

Research on Security Factors of Mobile Payment
——Taking Alipay, the leader of China's third party
payment, as an example

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PORTUGUESE CULTURAL STANDARDS FROM THE CHINESE PERSPECTIVE

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Abstract

Mobile payment is one of the most crucial links in E-commerce. As a representative of third-party payment, Alipay has become the field of payment unicorn enterprises. The purpose of this thesis is to study the security factors affecting mobile payment taking Alipay as the specific research object. Based on the literature review, exploratory factor analysis (EFA) and structural equation model (SEM) analysis were used to conduct empirical research. Data were obtained by random sampling through a questionnaire (N=364). Research shows that the "Knowledge" at the People aspect, the "System Function" and "Financial Security" at the organization aspect, and the "Transaction Platform" at the Technology aspect have a positive relationship with the safety of Alipay. Based on the above empirical analysis, this thesis puts forward some suggestions on how to improve the safety of Alipay.

Keywords: Mobile Payment, Alipay, Security Factors, EFA, SEM

JEL classification: C00-Mathematical and Quantitative Methods

M10-General Business Administration

Resumo

O pagamento móvel é um dos links mais importantes no comércio eletrônico. Como representante de pagamento de terceiros, Alipay tornou-se o campo de empresas de unicórnio de pagamento. O objetivo desta tese é estudar os fatores de segurança que afetam o pagamento móvel tomando Alipay como objeto de pesquisa específico. Com base na revisão da literatura, a análise fatorial exploratória (EFA) e modelo de equações estruturais (SEM) análise foram utilizados para realizar pesquisas empíricas. Os dados foram obtidos por amostragem aleatória através de um questionário (N = 364). A pesquisa mostra que o "Conhecimento" no aspecto Pessoas, a "Função do Sistema" e a "Segurança Financeira" no aspecto da organização, e a "Plataforma de Transação" no aspecto Tecnologia têm uma relação positiva com a segurança do Alipay. Com base na análise empírica acima, esta tese apresenta algumas sugestões sobre como melhorar a segurança do Alipay.

Palavras-chave: Pagamento Móvel, Alipay, Fatores de Segurança, EFA, SEM

Classificação JEL: C00-Métodos Matemáticos e Quantitativos

M10-Administração Geral de Empresa

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1.Introduction

1.1 Background and Purpose

With the rapid development of mobile communication technology from 1G to 5G and the high popularity of smart mobile terminals, modern society has rapidly entered the era of mobile Internet, in other words, From the PC (Personal Computer) Internet 1.0 era to the MI (Mobile Internet) Internet 2.0 era. By June 2018, China had 802 million Internet users, with Internet penetration reaching 57.7 percent, of which 788 million were mobile phone users, with 98.3percent of Internet users using mobile phones.**(CNNIC,2018)**

In mobile electronic commerce, the whole mobile transaction includes pushing goods, browsing goods, issuing orders, mobile payment,receiving goods and evaluating transactions. Among them, mobile payment **(TOMI D, JIE G, JAN O,2015)** is a kind of service that users use their mobile terminal to account for the goods or services they consume. It provides users with money transfer, payment, and other financial services. Its security involves the personal privacy security and the financial security of the user and is the key to the successful completion of the whole transaction link. Also, as a kind of multi-interface network device, the mobile terminal has many network portals, such as Wi-Fi, NFC,4G, which is different from wired devices. The network architecture, network security environment, and attacks must be more complex.**(JESUS T I, SHERALI Z,2014)**

Professor Tomi's literature review on mobile payment combines PEST analysis with Porter's five-force competition model, and constructs the theoretical framework of influencing factors of mobile payment service. **(Tomi.D,Niina.M,Jan.O, Agnieszka.Z.2007)**

Based on the theoretical analysis model of management information system (MIS) and under the macro environment where the Alipay user group is mature and stable in China, it is entirely appropriate to carry out quantitative empirical research on Alipay's security problems. This thesis will explore the security factors of Alipay in three aspects: People, Organization, and Technology. First of all, by summarizing the literature and the analysis of PEST model, the thesis constructs the model of Alipay security influencing factors, and then collects the data by questionnaire. The survey objects are mainly the young people who are the main group users of mobile payment in China, and finally, the data are processed and analyzed by SPSS and AMOS software. Thus, the model of Alipay security influencing factors is modified and confirmed, which is more suitable for the actual situation. This thesis might help Alipay to better improve the relevant security mechanisms, improve the satisfaction rate of users, and enhance the competitiveness of Alipay.

1.2 Theoretical Model

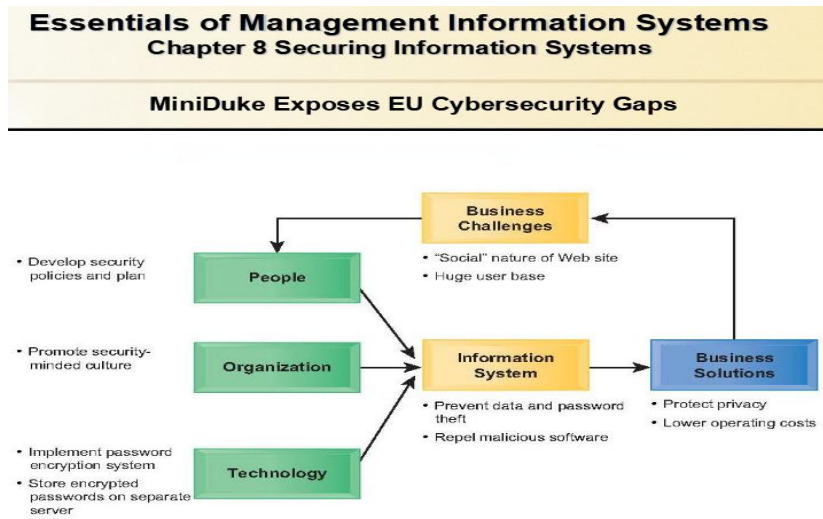
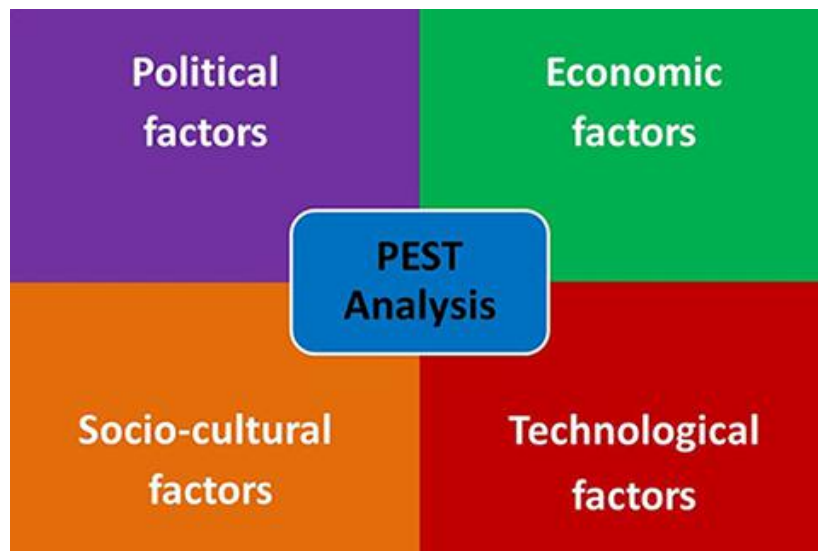


Figure 1: MIS Theory

Source: Essentials Of Mis Global Edition by Laudon Jane Laudon Kenneth C.

The framework used for the review of the literature and the constructs of Alipay security factors model apply one guiding theory which is the MIS model developed by Jane Laudon, Kenneth C. Laudon. Using information systems effectively requires an understanding of the organization, people, and information technology shaping the systems. An information system provides a solution to important business problems or challenges facing the firm. **(Jane Laudon, Kenneth C. Laudon.2016)**

Organizations mean coordinate work through the structured hierarchy and business processes. The Business processes refer the related tasks and behaviours for accomplishing work for examples fulfilling an order, hiring an employee. Maybe sometimes also include informal or formal rules like culture embedded in information systems. People means Information systems require skilled people to build, maintain, and use them. Employee and client attitudes affect the ability to use systems productively. Technology means IT Infrastructure including foundation or platform that information systems built on computer hardware and computer software, Data management technology, networking and telecommunications technology and Internet and Web, extranets, intranets.



[Figure 2: PEST Theory](#)

PEST analysis (political, economic, socio-cultural and technological) describes a framework of macro-environmental factors used in the environmental scanning component of strategic management. It is part of an external analysis when conducting a strategic analysis or doing market research, and gives an overview of the different macro-environmental factors to be taken into consideration. It is a strategic tool for understanding market growth or decline, business position, potential and direction for operations. **(Richardson, J.2017)**

2. Literature Review

The literature review is a general understanding of history and cutting-edge science and technology in a given field, through critical research on relevant studies by other scholars, and a comparison of different aspects, countries, situations, etc. Thus, the thesis abstracts a comprehensive comment on the subject. The literature sources include 40 journal and thesiss, 6 research reports, 11 news reports, and 12 related websites. The literature review of this thesis mainly includes the following three aspects: the concept and technology of mobile payment, the development and trends of the global market of mobile payment, the introduction of Alipay and security issue.

2.1 Mobile Payment

2.1.1 Concept and Definition

Microscopically, mobile payments refer to the way users pay for goods and services that mobile terminals consume over the years, such as mobile phones and tablets. From the macro point of view, mobile payment generally refers to the way of providing users with money payment, payment, and other financial services through the integration of mobile terminals, Internet, service providers, and financial institutions.**(ZHANG.Y.C,YANG.J.Z,WANG.L,2015)**Current mobile payment systems are mainly divided into two types: remote payment and near-field payment.**(JESUS.T.I,SHERALI.Z,2014)**

Remote payment refers to the payment method using medium and long-distance wireless communication technology, such as 4G, Wi-Fi.Near-field payment **(ZHANG.Y.Q,WANG.Z.Q,LIU.Q.X.etc.2016)** refers to the payment by mobile phone card-swiping and adopts the current mainstream wireless near-field communication technology, such as Bluetooth, RFID, NFC and so on. With the development of facial recognition technology, the payment of human body recognition is developing rapidly.

NFC close-range wireless communication is the mainstream technology of near-field payment. It is a short-range high-frequency wireless communication technology, which allows non-contact point-to-point data transmission and exchange between electronic devices. The technology is evolved from RFID and compatible with RFID technology. Through NFC, mobile phone, computer, camera, Pad, and other devices, a wireless connection can be made quickly, thus realizing the data exchange service. NFC payment means that the consumer is buying goods or services. NFC technology is used to complete payment through handheld devices such as mobile phone, without the need for the mobile network, and offline. **(Garry Wei-Han Tan, etc 2014)**

For the average consumer, the most sensitive mobile payment may be the remote end. The use of payment software in mobile phones is becoming more and more common. Unlike NFC technology, software payment is mostly done through third-party payment service providers. Commercial banks, bank card organizations, and telecommunications operators are also vigorously developing remote payment. In addition to making mobile phones turn into bank cards, the use of bank client software can also meet people's various needs, such as account management and independent transfer of funds. Credit card management, self-payment, etc. But relatively speaking, in the field of remote payment, a third party represented by PayPal, a mobile phone Alipay, Platforms occupy a larger share.

2.1.2 Safety of Each Layer

1.Non-contact layer security

In the non-contact layer, the most widely used is the NFC interface, and the research on near-field payment at home and abroad is mostly focused on NFC.

