Factors Influencing the Diffusion of the GIS Technology by SBD Qingdao; an UTAUT Approach

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Factors Influencing the Diffusion of the GIS Technology by SBD Qingdao; an UTAUT Approach

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Abstract

This dissertation examines the roles of various factors of the UTAUT in the adoption of technology by SBD Qingdao to assist in the understanding of technology diffusion within the Chinese swine industry. From research into the Chinese society and swine industry, voluntariness is excluded from the model and education is introduced as a moderating factor. Using a single case study approach, research was conducted on six respondents in influential positions from SBD Qingdao that had direct input into the introduction of the Geographic Information System. Results differed from the original proposed model of UTAUT. It was found that Performance Expectancy (PE), Effort Expectancy (EE) and Social Influence (SI) expected to have direct influence on Behaviour Intention (BI) and Facilitating Conditions (FC) influenced Use Behaviour. PE, SI, FC is expected to be moderated by Experience and Education. EE is moderated by only Education. Age and Gender were not expected to have any moderating effects on the use of new technologies in SBD.

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1.0 Introduction and Research Aims

1.1 Broad Introduction

As the eighteenth and nineteenth centuries were viewed as the age of rapid industrial advancements, where companies gained competitive advantage through production and engineering, the twenty first century is commonly recognised as an age of technology and information (Sunassee & Sewry, 2003). With the modern market place becoming ever more competitive, the ability to implement and the use of technology to manage information has become an important asset for companies. As competitive advantage become increasingly difficult to accomplish, every organisational asset has to be managed efficiently; business knowledge like all other assets, has to be properly managed and correctly implemented to ensure that it works in parallel with the business objectives of the organisation (Wenger, 2004).

In an age where data management and control are computerised, collection and storing of information has become cheaper and more efficient. Consumer access to information has become more readily available with widespread use of the computer and internet technologies (Pearlson & Saunders, 2010). Coupled with the rise in awareness to quality and health concerns, a demand for increased control and processes to ensure quality is evident (Petersen et al, 2002).

This applies to all industries worldwide; pig breeding in China is no different. Traditional farming and breeding techniques are no longer sufficient to compete in the modern business environment as pig farming are becoming more commercialised. Corporate pig breeding and farming companies are just starting to takeoff in China where small suppliers dominate 95% of the Chinese pork industry. This compared to the United States where the top five slaughter houses account for half of the pork

consumed. It has become evident that food safety and quality is believed to be tightly associated with corporate management (Flannery, 2009).

Previous research on the use of information technology in pig breeding and farming techniques in European nations and the United States has shown significant importance and benefits (Lehmann, 2009). But because of the relatively short history and small size of Chinese corporate pig farming, their abilities to utilize new information technologies in the majority of companies are in doubt. The question now is not whether information technology is beneficial to the industry's farming processes but rather whether the Chinese pork industry as a whole has the ability and resources to embrace it (Davis, 2005). Research conducted by Shudong et al. (2008) on Chinese farms' ability to adopt new technologies found that larger farms had a much higher probability of adoption than smaller farms. The research also showed that the majority of famer's viewed technology upgrades are beneficial to their daily tasks.

In the United States, successful swine farms have implemented Geographic Information Systems (GIS) to assist in the monitoring and control of the spread of infectious swine diseases like the H1N1 or more commonly known as the swine flu. Offsite veterinarians and farm personnel are able to precisely pinpoint the location of infected animals and enter individual information into the system allowing for central control offices to effectively dispatch resources as needed (Davies et al., 2007).

Super Breeds Driving (SBD) Qingdao is one of the largest and most successful commercial swine breeding and farming companies in China. Located in Qingdao, Shangdong Province, SBD has one of the most modern swine farming facilities in Asia. The company is looking to improve its overall farming capabilities by implementing a new information system to assist in its ability to control and maintain its farms from its central office in Qingdao.

1.2 Research Aims

The overall aim of this research project is to study the needs, capabilities and readiness of SBD to adopt and use the GIS systems to control and prevent the spread of infectious swine diseases. Using a qualitative, case study approach, this research is designed to look into the possible problems and potential benefits of the GIS system from managerial point of view. The aim of this research is to develop and test a model of the most important factors and their relationships that affect the adoption of new technology in the Chinese swine farming industry. The overall aim of this project is met in a series of objectives which will be addressed within this report.

Firstly, Chapter 2 reviews the relevant literature and past research to identify the potential problems to the adoption of new technology and existing uses of GIS systems in the swine industry.

