feature.

请为相应的功能选择评级。

1	2	3	4	5	6	7	8	9
Poor								Excellent!
差劲								优秀

What do you like about this feature? Please explain.

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