(VEDAT.C.BUSRA.O,KEREM.O,2013) Non-contact layer security threats mainly include terminal security and communication security. The threat of terminal security

is mainly in the reader mode where attackers copy, tamper and destroy the data stored in NFC mobile phone tags through various illegal ways. Also, cell phone lost SIM card clone, chip implantation virus is also the focus of terminal security research. The threat to communication security is mainly due to the adoption of wireless communication technology in NFC, and various typical wireless communication attacks exist in NFC, such as passive listening. Denial-of-service attacks (jamming attacks), man-in-the-middle attacks, replay attacks, message insertion tampering, etc. The existing solutions include the establishment of secure encrypted channels, such as the use of the Diffie-Hellmann key exchange protocol.

2.Control layer security

The security of the control layer mainly involves the hardware of the control layer and the security of the operating system. The former mainly focuses on the security algorithm module, which provides various encryption algorithms and digital certificates for mobile phones, data isolation protection and API. for secure transactions. The attacker's attack behavior may result in the module losing availability, certificate or key loss, privacy data disclosure and so on. The existing solutions mainly include: using cryptography to protect the data stored and transmitted in the module, developing a special NFC security algorithm module chip and establishing encrypted security channels, such as the use of Diffie-Hellmann key exchange Agreement. The latter is the kernel, architecture and privilege management of the operating system platform, such as Android security (JONATHAN Z.2014)and so on.

3.Network layer security

In the mobile payment system, remote payment needs to access the Internet through a network layer to complete a payment transaction. In near field payment, the network layer is also required to complete other related transactions in addition to NFC. In

mobile payment systems, the typical network layer communication technologies include Wi-Fi-GSM 4G and so on.

The security of the Wi-Fi system is mainly threatened by wireless interference, key breaking, and AP forgery. The related research includes attack methods, network protocol analysis, and formal verification, security enhancement and so on.(LIU.Y.L. 2014)

GSM protects the security of user data and signalling data through authentication and encryption, and prevents unauthorized users from accessing network resources. The main weaknesses and attacks include authentication unidirectional man-in-the-middle attack, encryption algorithm vulnerability, SIM card cloning, etc. Replay attacks, wireless interference attacks, transmission channel threats and so on.

The security architecture of 4G communication technology is based on the security characteristics of GSM, and a perfect security guarantee system is formed according to the new service characteristics. However, in practical applications, 4G authentication still needs to be improved in key agreement and data encryption algorithm. (ELBOUABIDI I,ZARAI F,OBIDAT M S,et al.2014)The existing research mainly includes the formal analysis of network protocol in the security system of 4G, the security fusion with the WLAN network, the design and improvement of security protocol and so on.

4.Application layer security

The various APP running on the phone to complete payment transactions constitute the application layer. At present, there is the development interface of mobile phone payment system based on J2ME, and the corresponding malware appears, which is aggravated by mobile phone virus, phishing attack and so on. Related research

includes mobile phone malware detection, secure programming interface, unified security payment software standards, mobile phone privacy protection and so on.(XU.Y.P,MA.Z.H,WANG.Z.H.2016)

2.1.3 Mobile Payment Protocol

The early mobile payment protocols focused on the efficient implementation of the algorithm and ignored the security, such as the non-repudiation and fairness of the Payword protocol. The subsequent improvement uses the single Hash chain to correct some security problems but still can not meet the fairness. The double/multiple Hash chain is used to realize fairness but the terminal computation is too large. In order to further reduce the terminal operation, a scheme based on ECC is proposed. For a mobile environment with limited communication conditions, the off-line third-party mechanism is used.

Wang Hongxin (WANG.H.X,YANG.D.L,JIANG.N,2013)and others put forward a new payment model and system architecture and presented a new model based on pre-trust and public service. Service domain mobile payment protocol family. Blind signature, identity-based cryptography, and other security techniques are introduced to ensure the security characteristics of mobile payment.(ERIC.K.,CAO.Z.J,WU.T.Y,etal.2015)

2.1.5 Summary

At present, the research on the security of mobile payment still needs to be improved. The ideal secure mobile payment system should form the whole network defense means and the security mechanism.(LIU Yonglei, JIN Zhigang, GAO Tianying. 2017)

From the perspective of this thesis , in non-contact layer, hardware security of non-contact layer interface should be considered and security mechanism such as mobile TPM should be introduced. The control layer should ensure the security of mobile operating systems such as Android, iOS. The network layer should guarantee the security of the user to access the Internet using various network interfaces, and the application layer should use the lightweight secure network payment protocol. Cross-layer security mechanisms such as access layer and non-contact layer should also be added. Safety assessment methods should combine qualitative and quantitative methods and avoid using only expert experience. Finally, the overall security system should be able to evaluate security based on the results of the assessment Self-adaptive enhancement of the property.

2.2 M-Payment Global Market

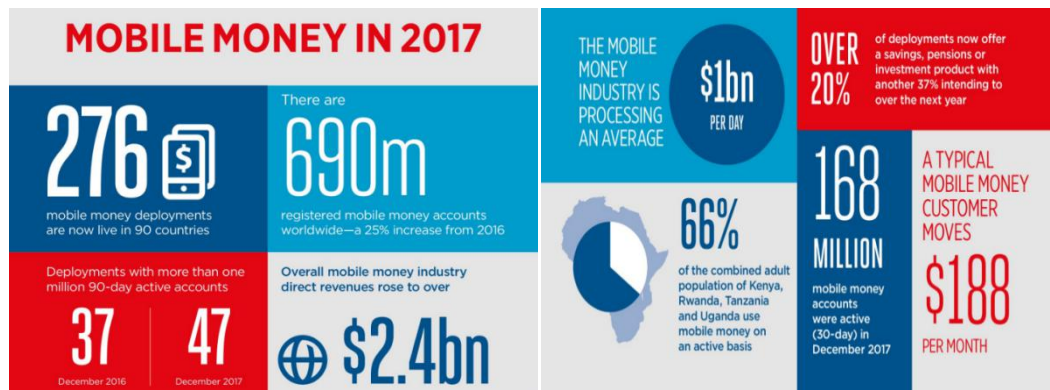


Figure 3: Mobile Money in 2017

Source: 2017 State of the Industry Report On Mobile Money

2.2.1 Global M-Payment

Mobile payments accounted for 23.3 of the global online payment market as of the third quarter of 2014, with IOS accounting for 38 percent of mobile market share in the third quarter of 2014, according to the Netherlands Adyen (2014)report.

Europe

Mobile Europe is well ahead of the rest of the world, accounting for 24 percent of the global online payments market in the third quarter of 2014, up 34 percent from a year earlier. From the point of the business model, the European mobile payment mainly adopts the multi-country operator joint operation mode, the bank only acts as the cooperator, does not participate in the operation activity. In terms of technology, European operators and banks are more inclined to use SIM cards as a tool for near-field payments in order to better coordinate the interests of all parties.

T-Mobile UK and French operator Orange have formed a joint venture, EverythingEverywhere, to introduce and launch contactless mobile payment services for the first time in the UK, in partnership with Barclays Bank Card. The report shows

that most British consumers are willing to use mobile wallets, with 58 percent of British consumers surveyed using mobile wallets.

In Europe, Germany has one of the highest mobile payment levels. In August 2012, Deutsche Telekom announced a partnership with Wirecard, an electronic payment service provider, that laid the technological foundation for mobile payment. As in China, mobile operators are prominent in the field of small payments. German Railways United operators to use NFC technology to withdraw from mobile phone ticket service. Germany's largest bank, the will Bank, has pulled out of mobile payment services for all types of smart terminals.

Italian mobile companies such as TIM, Vodafone Windsor Mobile, and Fastweb will provide digital content providers and consumers with a shared standard mobile payment platform that uses the phone number as a customer authentication key. The mobile phone as online digital content and service payment terminal.

Asia

South Korea's mobile payment market is relatively mature. **(Miao.M,Krishna.J.2016)** In 2013, smartphone users accounted for as much as 90 percent, and 70 percent of electronic payment transactions were done by mobile phones. South Korea's mobile payment service mainly uses infrared technology to achieve. LGT, SKT, KTF, South Korea's three major operators, also rely on the pain of infrared technology's mobile payment business, and all three major carriers offer mobile phones with credit cards and prepaid smart cards based on FeliCa standards. At present, South Korea's mainstream financial terminals can identify mobile credit cards.**(Jinan Branch of the People's Bank of China.2013)**

Africa

According to statistics, Africa has nearly 500 million users in 2014, which Africa's mobile phone penetration rate reached 56.

Kenya mobile payment service mainly for the dominant mode of communication operators. Kenyan communications operator Safaricom launched a virtual e-currency, M-PESA, in March 2007 to send SMS messages to recipients to withdraw money from M-PESA service outlets. In the course of the business, neither the payer nor the payer is required to do so. **(Jinan Branch of the People's Bank of China.2013)**

To have a bank account, financial institutions are not involved in the entire payment and settlement process. M-PESA has realized the financial functions of transfer, payment, savings, lending, consumption, etc., which has become a useful complement to Kenya's weak banking sector. It also sets an example of the economic and financial backward areas to improve the availability of basic financial services by means of mobile payment services. With the M-PESA business model, Kenya has the highest mobile payment penetration rate in the world.

America

The mobile payment business in the United States has developed earlier and its commercial operation is more mature, mainly including two modes dominated by bank card organizations and by third-party payment service organizations. PayPal e-mail payment, Google digital wallet, and Square card cashier products are representative mobile payment products. **(Jinan Branch of the People's Bank of China.2013)**

PayPal email payment means that the payer logs on to the PayPal payment page through the mobile Internet, initiates the payment order by sending the email, realize

the receipt, and the payer transfers funds between the PayPal payment accounts. Google Digital Wallet is where payers close the NFC smartphone to Google's dedicated digital wallet processing terminal, and the phone automatically sends payment messages to an account bound to Google's digital wallet to complete the withholding. Google's digital wallet stores all payers' trading records, discount offers and shopping points, and synchronizes them to the cloud to facilitate consumers.

Square, founded in 2009 by Jim McKinley and the co-founder of Jack Dorsey (Twitter, focuses on small merchants' payment and settlement programs. Square card box products open Square card apps on their phones. After purchasing the goods in the store that supports the package register application, provide the recipient with the name and click the payment button to complete the payment.

2.2.2 China's M-Payment

With the development of new economy, especially in the field of electronic commerce, and the policy and technical standard from chaos to unification, the development of mobile payment in China has experienced three distinct historical stages with distinct characteristics.

From 1999 to 2010 Difficult Start

The integration of mobile payment industry chain is not enough. On the one hand, the operators and the banking industry compete for the dominant rights, which is mainly reflected in the mobile phone card of the operator or the account number of the bank. Previously, China UnionPay's main push of the 13.56MHz standard and China Mobile push the 2.4GHz standard is the two major domestic payment standards.

On the other hand, the domestic mobile internet coverage base is weak, which is manifested in the insufficient number of mobile internet users, the low penetration rate of smartphones and the unstable speed of network access of operators. Before 2010, less than 200 million mobile internet users and mobile electricity Less than 100 million domestic smartphones shipped 62 million units, penetration is only 7. At the same time, mobile communication technology has not entered the 3G era, so network speed has become an important factor restricting mobile payment.