From the literature review, a model to represent the factors which influence user acceptance of the GIS system by SBD is proposed which uses a modified version of the Unified Theory of Acceptance and Use of Technology which was first developed by Venkatesh et al. (2003). The model is amended to suit the Chinese swine industry setting.

Chapter 3 then describes and justifies the case study research methodology which is used to test the model. The validity of the model is assessed in a series of semi-structured interviews with managerial personnel from SBD.

Results of the case study are summarized in Chapter 4 and the model is further refined using feedback gained in the interviews to describe the expected relationship of various factors affecting technology adoption and usage.

Chapter 5 discusses the findings of the research and Chapter 6 considers the

implications of the findings and the limitations of the research. It is hoped that this work can be used as a foundation for future research into the ability of Chinese swine farms to implement new information technologies like the GIS system.

2.0 Literature Review

2.1 Background

Information technology is a vital aspect of modern day business operations. It is vital for the success of companies in the competitive nature of today's market. The importance of information systems to the success of companies is no longer a secret and is widely accepted. As the differences in technological capabilities between competing companies are quickly becoming negligible, a company's collective knowledge within a certain industry and its ability to manage this knowledge is now viewed as a source of competitive advantage (Sunassee & Sewry, 2003).

China, being the most populated county in the world, is also the largest consumer of pork meat; consuming five kilograms more pork per person than the United States (Fuller et al, 2000). The prices of pork have inflated by nearly double digits between 2007 and 2008, prompting governmental actions to boost production (Food Insecurity, 2008). Shan Dong being the largest province in China, in terms of GDP and population has always been an important economical centre in Northern China.

Quality have become an issue in the pork market in China, as 70 people in Guangzhou province alone fell sick in February 2009 due to below standard pork products. The Chinese government has issued new sanctions to smaller, less sanitary breeding companies in 2008 (Flannery, 2009). Efficient monitoring of the farming process from breeding right through to slaughter and packaging would reduce the chances of contaminated meats causing sickness to consumers (Hines, 2009). For successful monitoring of the entire production, sharing of knowledge and information is essential. The implementation of an information technology system is critical to the proper knowledge transfer between parties (Petersen et al, 2002). In particular, consumers nowadays have the right to and demand to have information on where the product they

are consuming came from. Animal identification and traceability becomes an important factor in ensuring product health and quality (Xiong et al, 2009). As large corporate farming companies are commonly dispersed geographically; farms, slaughter houses, feed factories and head offices are often in different localities, the need for efficient knowledge transfer between departments become even more crucial.

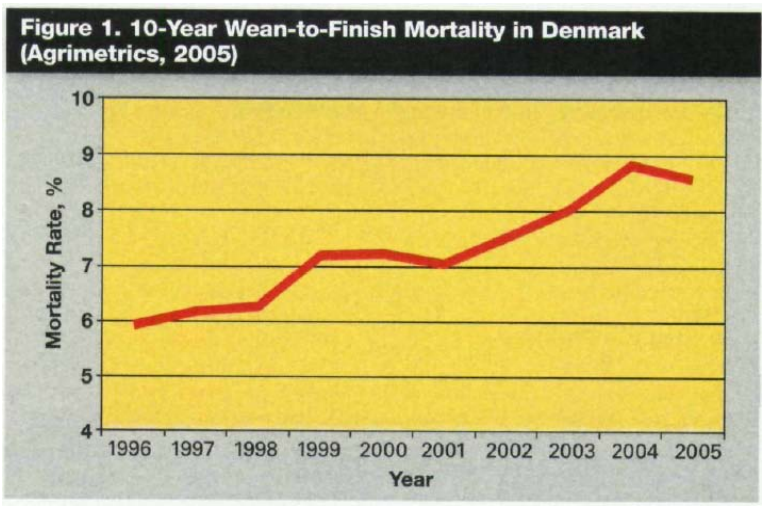
Particularly in recent years, the H1N1 virus or commonly known as the swine flu, has caused growing concerns among consumers of pork products, affecting not only pork prices, but also tourism and wider farming industries (H5N1 and H1N1 2010). Viral swine diseases like porcinis reproductive and respiratory syndrome (PRRS) creates significant damages to swine populations around the world and financial impacts on farmers. The H1N1 disease outbreak in 2009 led to huge financial impacts throughout the pork production chain. Farmers from all around the world right through to retail butchery chains suffered significant financial losses due to the outbreak (Kazemi & Esmaeili, 2010).