From 2011 to 2014 Standard unification

China's Mobile Technology Adoption

Time	Standard	Foreign/ Local	Equipment
Before 1994	Analogue	Foreign	Buy foreign
1994-2002	CM-GSM	Foreign	Buy foreign
	Unicom-GSM, CDMA	Foreign	Buy foreign
2002-2008	CM-GSM	Foreign	Buy local, reduce foreign
	Unicom-GSM, CDMA	Foreign	Buy local, reduce foreign
2008-2014	CM-TD-SCDMA	Local	Buy local
	Unicom-WCDMA	Foreign	Buy mostly local
	CT-CDMA2000	Foreign	Buy mostly local
2014-now	CM-TD-LTE 4G	Local	Buy local
	Unicom-FD-LTE 4G	Foreign	Buy mostly local
	CT-FD-LTE-4G	Foreign	Buy mostly local
2019 & Beyond	5G	Global	Buy mostly local

[Figure 4: China's Mobile Technology Adoption](#)

Source: South China Morning Post Sep.26.2018

The popularity of smartphones and China's beginning to enter a comprehensive 4G network era also provides the development of hardware conditions.

On June 21, 2012, China Mobile and China UnionPay signed the Mobile payment Service Cooperation Agreement, which indicates that China Mobile payment standard is basically defined as 13.56MHz standard, which realizes the unification of payment standard and removes the technical differences that hinder the development of mobile payment. In 2014, the Chinese mobile payment market showed an explosive growth trend, known as the first year of mobile payment. As of June 2014, the number of users using online payments in China had increased rapidly to 292 million mobile phone payments, with the number of users reaching 205 million, and the proportion of mobile payments paid by Internet users rose from 25.1 percent to 38.9 percent, the report said.

With the adoption of UnionPay's NFC uniform standard by the three major operators in China, the operators are no longer involved in the dispute with the standard in the

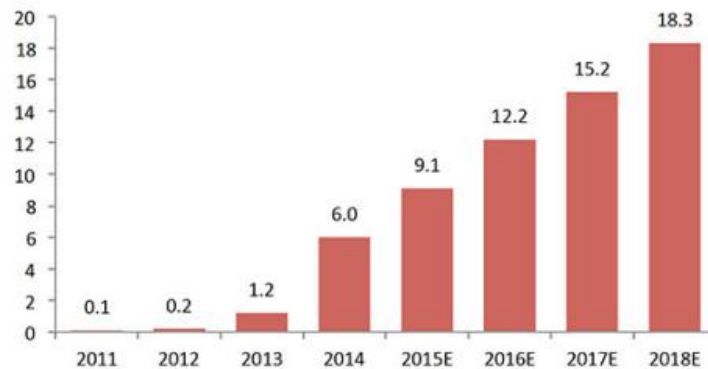
mobile payment market and have entered the stage of substantive application. At the same time, China Mobile payment two camps began to emerge: first, banks, telecommunications operators, the central bank and UnionPay promoted the NFC near field payment mode; second, the Chinese Internet giant promoted the QR code identification and remote payment architecture.

From 2015 until now Booming Development

The report showed that the mobile portal continued to make efforts in 2014, with "hand Amoy" growing rapidly, with mobile third-party payment transactions exceeding 7 trillion yuan, and mobile payments rising fivefold from the previous month. In 2014, China's third-party payment companies received 8.8161 trillion yuan of orders on the Internet, the report said. The month-on-month growth was about 47.8 percent. With the increasingly obvious substitution of the mobile end to PC, mobile payment has become an important direction in the development of Internet payment. At the same time, e-commerce from B2B B2C to O2O development, more spawned Alipay, Tencentpay and others payment giants scramble for mobile payment market.

Five years after the large-scale promotion of mobile payment in China, it has successfully achieved 90% penetration among 1 billion mobile Internet users. This is about the same product with the highest penetration rate since broadband and mobile phones in China, and even, Mobile payment is regarded as one of the four great inventions of China in the new era. China Mobile has about 890 million subscribers. Among them, Tenpay user 820 million, Alipay user 650 million, Tenpay and Alipay user penetration is 85.4% and 68.7% respectively.

The third-party mobile payment Transaction Value in China 2011-2018
(RMB Ttrillion)



[Figure 5: The third-party mobile payment Transaction Value in China](#)

Source: iResearch Fung Global Retail&Technology

2.2.3 Summary

Political aspects

At present, there are some laws and regulations in China, such as "Management measures for payment Services of Non-Financial institutions", "Electronic payment guidelines (No.1)", "Electronic signature Law", "Electronic Banking Management measures", etc., but the provisions are too general, with few manipulative norms and weak pertinence. Therefore, the guidance in practice is very weak. In the aspect of supervision, the main body is absent and there is long supervision. Mobile payment as a new form of business, the regulation of relevant departments is also in the groping stage, there is no way to start, resulting in a lack of regulation. At present, the departments that supervise mobile payments include the People's Bank of China, the Ministry of Industry and Information Technology, the General Administration of Industry and Commerce, and so on. Their respective responsibilities are not clear enough. The phenomenon of cross-regulation and lack of supervision is serious.

The formal implementation of the Internet Security Law of the People's Republic of China in 2017, as well as the related laws and regulations, have provided a practical

legal guarantee for the network security work that has been carried out since then. Government and enterprises work together to crack down on all kinds of network security problems, and the proportion of Internet users who encounter network security problems has dropped significantly. As many as 47.4 percents of netizens said they had not encountered any cybersecurity problems in the past six months, up 17.9 percentage points from 2016, according to the data.

Economic aspects

1. Marketing model fusion

Product marketing and purchase payment are two distinct links in commercial activities. Payment is payment, which is the process of receiving orders. Marketing is a series of commercial activities promoted by manufacturers or dealers to promote product sales. However, in the era of mobile Internet, "one of the major trends in the development of wireless payment is the convergence with marketing," Liu Jun, technical director of Alipay Wireless Division, told the Mobile Internet developer Forum at the China computer Conference.

2. NFC cell phone penetration rate

The mobile terminal is the most important factor that affects the development of mobile payment. At present, NFC technology has been relatively mature, but from the current domestic situation, the terminals supporting NFC are far from popularizing. HTC, ZTE, Huawei and other terminal manufacturers have launched NFC mobile phones, but still stay at the stage of promotion, the popularization rate and application rate are very low.

Social aspects

There are two main lines in the mobile payment industry chain: basic equipment manufacturing and operating service platform. Equipment manufacturers are mainly mobile phone smart cards (RF-SIM cards) and point of sale terminal (RF-POS) manufacturers. The operating service platform is China UnionPay, telecom operators, and third-party payment providers.

The leading enterprises do not use the industry chain to represent different interest groups, and different technologies have different advantages and limitations. Only by means of cooperation can resources be shared and their advantages complement each other. The key to the development of the mobile payment industry is to seek a mature business model and establish a win-win industrial chain.

From the current point of view, the security risks of mobile payment are manifested in the following aspects: first, mobile payment by mobile phone, there is a higher risk of system vulnerability and Trojan Horse implantation risk; second, SMS verification means are single, Lack of dynamic risk management system; third, the lack of mobile phone payment security overall solution.

Technical aspects

1. Remote and near-field fusion

There are two modes of mobile payment. One is remote payment. Depending on the network and completing the whole payment process on the network Alipay and mobile bank are typical remote payment. Near-field payment mainly refers to the close communication technology between mobile phone and terminal equipment such as POS machine via RF infrared Bluetooth and other channels.

Although the market share of online payment for mobile phones with BAT's three Internet giants as the background far exceeds the lower end of the line, in the long run, The only way out is a combination of upward and offline competitive cooperation at both ends of mobile payments. On June 21, 2014, Zhai Yi, deputy manager of electronic banking at the Agricultural Bank of China, said in a keynote speech. With the development of mobile internet technology, mobile payment will realize remote near-field integrated application.

2.Security fusion

At present, the flood of spam messages, personal information leakage, communication charges into the trap and other problems frequently appear. There are a variety of mobile phone security products in the market, divided into hardware and software camp, the combination of the two also show a clear trend. Hanyin Technology Mobile phone platform and China UnionPay jointly launched the "magic shield" is a dual encryption way to protect the phone. In the course of the transaction, the "magic shield" not only needs the keyboard input password but also assumes the dynamic password for the iPhone version, which minimizes the risk of losing the mobile phone.

3.NFC route and standard

At present, the most popular near field payment and the most mature payment medium is that NFC.NFC is a short-range and high-frequency radio technology. The core component that allows contactless point-to-point data transfer and exchange between electronic devices is the SE security component, which stores all the payment data. Who controls the SE means having access to the paid content and the corresponding funds. NFC is the most valuable resource.

The NFC solution of our country mainly revolves around the control right of SE. It has gone through the stage of leading many different organizations, from the current situation, The SIM all-card scheme led by mobile operators alone and the UnionPay led SWP-SD scheme have basically failed; the SWP-SIM scheme jointly led by UnionPay operators has become the mainstream. However, due to the agreement signed by UnionPay and China Mobile in 2013 that the hardware application belongs to the operator and the software and data application to the UnionPay, the SWP-SIM scheme has lost strategic significance to the operator and no longer has the promotion. power Handset makers are also seeing the appeal of the mobile payment market, with the NFC as a standard for smartphones and the all-terminal (ESE) as a new trend, including Apple's latest iPhone6, with Apple Pay features.

2.3 Alipay

2.3.1 What is Alipay



Figure 6:Alibaba&Ant Financial&Alipay

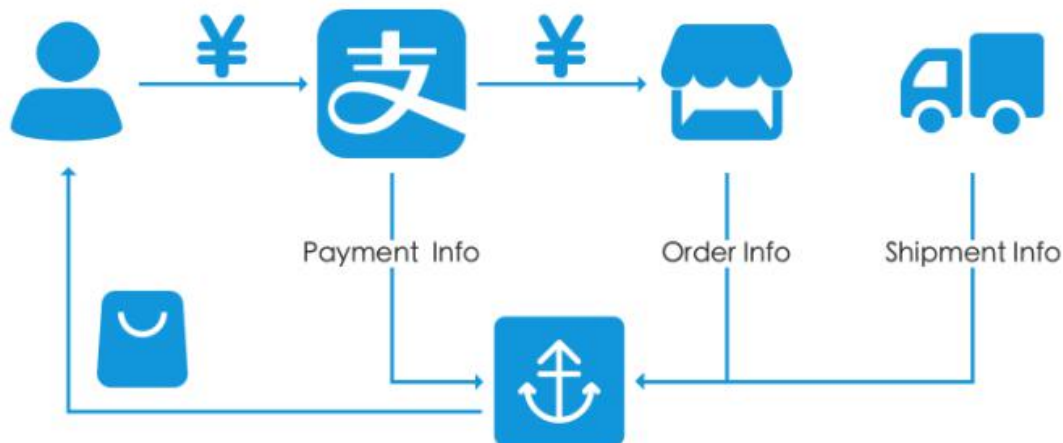
Ant Financial Services Group formerly known as Alipay, is an affiliate company of the Chinese Alibaba Group. Ant Financial is the highest valued fintech company in the world, and the world's most valuable unicorn (start-up) company, with a valuation of US\$150 billion. **(Wang, Yue. 2018)**

Ant Financial Services Group started Alipay, founded in 2004. In October 2014, Ant Financial Services Group was formally established. Alipay is a third-party mobile and online payment platform, established in Hangzhou, China in February 2004 by Alibaba Group and its founder Jack Ma. Alipay overtook PayPal as the world's largest mobile payment platform in 2013. **(John Heggestuen.2014)** In the fourth quarter of 2016, Alipay had a 54% share of China's US\$5.5 trillion mobile payment market, by far the largest in the world, although its share fell from 71% in 2015 as its rival Tencent's WeChat Pay was rapidly catching up. **(Financial Times. 1 May 2017.)**

2.3.2 Business Function

Alipay was founded in December 2004, dedicated to providing users with "simple, safe, fast" payment solutions, under the "Alipay" and "Alipay Wallet" two independent brands. Ant Financial Services Group's Alipay, is everyone-centered, with more than 450 million real-name users of the life service platform. At present,

Alipay has developed into an open platform that integrates payment, life service, government service, social, financial management, insurance, public welfare and etc.