Diseases among swine populations hold both health and financial consequences. In recently years, pig and hog mortality rates in farming facilities from around the world have experienced a significant increase. It was proposed to be mainly a result of the change in farming techniques and disease mutation (Vansickle, 2006). Modern swine farming has far higher population density than a few decades ago. Although litter size and birth rates have increased, mortality rates are also higher. Higher population density creates the ideal environment for the spread of diseases and swine farmers are suffering the financial losses as a consequence. As shown in Fig. 1, mortality rates in major swine farming countries such as Denmark has seen a significant increase over the past decade (Vansickle, 2006).

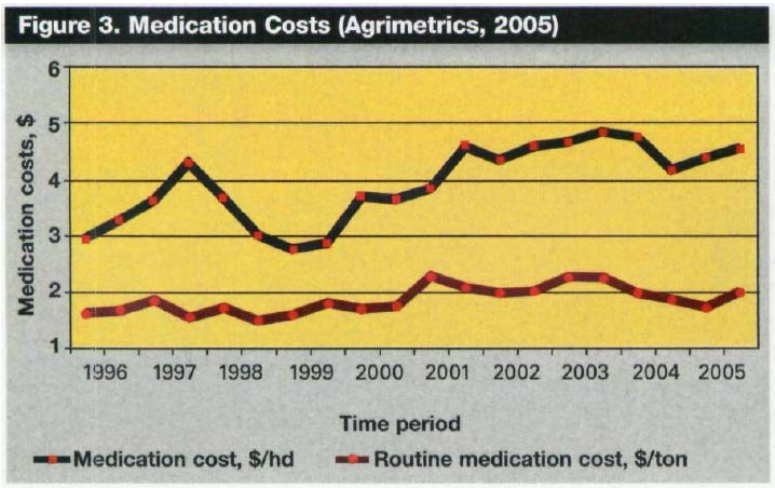
Findings show that although routine medication costs over the last decade have remained relatively similar, medication cost per head of swine has seen a major increase of over $1.5 (US) per head. It should be noted that medication costs have

remained relatively constant largely due to the decrease in medication prices as the veterinarian industry becomes ever more competitive. This added cost to counter diseases on top of increased mortality rates have put extra pressure on farmers and contributed to the significant increase in pork prices for consumers (Vansickle, 2006).

Fig 1: Swine Mortality Rate and Medication Costs



Swine Mortality Rate (from Vansickle, 2006)



Swine Medication Costs (from Vansickle, 2006)

2.2 Information Systems in Pig Farming

With the development of information technology, particularly computer and internet based systems; companies are spending more than ever to improve their own technological infrastructure. It is estimated that since the 1980's, around half of corporate capital investments have been for the development and implementation of new information systems (Venkatesh et al., 2003). Various information systems have been implemented in pig breeding and farming facilities around the world to improve efficiency and quality, particularly in animal monitoring and disease control. Systems have been put in place to ensure pig health and pork quality, particularly in developed countries like the Netherlands, England and the United States to ensure the well being of farmers and consumers (Stärk & Nevel, 2009).

Prior to 1982, all calculations conducted on farming data were done manually. But since then, traditional calculating methods were replaced by central computer processing of herd data. As technological advancements became more and more available to farmers, personal computer based systems become popularised for farmers to conduct their own calculations for their herds. Management Information Systems (MIS), which are systems that are designed to provide information on individual animals to assist in management decisions, helped to improve farming efficiency and processes. Tests conducted on Dutch sow farms showed that the adoption of MIS by farmers have increased productivity by 0.56 piglets per sow per year. This translated into a return on investment from 220% to 348% overall (Verstegen & Huirne, 1995).

In a Beijing swine farm, a system based on Microsoft's network (.Net) technology was used to ensure quality through improved traceability of pork products allowing slaughter houses and retail butcheries to trace products right back to their

breeding parents (Ji et al., 2008). .Net technology is developed by Microsoft and in the words of Jeff Jones, Microsoft's Mid-Atlantic developer evangelist; ".Net software is for connecting people, systems, information and devices" (Porter, 2003). It allows for companies to better interact with their customers, business partners and integrate employees in key company process (Porter, 2003). In accordance with the China Good Agricultural Practice (GAP) policies, the system uses SQL Server 2000 as the database management system; the Pig Health Breeding Management Information System was designed to improve the quality and efficiency of local pork production processes. The system consists of eight modules; farm management, swinery management, feed management, veterinary drug and vaccine management, disease prevention and cures, statistics analysis, GAP management and system management. The system's 'user-friendly' interface and logical structure along with its high security measures made it popular for the Beijing swine farms. The system allows for quality control from central management offices on pork and associated pork products. It also allows for various parts of the production chain to check and trace each individual animal and provides data regarding swine herds. Although this technology has not been adopted by the industry as a whole, it was successfully implemented by this particular Beijing farm (Ji et al., 2008).