[Figure 7:Alipay basic process](#)

1.Basic functions: quick payment, transfer, collection, etc.

Quick payment refers to the direct cooperation between payment institutions and banks to form an efficient, secure and dedicated payment method. Before this, most of the network payment was completed by the network bank. However, due to the low success rate and low security, a large number of urban banks in more than 1000 cities and towns in China did not provide network banking services except the big banks.

2.Life service function: city service, health care, shopping, and entertainment, etc.

On behalf of Alipay, Liu Xiaojie, deputy general manager of Ant Financial Services Group Public Service Division of Internet Finance Enterprise, released < 2015 "Internet" Urban Services report, summarizing the mobile Internet services in government affairs, transportation travel, and living expenses. The convenience and change brought to people's lives by medical treatment and other aspects. < 2015 "Internet" Urban Services report (hereinafter referred to as "the report") shows that, by the end of 2015, there were 19 provinces and 124 cities in Alipay City Service

platform. Nine major types of services, including vehicle owner services, government affairs, medical care, transportation, recharge, etc., involving 4 More than 4000 services in different categories, providing a simple and convenient service experience for more than 100 million users.

3.Wealth Management function: Yu'e Bao, Hua Bei, Sesame Credit, etc.

Yu'e Bao, a fund management service launched by Alipay, means buying a money fund and allowing users to spend their money on consumer spending at any time. Yu'e Bao money Fund sales services by the Internet Bank and the day Hong Fund to provide support. Yu'e Bao brand belongs to Ant Financial Services Group.

4.Public Charitable function: education, Sports, Green, and low carbon, etc.

Data show that Alipay users through Ant Financial Services Group public welfare platform online donation of 360 million, the cumulative amount of more than 1 billion yuan. In the last year of 2017, nearly 50 million people donated 4 trillion steps to the moon, equivalent to 3256 trips to the moon. At the same time, through public transport travel, online payment, and other real-life low-carbon behavior, 280 million ant forest users have reduced their emissions by 2.05 million tons, planted 13.14 million real trees, and guarded 12111 acres of protected land.

Alipay, which has 450 million real-name users under Ant Financial Services Group's umbrella, announced the launch of the organ donation registration function. Users who meet the requirements can register in one click, and the whole process does not exceed 10 seconds. Ant Financial Services Group became the third member of a billion-class club to register organ donation in the world.

2.3.3 Development Status

Market Status

On April 1, Analysis, an independent third-party organization, released the Quarterly Monitoring report on the third Party payment Mobile payment Market in China in the fourth quarter of 2017, according to the report. China's third-party payment mobile payment market traded about 37.8 trillion yuan, an increase of 27.91 yuan compared with the same period a year earlier, and an increase of 195 yuan over the same period last year. The mobile payment market has changed its share in a stable position, with data showing that Q4 Alipay and Tencent Financial (Tenpay) have seen their market share rise and fall in 2017, with Alipay accounting for a share of 53.7 from the third quarter. 3 percent rose 0.53 percent to 54.26 percent in the fourth quarter, while Tencent Financial, behind WeChat Pay, fell 1.2 percent to 38.15 percent from 39.35 percent in the previous quarter.

According to the data, Alipay has climbed out of its share trough of about 50 percent in the third quarter of 2016, not only stabilizing the leading position in the third-party payment industry, but also widening the gap between Alipay and the industry's second place. At present, the mobile payment has entered the second half, the flow dividend has reached the peak, the future competition is "ecological" effect, that is, "the superimposed value of payment", including credit, financial management, insurance, credit, marketing, and other services.

Profit Status

Alipay profit has four main ways, one is capital interest, that is, customer fund delivery process stay in Alipay period born interest. When Taobao registered users purchase online, after the buyer and seller have reached a transaction, due to the time of delivery, the payment needs to stay in Alipay third party account for interest.

The second is service commission, That is, the service fee paid to Alipay by enterprises and merchants in the form of Alipay.

The third is advertising expenses, that is, the advertising space provided by Alipay on its homepage, and the expense income incurred by merchants and customers as a result of advertising.

Fourth, other value-added financial services, that is, using Alipay to provide customers with air tickets on their behalf, To send gifts and other financial services income. (ZHANG.D.S,XIE.Q.K.2016)

Security Status

On September 25, 2018, Ant Financial Services Group's chairman and CEO Jing Xiandong announced the upgrading of the Alipay without Thieves program, in addition to extending the promise of "all stolen compensation" made 13 years ago. Two new elements will be added: mine action aimed at consumer financial safety education and action to assist regulators and police in fighting Internet crime. Try to ensure the safety of financial consumers from three aspects of user education, industry governance, and protection.

Jing Xiandong said that the reason why the stolen full indemnity promise could be held for 13 years was the support of Alipay's own intelligent wind control system. The system has been optimized and upgraded since 2005, and it is now the fifth generation (AlphaRisk), which can carry out various complicated tasks such as risk warning, detection, an interception and so on in 0.1 seconds, so as to realize "unmanned driving" in the field of mind control. Currently, Alipay's trading loss rate is less than 5/10000000, well below the 2/1000 of the world's leading payment agencies.

In addition, Alipay also launched an account security insurance one million indemnity guarantee service, stolen full indemnity commitment to form a double insurance cover mechanism, the account security insurance has covered more than 400 million users.

According to statistics, 2017 Alipay do all kinds of online safety education courses have covered 100 million people. Jing Xiandong welcomes all industry experts to Alipay to participate in the process of financial consumer protection. Recently, Alipay also launched a number of telecom fraud victims of "delay transfer" services, and one-click identification of fraud phone, the URL of "anti-fraud" Mini Programs.

2.3.4 Competitors in China



[Figure 8:Alipay Competitors in China](#)

Alipay model (mainstream of remote payment in China)

The third-party payment agency formulates the pricing rules for the transaction commission and obtains the full commission at the same time. Tencentpay and Alipay had user penetration rates of 85.4 percent and 68.7 percent, up 0.6 and 0.4 percentage points from the November 2017 survey, respectively. As we all know, Alipay and Tenpay have occupied 92% of mobile payment market share and have formed duopoly pattern.

The main competitors faced by Alipay fall into the following three categories:

1. Telecom Operators' Organizations

Recharge link: the payment commission provided by the mobile communications operator is a communications service company that provides telephone and Internet access, including fixed and mobile phones. In China, there were originally six major operators, but later the major operators merged one after another, finally forming the current three major telecommunications operators, namely, China Mobile, China Unicom, China Telecom.

Fund account: the mobile phone fee account and mobile phone account binding.

Related products: digital products, such as cell phone ringtone, network pictures, network literature, and other products operator as the merchant is the main source of income. The card issuer, the liquidation institution and the order receiving agency shall divide the goods according to the regulations.

Transaction link: all commodities are settled in a telephone account

Disadvantages: only small transactions; narrow range of products; operators charge high commission contrary to the free spirit of the Internet

2. Commercial Banks Organizations

Commercial banks refer to financial institutions with the function of credit creation, aiming at the profit, raising funds from various financial liabilities and operating various financial assets. Chinese commercial banks mainly include state commercial banks and joint-stock commercial banks.

UnionPay is a joint bank card organization approved by the People's Bank of China and approved by the State Council. It was established in March 2002 and is headquartered in Shanghai. China UnionPay is a joint bank card organization of China through the UnionPay Interbank transaction Clearing system to achieve interconnectivity and resource sharing among commercial banking systems, and to ensure the use of bank cards across banks, across regions, and across borders. Similar to this is the internationally common Visa and MasterCard organizations.

Payment account: bank card account

Charging object: the merchant is still the main object of near-field payment

Source of income: transaction fee card issuer, clearing agency, an order receiving agency according to the provisions of the division run.

Near-field payment: because the distribution of off-line merchants is relatively dispersed and the concentration degree is far lower than that of online merchants, no matter which kind of near-field payment mode cannot bypass the card organization, the card organization occupies a certain advantage in the near field payment business model.

3. Third-party Payment Organizations

Third-party payment refers to some large enterprises or institutions, signed with the major commercial banks to promote a certain strength of the credibility of the trading platform. The third party is the "intermediate platform" supported by the buyer and seller in the absence of credit guarantee or legal support. Its operation is essentially an intermediate transitional account established between the payers and a controllable standstill for remittances. In China, the mainstream third-party payment products are mainly Alipay, WeChat Pay ApplePay and so on.

2.3.5 Summary

Alipay occupies the leading position in Financial payment

Online shopping is the birthplace of Alipay, thanks to Alibaba Department Tmall, Taobao and other e-commerce in the field of continued solid leadership, Alipay online consumer transactions (mainly online purchase payments) remain the leading edge. In terms of transaction amount and number of transactions, Alipay's share of online consumer transactions was 49 percent and 48 percent, while Tenpay's share of online consumer transactions was 40 percent and 41 percent, basically maintaining the same pattern as the November 2017 survey.

In financial transactions, Alipay still has obvious advantages. Alipay accounts for 58% of the transactions and 51% for the number of pens, Tenpay 33%, and 40%; moreover, compared with the November 2017 survey, Alipay to Tenpay's financial payment lead seems to have expanded.

Alipay's international road is extremely bumpy

Today, Alipay is still not a global mobile payment service provider. In the global mobile payment market, there are mainly four companies competing for share: Apple payment, Samsung payment, and Weibo Android payment, as well as the PayPal., which mainly relies on software payment methods such as scan code. The first three companies are mainly promoting NFC payments based on smartphone hardware, which is equivalent to using mobile phones to make card payments. PayPal relies on the first-mover advantage and has accumulated hundreds of millions of users around the world.

The internationalization of mobile payments is difficult to achieve in the short term, especially unlikely to achieve the same speed and scale as the domestic market but requires a long and sustained effort. This is because, compared with the domestic

financial system, the western financial system is very different. It relies heavily on banking institutions and bank cards (debit cards and credit cards) to pay, and the entire business has developed for a long time, has been quite mature, and user habits have also been formed. In the meantime, there are many stakeholders.

Despite the many unfavorable factors, the Giants' overseas expansion has never ceased, extending from Southeast Asia to Europe and the United States. At present, Alipay has access to more than 20 000 offline merchants in more than 30 countries and regions such as Southeast Asia, Europe, and the United States, and has completed the layout of local wallets in 9 countries and regions with local brands.

The hidden trouble of Alipay Security

Although Alipay is committed to providing users with simple, secure online payment solutions, there are still many security problems, such as retention funds, information leaks, virtual accounts and so on. All payment services of Alipay are based on two major foundations, one is the hard foundation, that is, network computer technology, the other is the soft foundation, that is, credit endorsement of banks and other financial institutions. On the basis of the open Internet, it is easy to illegally steal and maliciously tamper with the third party by transferring the cash of both sides of the transaction to the third party through the network computer technology. And there are many kinds of viruses on the Internet. In 2008, the spread of a variety of ways, are always threatening the security of Alipay. So security risk of Alipay is still prominent.