To assist veterinarians in the control and monitoring of infectious diseases, Geographic Information Systems (GIS) have been implemented in the United States, particularly in the Minnesota area which is the third largest producer of pork in the USA. Instead of using charts or tables to display information, a GIS system implements a map format to display information in a more visually appealing manner (Mandel, 2010). This web based information system allows for veterinarians in remote areas to input information regarding infected individuals into a centralised data base via the internet. This offers corporate swine farming companies real time surveillance of infected swine population and distribution. Passwords are implemented to ensure only authorised personnel can input and alter information on the database of client farms

(Davies et al. 2007). The GIS system is useful in the prevention of diseases among swine herds. This is of particular importance for pigs raised in pasture environments. They are extremely vulnerable to Trichinella Spiralis infections, which are passed to them through wild hosts. Many pastured pig farms across North America have implemented a GIS system to pin-point infected animals and map the spread of diseases to implement appropriate measures to prevent further infections (Burke, 2008).

Since January 1st, 2005, the European Union made traceability of many consumer products mandatory, particularly drugs and food products. This was to ensure product quality, safety and security. Every aspect of the production process must be recorded in detail and available. Also traceability is a vital element of marketing and positioning. In Spain, Radio Frequency Identification (RFID) technology was utilised to improve the traceability of pork and ham products. RFID uses wireless technology to build a link that transfers information. A RFID tag is applied into pig hind legs that contain information about the origin of the animal for the purposes of tracking and identification. Each of these tags contains a unique identification code and information regarding the animals is kept in a database which can be then accessed. Information can be updated or changed in the database to ensure it is accurate and up to date (Garrido et al., 2010).

Behavioural monitoring systems are often used in farming facilities to study the behavioural patterns of animals. Cameras are used to tape individual animals for later assessment of their behavioural patterns to assist in farm management. A study conducted by Rodríguez-Estévez et al. (2010) used this technology to assess the behavioral patterns of a herd of 86 Iberian pigs. They used this technique to assess their grazing patterns, drinking patterns and resting times/areas. This helped to determine the space required in feeding areas to avoid competition, playing habits and was a good indication of space needed in farms to avoid stress of the pigs. Also it helps with the understanding the social relationships of the animals and optimal sex

composition of the groups. This technique is of particular use during breeding periods where there is a distinct behavioral variance between sexes (Rodríguez-Estévez et al., 2010)

2.3 Uses of Geographic Information System in the Swine Industry

Geographic Information Systems (GIS) are not a new technology. It is extensively used in other settings, particularly in human population distribution and geographical studies. It is also used in market research to map out demographics of consumers (Alexandris & Giannikos, 2010). GIS systems have also been implemented on much smaller scales. In the United States, GIS systems were used in Libraries to map out book locations and desk/computer usages. Detailed records can be kept regarding the usage rate of computers and labs (Mandel, 2010).

It is proposed that a GIS would be beneficial for SBD in its attempt to monitor and stop the spread of infectious diseases. Past studies have shown that the GIS system is effective in the locating and controlling the spreading of diseases (Burke et al., 2008). The capturing and sharing of data is of particular importance to the prompt responses and recovery of disease control (Sheng et al., 2008). GIS systems are used in India to identify malaria areas and help to stop the spread of the disease through mosquito bites. Quarantine and insect sprays were put in areas where there are a high number of malaria cases to prevent the spread of the disease. The GIS system allowed for relevant government departments to have an up to date display of the distribution of malaria patients in order to dispatch appropriate counter actions (Srivastava et al., 2009). In Missouri, USA, the GIS systems are used to help identify areas with high accounts of diseases and health problems among African American communities to assist in the set up of help desks and medical facilities. Serious illnesses such as cancer and HIV are able to be located and attended to with the help of GIS systems (Alcaraz et al., 2009).

The use of GIS systems in the pig farming industry is not new either. In Minnesota, USA, GIS systems have been implemented to help assist veterinarians in the monitoring of diseases among various farms (Davies et al., 2007)

Figure 2 GIS Output (from Davies et al., 2007)

Off site veterinarians are able to access farm information and location along with farm details. With the more widely availability of public information such as aerial photographs and geographic locations, the database is also able to offer photographs and pictures of the farms indicated in Figure 3 (Davies et al., 2007).