3. Methodology

3.1 Factor analysis Methods

Factor analysis is a unity of two analytical forms, that is, confirmatory analysis and pure exploratory analysis. Exploratory factor analysis (EFA) is a technique used to find out the essential structure of multivariate observation variables and to deal with dimensionality reduction. One of the main purposes of exploratory factor analysis is to obtain the number of factors. Confirmatory factor analysis (CFA) is a statistical analysis of social survey data. It tests whether the relationship between a factor and the corresponding measure is in accordance with the theoretical relationship designed by the researcher. Confirmatory factor analysis is often tested by structural equation modeling.

Exploratory factor analysis and confirmatory factor analysis are two important parts of factor analysis. In the practical application of management research, the two can not be separated completely. Make the research more profound. Some scholars suggest that in the process of developing the theory, we should first establish the model by exploratory factor analysis, and then provide the concept and calculation tools of the analysis model to verify and modify the model by verification. The results provide an important basis and guarantee for confirmatory factor analysis to establish assumptions. Without either factor analysis, the factor analysis will be incomplete.

3.2 Structural Equation Modeling Analysis

Structural equation model is a multivariate statistical technique which combines factor analysis and path analysis. It is a method to establish estimate and test causality model in social science research. The model contains both observable explicit variables and potential variables that cannot be observed directly. The structural equation model can replace multiple regression, path analysis, factor analysis, covariance analysis and so on. Structural equation analysis can deal with multiple dependent variables at the same time and can compare and evaluate different theoretical models. In the structural equation model, we can propose A specific factor structure and verify that it matches the data.

4. Research Design

4.1 Correlational Research&Hypothesis

1. People Factors

Based on the research and analysis of user trust level, McKnight etc selected 11 trust factors widely recognized by scholars on the basis of sorting out relevant documents, and these trust factors can be merged into Integrity, Ability and Goodwill three kinds.

(McKnight,D.H.Cummings,L.L.,Chervany,N.L.1998)

Mayer etc summarizes the relevant literature and puts forward a trust construction model, which points out that the measurement index of the trusted person is Integrity, Ability, and Goodwill.**(Mayer,R.C,Davis.E.D,Schoorman,F. D.1995)**

Integrity is the feeling that a trusted person will adhere to certain principles that can be relied upon; Ability is a person who believes that a trusted person has the ability to deal with certain things; Goodwill is the degree to which a trusted person is concerned about a trusted person rather than acting selfishly and egotistically. Cheng Zhenyu points out that trust is a multi-dimensional concept, which includes three dimensions: ability, Integrity, and goodwill. He applied the three dimensions of trust to the security of online transactions. **(CHENG.Z.Y.2013)**

From the above studies, we can find that ability, Integrity, and goodwill have an important impact on the trust of the user to the trading platform. Blanchard puts forward in MSN. It is easy to increase trust between users when they communicate with other users with real information.**(Blanchard,A.2004)**

Oiifaris and Sosa studied the initial determinants of online transactions, confirming the reputation and scale of the site's suppliers. The willingness to provide custom-made services to consumers and the individual trust tendency of consumers will affect consumers' recognition of the security of online transactions. **(Koufaris,,Hampton-Sosa,W.2004)**

Li Ming Ren, through empirical research, finds out that the information richness of the virtual community and the trust tendency of the users. The degree of familiarity with the virtual community and the social interaction between users will have a direct impact on the security of online transactions **(LI.MING.REN.2001)**.

Therefore, through these studies, we can draw a general conclusion that user trust mainly includes three dimensions: ability, Integrity, and goodwill. We affect the users of Alipay security evaluation.

Knowledge is one of the determinants of perceptual control**(Wortman,,C.1975)**. Studies have shown that the additional knowledge needed to use the network may hinder users use the Internet **(Klobas,,J.E.,Clyde,L.A.2000)**.

Therefore, this study believes that the more knowledgeable users have about mobile payment, the more they understand the process of mobile payment services, and this understanding will enhance the perceived control of users and the evaluation of expected benefits. In order to increase its perceived benefits and reduce its perceived risk.

Thus the relevant assumptions are as follows:

H1: Integrity has a positive relationship with Alipay's Security

H2: Goodwill has a positive relationship with Alipay's Security

H3: Knowledge has a positive relationship with Alipay's Security

2.Organization Factors

Lee Raito believes that users buy goods on social networks based on trustworthiness, protection, and security. Qi Aimin pointed out that the lack of legal obligations and responsibilities of network trading platform providers is the bottleneck restricting network transactions.**(QI.A.M.2011)**

According to China News Network, with the rapid expansion of online trading volume of Alipay, A number of financial institutions have established long-term partnerships with Alipay which means that the financial industry has provided Alipay with enormous support, enabling Alipay to better Maintain its refund, compensation and value-added services to provide users with safe, timely and reliable services. According to the above research, this thesis regards the protection and financial security service as the important factor of Alipay security support.

Some articles have studied how to evaluate the security of the payment system from the user's point of view, including transaction steps, security description etc. Transaction steps are primarily used to ensure the smooth progress of payments and to address user concerns about the security of payment systems in order to meet the security needs of users, payment systems should provide smooth transaction steps. It includes: certification of relevant participants before a transaction, providing several independent steps to complete payment, sending confirmation information after the end of the transaction, etc. Security description is an extremely critical factor in influencing user perceived risk **(Lim,A.S.2008)** If the average user is not aware of his or her transaction security level of the process, he is unlikely to use mobile payment means.

Therefore, the system security function is actually composed of the above aspects. It is called the system function. Making users fully understand and believe in the security mechanism of a mobile payment system will reduce the perceived risk of

users and improve the perceived benefits, thus having a positive impact on the use of mobile payment.

Thus the relevant assumptions are as follows:

H4: Protection has a positive relationship with Alipay's Security

H5: System Function has a positive relationship with Alipay's Security

H6: Financial Security has a positive relationship with Alipay's Security

3.Technology Factors

Leimeister etc pointed out that the accuracy of the information provided by the network trading platform affects the users' evaluation of its security.

(Leimeister,J.M.Sidiras,P,Krcmar,H.2004)

Be-langer etc proposed that the security of the trading platform is a problem that users are very concerned about when they deal in the network. Dong Dahai and others think that the platform and the network word-of-mouth influence the users' risk consciousness of online shopping.

Hernandes and Fresneda research find that the reliable technology platform, network responsiveness, and community stability and other factors play an important role in the network transaction**(Hemandes,C.A.Fresneda,P. S.2003)**.

Thus, the trading platform is stable, word-of-mouth and technical insurance. Obstacles to Alipay's user image have a great impact.

Lou Qiqun and others pointed out that the problems faced by information security in the modern information technology environment include information disclosure, information pollution, information destruction, and information intrusion, and pointed out that information security measures for network transactions need to be continuously improved improved.**(LOU.C.Q,FAN.H,WANG.F.2000)**

Research has shown the importance of encryption techniques. Gao Lei pointed out that strong security of online banking, as well as the account management services, the stability of the application system, and the safety and security of the operation of the system, have relatively satisfactorily solved the problem of security and credit that troubled online transactions. Caters to the need for online payment in the e-commerce market**(GAO.LEI.2010)** , run backend to support Fu Bao's safety has a direct impact.

From the previous research, it is very necessary to analyze the security technology of Alipay from trading platform, encryption and operation background.

Thus the relevant assumptions are as follows:

H7: Transaction Platform has a positive relationship with Alipay's Security

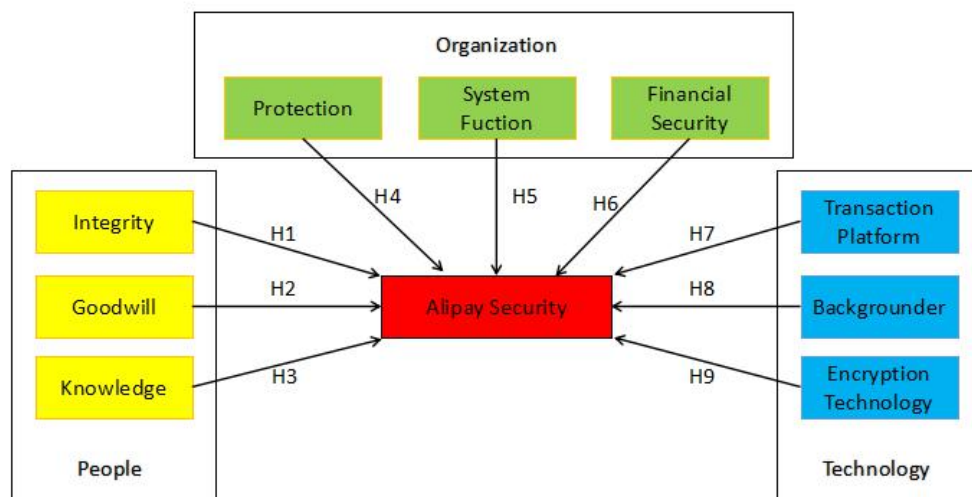
H8: Backgrounder has a positive relationship with Alipay's Security

H9: Encryption Technology has a positive relationship with Alipay's Security

4.2 Research Model

This thesis modified the previous models and constructed the following models. According to the three aspects of Alipay's security, this thesis will study the security of Alipay from three aspects: people, organization and technology.

According to the multi-factor relation theory in the structural equation, nine exogenous latent variables (Integrity、Goodwill、Knowledge、Protection、System Fuction、Financial Security、Transaction Platform、Backgrounder、Encryption Technology) and one endogenous latent variable (Alipay Security) are designed in this thesis. Three items are set up for each variable, and 12 items are added to the basic information.



Alipay Security Research Model hypothesis Chart

[Figure 9:Alipay Security Research Model](#)

4.3 Questionnaire Design

The questionnaire adopted a multi-item method, in which each item was measured with a five-point scale (strongly disagree=1, disagree=2, neither disagree nor agree=3, agree=4, strongly agree=5), and the degree of the scale was shifted from strong opposition to the strong agreement. In order to ensure the validity of variables, all the questions in the questionnaire are derived from the existing literature. In addition to the basic information of the respondents, the questionnaire involved 10 constructs and 30 questions. The corresponding questions and sources for each construction can be found in the bibliography.

Part one-Factual Questions

1. Gender: Female; Male

2. Age Group (Years) : 18-24; 25-34; 35-44; 45 or over

3. Marital Status: Married; Single; Divorced

4. Only Child: Yes; No

5. Schooling Years: High School; Undergraduate; Master; PHD

6. Employment: Employed; Unemployed; Studying

7. Salary(RMB): less than 3500; 3500-5000; 5000-8000; more than 8000

8. Mobile Phone System: IOS; Android; Symbian; Windows; Others

9. Mobile Phone Brand:

Apple; Huawei; OPPO; VIVO; LG; ZTE; Honor; MI; SAMSUNG; Lenovo; Meizu;

OnePlus; Others

10. The frequency of Use M-P app:

Often Use; Occasionally Use; Hardly Use; Never Use

11. Favorite M-P app: Alipay; WechatPay; UnionPay; ApplePay; Others

12. Consumer Spending Every Month by M-P app(RMB):

less than 500; 500-1000; 1000-2000; 2000-3000; more than 3000

Part Two-Attitude Questions

Measurement variables and Questionnaire		
Variable	No.	Item-EN
Integrity	I1	I think Alipay's message to users is real.
	I2	I think Alipay and my information interaction is sincere
	I3	I believe Alipay can keep its promise to customers
Goodwill	G1	While paying attention to its own interests, Alipay will take into account the interests of the users
	G2	If problems arise, Alipay will do its best to provide support and help to users
	G3	I believe Alipay will protect the interests of users
Knowledge	K1	I always use Alipay payment when buying products or services.
	K2	I will soon be familiar with Alipay related knowledge.
	K3	I have confidence in using Alipay
Protection	P1	Alipay transactions are protected by reliable software, and you will feel that Alipay is secure
	P2	Alipay transactions are protected by relevant laws and regulations, you will feel Alipay safe
	P3	When you use Alipay, the more secure the network you use, the more secure you will feel about Alipay
System Fuction	SF1	The payment amount and transaction data are shown in Alipay's payment system are usually accurate.
	SF2	The Alipay system is often described in a number of ways
	SF3	Few unexpected situations or errors occur when using Alipay to pay
Financial Security	FS1	The more sound Alipay's compensation measures are in trading, the safer you will feel about Alipay.
	FS2	The more effective Alipay's refund policy is in trading, the safer you will feel about Alipay
	FS3	The more stable Alipay's value-added services are in trading, the safer you will feel about Alipay.
Transaction Platform	TP1	The more familiar you are with Alipay trading platforms, the more secure you will be
	TP2	The more standardized Alipay trading is, the safer you will feel about Alipay
	TP3	The better the reputation of Alipay trading platform, the safer you will feel about Alipay
Background er	B1	The more stable Alipay's operating system is, the safer you will feel about Alipay
	B2	Alipay's information is updated in time, and it can guarantee quality. You will

		feel that Alipay is safe.
	B3	The more secure the financial institution entrusted by Alipay, the safer you will feel about Alipay
Encryption Technology	ET1	The higher the password requirement for Alipay trading, the safer you will feel about Alipay
	ET2	The more the password protection means of Alipay, the more secure you will be.
	ET3	Alipay transaction password security system better, you will feel Alipay the more secure
Alipay Security	AS1	I think Alipay is safe and reliable.
	AS2	I believe the Alipay trading platform will do better and better.
	AS3	I think Alipay will become more and more popular as security improves

5.Results and Interpretation

Since we have collected all the data from participants, the next step is to analyze data. In this study, we use SPSS and AMOS as the statistics software to analyze data.

5.1 Descriptive analysis

In this study, the online questionnaire was used to collect data, and random sampling of Alipay users in mainland China was carried out by online website (<https://www.wjx.cn/>). According to the statistics, the 364 data were collected, and the questionnaires with the same IP, filling time, and all the same options were eliminated, and the 364 questionnaires were collected for the empirical analysis in this thesis. The sample size is ten times more than the number of items, in line with the requirements of statistical analysis.

Source Distribution

Because the data were collected by random sampling through social software, the data sources of 364 questionnaires were distributed in addition to some students from abroad (11.54%), and most of the other data sources were from 26 different provinces in China (88.46%). Most of the Chinese market is covered, but the largest data sources are mainly in Guangdong (34.34%), Shanxi (20.88%), Beijing (6.32%) and so on.

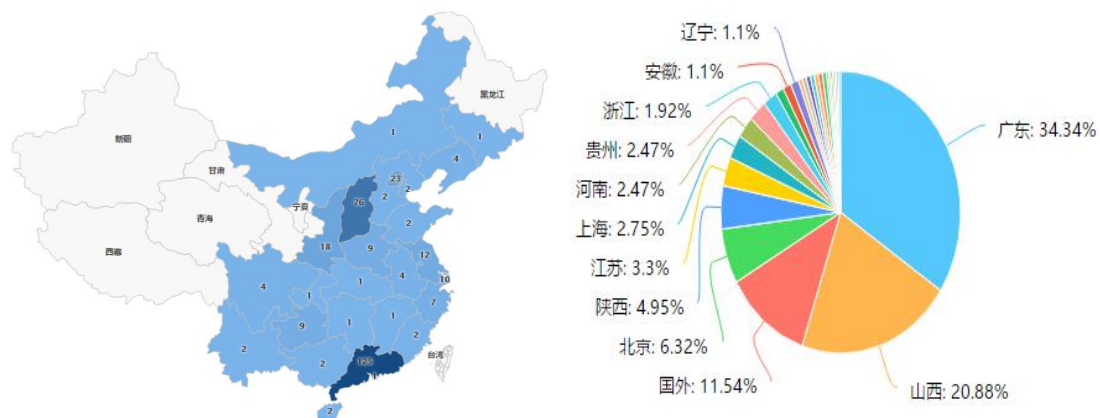


Figure 10: Descriptive statistics of sample data (source distribution)

Participant

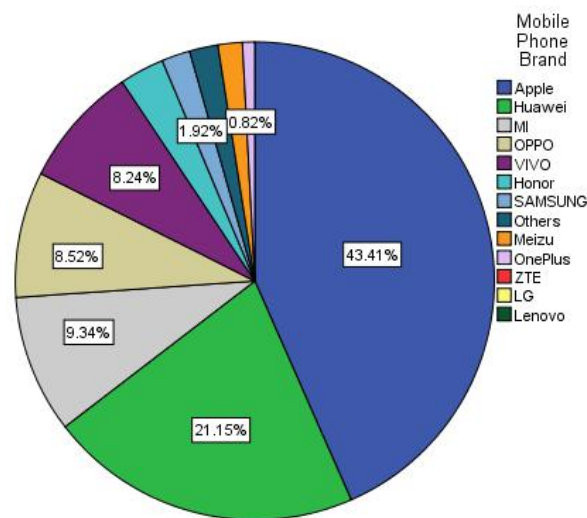
In the sample data, there were more females (58.8%) than males (41.2%). Young people with a young age structure of 18 to 34 accounted for 93.4% of the total. Most of the participants are unmarried, that still single (42.3%) and love (34.6%) stage. The proportion of only child (28.8%) is less than that of the non-only child (71.2%). The education level of the sample data is generally high, the majority of them have an undergraduate degree (57.4%). The vast majority (61.5%) earn more than 3500RMBs a month. The young people, highly educated people with middle and high income is the main user of mobile payment service at present, so the sample distribution is reasonable and representative.

		Count	Column N %
Gender	Female	214	58.8%
	Male	150	41.2%
Age Group(Years)	18-24	122	33.5%
	25-34	218	59.9%
	35-44	17	4.7%
	45 or over	7	1.9%
Marital Status	Married	82	22.5%
	In Love	126	34.6%
	Single	154	42.3%
	Divorced	2	.5%
Only Child	Yes	105	28.8%
	No	259	71.2%
Schooling Years	High School	24	6.6%
	Undergraduate	209	57.4%
	Master	119	32.7%
	PHD	12	3.3%
Employment	Employed	217	59.6%
	Unemployed	25	6.9%
	Studying	122	33.5%
Salary(RMB)	less than 3500	140	38.5%
	3500-5000	63	17.3%
	5000-8000	84	23.1%
	more than 8000	77	21.2%

[Table 1:Descriptive statistics of sample data \(personal information\)](#)

Mobile Payment

Sample data show that the top five smartphone brands are Apple, Huawei, Xiaomi and OPPO & Vivo respectively. All the brands are Chinese brands except the Apple phone, in line with the current market share of mobile smartphones in China. Just because most of the respondents were from the middle and high-income groups with a higher education background, so the percentage of iPhones increased, and the actual market survey showed that Apple was probably third and fourth in the market.



[Figure 11: Descriptive statistics of sample data \(smartphone brand\)](#)

Alipay (49.18%) and WeChat Pay (48.90 %) accounted for the majority of the market share of China Mobile payment market, and Alipay maintained a narrow lead, which is consistent with the previous Alipay domestic competition analysis. Apple's phones have a big market share, but Apple has been slow to open the market in China because of the BAT Internet giant's first-mover advantage and localization advantage.

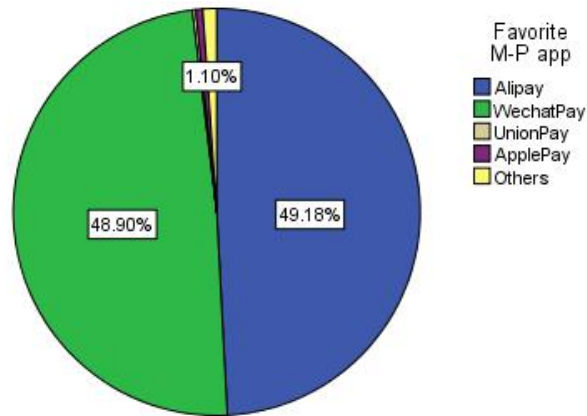


Figure 12: Descriptive statistics of sample data (Mobile payment Software)

Female users use mobile payment software more than male users, with 57.45% and 63.64% of the frequently used and occasionally used options, but at the same time, the women market has more potential to tap.

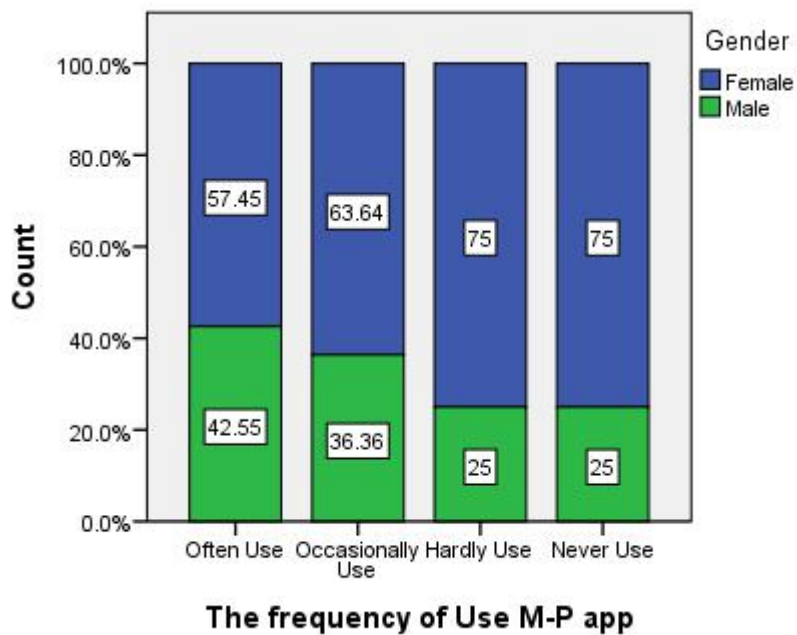


Figure 13: Frequency of use of gender-specific mobile payment software

Alipay and WeChatPay occupy absolute leading proportion in different consumption level. From the chart analysis, we can see that in less than 500 and 500-1000 yuan options, the users choose WeChat Pay relatively more, the proportion reached 58.7% and 58.6% respectively; However, in the field of 2000-3000 and larger than 3000, Alipay has a relative advantage with 56.6% and 51.1%. This is consistent with the results of the related study, where Alipay is more focused on third-party payment services, while WeChat Pay is more focused on social app users for market share.

Consumer Spending Every Month by M-P app(RMB) * Favorite M-P app Crosstabulation								
			Favorite M-P app					Total
			Alipay	Wechat Pay	UnionPay	ApplePay	Others	
Consumer Spending Every Month by M-P app(RMB)	less than 500	Count	16	27	0	0	3	46
		%	34.8%	58.7%	.0%	.0%	6.5%	100.0%
	500-1000	Count	29	41	0	0	0	70
		%	41.4%	58.6%	.0%	.0%	.0%	100.0%
	1000-2000	Count	64	47	1	1	0	113
0	%	56.6%	41.6%	.9%	.9%	.0%	100.0%	
	2000-3000	Count	26	25	0	0	0	51
	0	%	51.0%	49.0%	.0%	.0%	.0%	100.0%
	more than 3000	Count	44	38	0	1	1	84
		%	52.4%	45.2%	.0%	1.2%	1.2%	100.0%
Total	Count		179	178	1	2	4	364
	%within Consumer Spending Every Month by M-P app(RMB)		49.2%	48.9%	.3%	.5%	1.1%	100.0%

[Table 2: Different monthly consumption of mobile payment software](#)

5.2 Reliability analysis

Reliability analysis is an effective method to test whether the questionnaire has certain stability and consistency, which can reflect the true degree of the questionnaire. In exploratory research, Cronbach's Alpha coefficient is the most common factor. Based on the reliability analysis of SPSS, the following table shows that both the influencing factors of 9 dimensions and the Cronbach's Alpha value of Alipay are above 0.8, which indicates that each dimension is consistent and the questionnaire has high reliability.

Variables	Items	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha
Integrity	I1	0.798	0.838	0.892
	I2	0.785	0.848	
	I3	0.781	0.852	
Goodwill	G1	0.753	0.882	0.894
	G2	0.814	0.831	
	G3	0.81	0.834	
Knowledge	K1	0.617	0.828	0.824
	K2	0.693	0.745	
	K3	0.739	0.702	
Protection	P1	0.798	0.855	0.898
	P2	0.843	0.815	
	P3	0.756	0.891	
System Fuction	SF1	0.797	0.814	0.883
	SF2	0.722	0.88	
	SF3	0.803	0.807	
Financial Security	FS1	0.792	0.83	0.887
	FS2	0.836	0.792	
	FS3	0.716	0.895	
Transaction Platform	TP1	0.753	0.832	0.875
	TP2	0.74	0.843	
	TP3	0.792	0.792	
Backgrounder	B1	0.783	0.836	0.887
	B2	0.819	0.803	
	B3	0.738	0.877	
Encryption Technology	ET1	0.781	0.857	0.894
	ET2	0.799	0.842	
	ET3	0.794	0.847	

[Table 3: Reliability test of influencing factors](#)

Vriables	Items	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha
Alipay Security	AS1	0.764	0.881	0.897
	AS2	0.839	0.817	
	AS3	0.789	0.86	

[Table 4: Reliability test of Alipay Security](#)

5.3 Validity analysis

The validity analysis of the questionnaire is to use SPSS to carry out factor analysis to obtain the structural validity of the data. The KMO test and the Barlett spherical test are generally required to be greater than 0.6 before factor analysis. As shown in the following table, after using SPSS to test the data with KMO and Barlett sphere test, the KMO value of 9 influencing factors is 0.964, and the KMO value of Alipay safety is 0.737, which indicates that the data is suitable for factor analysis.

The data were analyzed by exploratory factor after KMO test and Barlett spherical test. The exploratory factor analysis selects the factor extracted by principal component analysis and the factor whose eigenvalue is greater than 1. The result shows that there are 9 factors whose eigenvalue is greater than 1, which is processed by the orthogonal rotation method with maximum variance. The cumulative validity of the nine influencing factors was 82.727, which satisfied the requirements.

KMO and Bartlett's Test of influencing factors		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.964
Bartlett's Test of Sphericity	Approx. Chi-Square	8694.985
	df	351
	Sig.	0.000

[Table 5: KMO and Bartlett's Test of influencing factors](#)

KMO and Bartlett's Test of Alipay Securit		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.737
Bartlett's Test of Sphericity	Approx. Chi-Square	674.603
	df	3
	Sig.	.000

[Table 6: KMO and Bartlett's Test of Alipay Securit](#)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	15.488	57.363	57.363	15.488	57.363	57.363	3.651	13.521	13.521
2	13.787	6.618	63.981	13.787	6.618	63.981	3.354	12.421	25.942
3	11.972	3.601	67.582	11.972	3.601	67.582	2.930	10.851	36.793
4	9.884	3.274	70.856	9.884	3.274	70.856	2.872	10.637	47.430
5	7.767	2.840	73.696	7.767	2.840	73.696	2.389	8.849	56.278
6	5.699	2.587	76.283	5.699	2.587	76.283	2.350	8.704	64.982
7	4.638	2.362	78.645	4.638	2.362	78.645	2.287	8.471	73.453
8	2.593	2.197	80.842	2.593	2.197	80.842	1.407	5.211	78.664
9	1.009	1.885	82.727	1.009	1.885	82.727	1.097	4.063	82.727
10	.491	1.820	84.547						
11	.408	1.512	86.059						
12	.379	1.404	87.463						
13	.339	1.255	88.718						
14	.331	1.224	89.942						
15	.309	1.144	91.086						
16	.281	1.040	92.126						
17	.276	1.022	93.148						
18	.242	.896	94.044						
19	.222	.824	94.868						
20	.208	.770	95.638						
21	.198	.735	96.373						
22	.191	.709	97.082						
23	.175	.649	97.730						
24	.163	.605	98.335						
25	.161	.598	98.933						
26	.150	.557	99.490						
27	.138	.510	100.000						

Extraction Method: Principal Component Analysis.

[Table 7: Total Variance Explained](#)

Rotated Component Matrix^a									
	Component								
	1	2	3	4	5	6	7	8	9
I1	.170	.289	.249	.178	.188	.209	.715	.082	.202
I2	.192	.363	.162	.171	.118	.194	.740	.181	.038
I3	.115	.401	.248	.242	.336	.231	.558	.067	.180
G1	.184	.736	.166	.157	.144	.137	.323	.053	.075
G2	.128	.772	.186	.163	.184	.222	.198	.140	.126
G3	.161	.803	.118	.150	.226	.173	.170	.182	.093
K1	.217	.218	.169	.151	.186	.081	.197	.772	.171
K2	.207	.229	.110	.197	.193	.162	.150	.798	.215
K3	.191	.407	.252	.224	.346	.228	.178	.668	.260
P1	.261	.317	.201	.118	.645	.304	.207	.177	.156
P2	.292	.284	.161	.212	.707	.236	.181	.186	.096
P3	.313	.293	.213	.300	.585	.203	.165	.117	.144
SF1	.219	.281	.151	.354	.263	.667	.180	.065	.098
SF2	.226	.276	.222	.112	.114	.681	.275	.320	-.073
SF3	.223	.196	.226	.274	.287	.711	.161	.043	.155
FS1	.266	.160	.156	.752	.222	.230	.222	.103	.144
FS2	.299	.187	.284	.704	.175	.253	.161	.156	.133
FS3	.259	.367	.361	.565	.111	.142	.110	.214	-.029
TP1	.249	.231	.731	.190	.074	.245	.146	.130	.174
TP2	.329	.190	.575	.146	.135	.256	.142	.089	.123
TP3	.277	.247	.740	.217	.167	.160	.178	.070	.102
B1	.026	.023	.100	.297	.342	.102	.287	.062	.691
B2	-.026	.155	.480	.302	.289	.117	.228	.118	.500
B3	-.092	.150	.277	.366	.296	.017	.254	.188	.578
ET1	.747	.148	.251	.122	.151	.231	.208	.137	.112
ET2	.826	.186	.161	.193	.175	.163	.026	.110	.091
ET3	.720	.144	.260	.280	.151	.190	.106	.051	.254
Extraction Method: Principal Component Analysis.									
Rotation Method: Varimax with Kaiser Normalization. ^a									
a. Rotation converged in 9 iterations.									

[Table 8: Rotated Component Matrixa](#)

5.4 Correlation analysis

Correlation analysis detects whether there is a close relationship between variables by the correlation coefficient. The commonly used Pearson correlation coefficient is used to measure the linear correlation between two variables. The greater the correlation coefficient is, the stronger the correlation is. When the test results reach the significant level of $p < 0.05$, the correlation coefficient will be marked *, and when the test results reach the level of $p < 0.01$, the correlation coefficient will be marked **; according to the following table, There was a good correlation between the variables at the significant level of 0.01.

Correlations among all factors											
		Integrity	Goodwill	Knowledge	Protection	System Function	Financial Security	Transaction Platform	Background	Encryption Technology	Alipay Security
Integrity	Pearson Correlation	1	.739**	.666**	.711**	.691**	.659**	.668**	.638**	.557**	.706**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	364	364	364	364	364	364	364	364	364	364
Goodwill	Pearson Correlation	.739**	1	.671**	.687**	.654**	.609**	.595**	.543**	.509**	.668**
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.000	.000	.000	.000
	N	364	364	364	364	364	364	364	364	364	364
Knowledge	Pearson Correlation	.666**	.671**	1	.721**	.641**	.650**	.627**	.603**	.607**	.713**
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000	.000	.000	.000
	N	364	364	364	364	364	364	364	364	364	364
Protection	Pearson Correlation	.711**	.687**	.721**	1	.730**	.707**	.673**	.702**	.687**	.754**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000	.000	.000	.000
	N	364	364	364	364	364	364	364	364	364	364
System Function	Pearson Correlation	.691**	.654**	.641**	.730**	1	.706**	.679**	.640**	.619**	.763**
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000	.000	.000	.000

	N	364	364	364	364	364	364	364	364	364	364
Financial Security	Pearson Correlation	.659**	.609**	.650**	.707**	.706**	1	.771**	.742**	.686**	.757**
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000	.000	.000	.000
	N	364	364	364	364	364	364	364	364	364	364
Transaction Platform	Pearson Correlation	.668**	.595**	.627**	.673**	.679**	.771**	1	.779**	.709**	.819**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000		.000	.000	.000
	N	364	364	364	364	364	364	364	364	364	364
Background er	Pearson Correlation	.638**	.543**	.603**	.702**	.640**	.742**	.779**	1	.767**	.793**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000		.000	.000
	N	364	364	364	364	364	364	364	364	364	364
Encryption Technology	Pearson Correlation	.557**	.509**	.607**	.687**	.619**	.686**	.709**	.767**	1	.750**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000		.000
	N	364	364	364	364	364	364	364	364	364	364
Alipay Security	Pearson Correlation	.706**	.668**	.713**	.754**	.763**	.757**	.819**	.793**	.750**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	
	N	364	364	364	364	364	364	364	364	364	364

** . Correlation is significant at the 0.01 level (2-tailed).

[Table 9: Correlations among all factors](#)

5.5 Structural Equation Model analysis

After data processing with SPSS, the structural equation model of Alipay security should be constructed by using AMOS. The latent variables and observational variables studied in this thesis are as follows: Integrity (I1I2I3)、Goodwill (G1G2G3)、Knowledge (K1K2K3)、Protection (P1P2P3)、System Fuction (SF1SF2SF3)、Financial Security (FS1FS2FS3)、Transaction Platform (TP1TP2TP3)、Backgrounder (B1B2B3)、Encryption Technology (ET1ET2ET3)、Alipay Security (AS1AS2AS3)

By the initial model, AMOS is used to modify the model to improve the fitting degree. Also, the residual error of the structural equation model should be increased to obtain a satisfactory model. The initial model as well as the associated index tables are as follows:

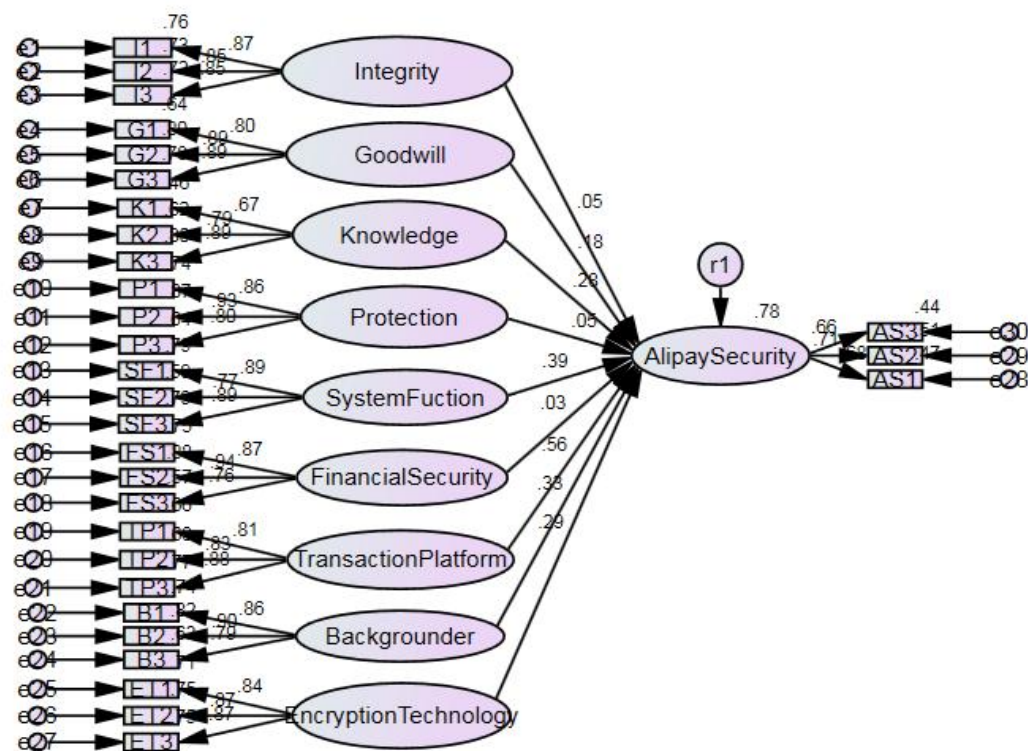
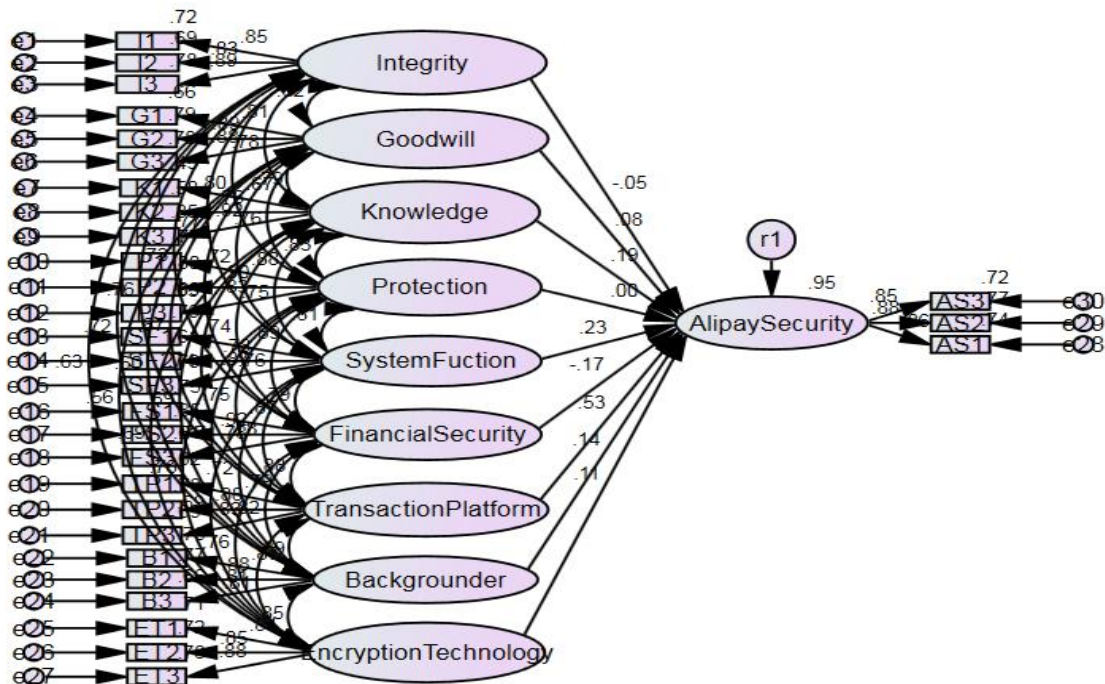


Figure 14: SEM initial model

Statistical test		Adaptation standard	Test result	Model adaptation judgment
Absolute fit indicator	CMIN/DF	<3	9.043	NO
	RMR	<0.05	0.463	NO
	RMSEA	<0.08	0.149	NO
	GFI	>0.9	0.453	NO
	AGFI	>0.9	0.357	NO
Relative fit indicator	CFI	>0.9	0.680	NO
	NFI	>0.9	0.655	NO
	RFI	>0.9	0.621	NO
	IFI	>0.9	0.681	NO

[Table 10: Initial model fitting index table](#)

The revised AMOS indicators have basically reached the recommended value, indicating that the modified model is more successful, although the GFI and AGFI values are slightly lower than recommended, but still within an acceptable range. The revised model and related indices are shown in the following table:



[Figure 15: SEM Modified model](#)

Statistical test		Adaptation standard	Test result	Model adaptation judgment
Absolute fit indicator	CMIN/DF	<3	2.100	YES
	RMR	<0.05	0.028	YES
	RMSEA	<0.08	0.055	YES
	GFI	>0.9	0.874	CLOSE
	AGFI	>0.9	0.837	CLOSE
Relative fit indicator	CFI	>0.9	0.960	YES
	NFI	>0.9	0.927	YES
	RFI	>0.9	0.912	YES
	IFI	>0.9	0.961	YES

[Table 11: Modified model fitting index table](#)

Path Coefficient				
	Estimate	S.E.	C.R.	P
Alipay Security<---Integrity	-0.045	0.06	-0.631	0.528
Alipay Security<---Goodwill	0.079	0.053	1.251	0.211
Alipay Security<---Knowledge	0.185	0.057	2.635	0.008
Alipay Security<---Protection	0.003	0.072	0.038	0.97
Alipay Security<---System Function	0.234	0.057	3.622	***
Alipay Security<---Financial Security	-0.175	0.08	-2.23	0.026
Alipay Security<---Transaction Platform	0.529	0.117	4.339	***
Alipay Security<---Encryption Technology	0.113	0.064	1.653	0.098
Alipay Security<---Backgrounder	0.143	0.097	1.409	0.159

[Table 12: Path Coefficient](#)

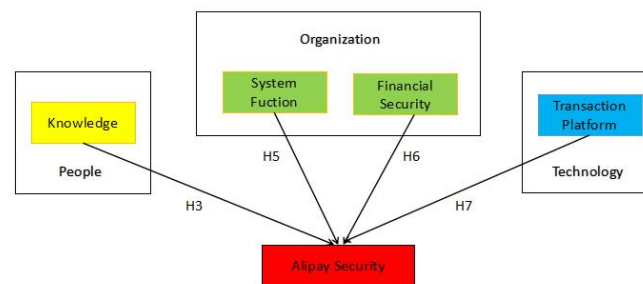
5.6 Results Analysis

The results show that Knowledge, System Function, Financial Security, and Transaction Platform have a positive relationship with Alipay security, and the correlation coefficient are 0.185 , 0.234, - 0.175, 0.529, and assumptions that H3, H5, H6, H7 are confirmed.

The System Function and Transaction Platform have the most prominent influence on the security of Alipay. Therefore, Alipay should improve the accuracy of service, reduce the error of various system functions and increase the elaboration and publicity of security problems in different ways. On the other hand, Alipay should improve the interface and interactive design of system to improve the convenience for users, improve the ability of standardized services to reduce the need for manual processing processes and improve the reputation through different online and offline ways.

Knowledge has a prominent impact on the security of Alipay. With the relative maturity and stability of Alipay user group, it is particularly important to do well the education and communication of safety knowledge.

Financial Security also has a partial impact on the security of Alipay. Alipay should continue to improve compensation and return policies to provide more safe and convenient high-value services. The model diagrams obtained from the final validation of the study are as follows:



Confirmed Alipay Security Research Model

[Figure 16: Modified Alipay Security Model](#)

6. Conclusions

Third-party payments, represented by Alipay, are transforming from a fast payment tool to an integrated financial services platform in a rapidly developing modern China. In the future, the use of Alipay with Big Data and Cloud Services for urban management and convenient services will also play an increasingly important role, as well as an important tool for Chinese tourists and Chinese enterprises to go overseas.

Through literature review and empirical analysis, this thesis proves that the "Knowledge" at the aspect of people, the "System Function" and "Financial Security" at the organization laspect, and the "Transaction Platform" at the technical aspect are the main factors affecting the security of Alipay. Here are some suggestions on how Alipay can improve its security performance:

Firstly, pay more attention to the education of safety knowledge and prevent error in the early stages.

Up to now, there are few types of research on the consideration of mobile payment Knowledge in the research model, but the cognition of mobile payment plays a very important role in preventing risks in the actual process. Alipay has sent out annual security payment reports to all users, but more often than not, there have been billing annual reports. I think that in addition to all kinds of security statements in daily life, such as login interface tips, safety knowledge Mini Game, and so on, Alipay should also provide regular security reports to users, thus causing users to pay enough attention to security issues.

Secondly, Improve the system function and continuously enhance the technical accuracy.

As the largest third-party trading platform in China, Alipay occupies an absolute advantage in the field of large expenditure, so it is particularly necessary to continuously improve the accuracy of transaction information and the convenience of the transaction process. T-mall's shopping festival, with a daily turnover of hundreds of billions of dollars, poses a great challenge to the system and workers.

Thirdly, to ensure the quality of financial services and improve the level of service.

Alipay accumulates a lot of funds through Yu'e Bao's service. How to ensure the safety of users' funds is the first key factor. Alipay has set up a closed loop of financial services through the establishment of online merchant banks, but if it can better cooperate with China UnionPay and major commercial banks, Alipay's users will be provided more convenient and secure financial services.

Fourth, trading platform standardization, increase user viscosity and good reputation.

Alipay is gradually moving from domestic to international with Alibaba's e-commerce trading platform. How to establish a standardized business service process will determine whether Alipay can gain a competitive advantage in the complex international market in the future. At the same time, the pace of Chinese tourists and Chinese companies moving overseas is accelerating, and how to gain an advantage in the subdivision of cross-border payment transactions depends on Alipay's own user viscosity and good reputation effect.

7.Academic Contributions and Limitations

Academic contributions

The main theoretical contribution of this thesis is to combine the research model of management information system with the empirical research, and the theoretical model of management information system is provided as a theoretical framework for qualitative research in textbooks. In this thesis, a structural equation model for empirical research is constructed under the management information system theory model, and some of the hypotheses are supported by the data.

Limitations

Although there is no data support in areas such as government regulatory protection and emphasis on encryption technology, I still believe that government regulatory protection (such as privacy protection) is necessary. Data leakage and increasing the level of software encryption (such as gesture password, fingerprint password, face password, etc.) has a great impact on the security of Alipay.

In addition, although the scope of the random sampling in this thesis is very large, the sample is not representative enough, because most of the interviewees are young people with higher education. So the factors that affect Alipay's safety may vary from country to country and to those who have not received higher education. Therefore, if a larger range of empirical research is carried out, the better the randomness of sampling, the larger the scope of evidence collection, then the greater the practical value of the results.

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