Once infected swine individuals are identified, veterinarians are able to precisely locate the animal and mark possible infection areas around the infected farm. This radius is user defined according to the density of swine population and existing possible transmission mediums (Davies et al., 2007).

Figure 3 Identification of potentially infected areas (from Davies et al. 2007)

In the United States, the GIS system was also used to monitor pasture raised pigs. Because they are vulnerable to Trichinella Spiralis infection, the GIS system was used to determine the spreading patterns of the disease. Infected farms and animals were mapped out on the GIS system as indicated in figure 4 (Burke et al., 2008).

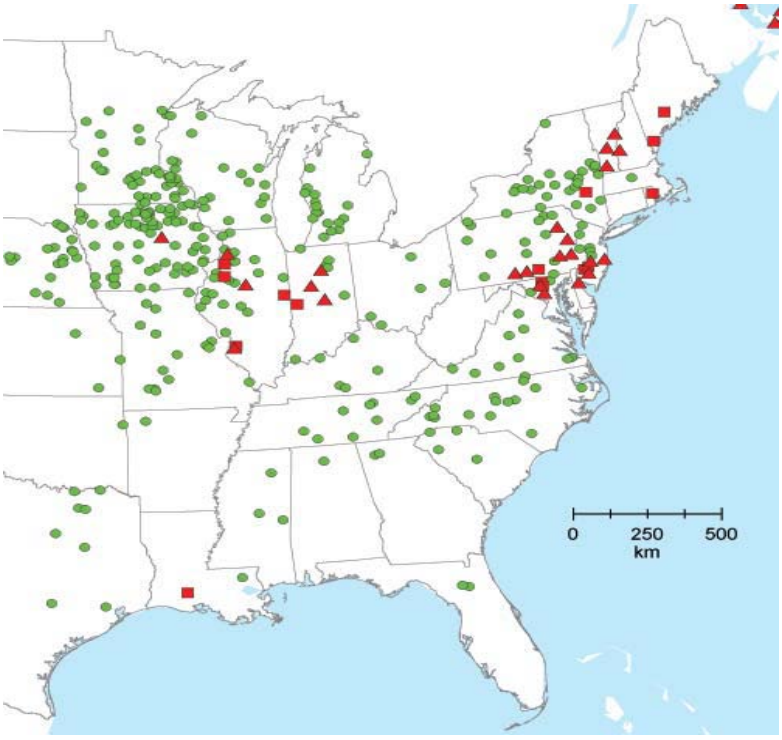


Figure 4: Locations of pastured-pig operations (green dots) and previous records of *Trichinella spiralis* in domestic pigs (red squares) and wildlife (red triangles) (Burke et al. 2008).

It was found through the system that infections were occurring within 50km of the previous infected farm. This assisted veterinarians and farm owners to set up preventions and control efforts to stop the spreading (Burke et al., 2008).

In Taiwan, the GIS system was used to assist in the generation of biogas from swine manure. The GIS system was used to locate and identify swine farm clusters where swine manure is abundant. By incorporating a GIS system into the biomass-to-energy system, it was found that the collection of high dry matter swine manure within 40km showed superior performance than collecting low dry matter swine manure within 10km. This has significant environmental effects as it contributes to lower carbon

power generation, pollution reduction and the reduced production of greenhouse gases (Yeh et al., 2011).

The GIS system could be used by SBD to map out individual farms both on a micro scale and macro scale. On a micro scale, SBD could to map out farm houses and transportation routes. This would allow for SBD to monitor and locate infected animals within each farm to prevent the transporting and direct contact between infected individuals and healthy individuals. On a macro scale, SBD would be able to directly input diseased farms. This, with the cooperation with other companies in the Shandong province, could provide an overall mapping of all swine infections. This will help in the prevention of epidemics which causes enormous financial loses to the entire province.

GIS systems could also assist SBD in their breeding schemes. The mapping of herds of various traits can be beneficial for the overall planning and movement of animals. It allows for a quick and easily accessed information source to locate a specific herd. Information regarding individual herds could also be displayed to build on the existing spread sheet format.

2.4 Diffusion of the GIS Technology

2.4.1 Influencing Factors

Every situation will be different and so would the factors affecting the introduction of new technology. The following factors are perceived as the most influential for the diffusion of the GIS system by SBD Qingdao. It should be noted that a revolutionary change such as introducing a new information system to company operations can be overwhelming. Various forms of resistance can be expected in a sudden significant change within the processes of a company. Psychological, cultural and political resistances can occur during times of change (Wit & Meyer, 2004).

There are barriers which can restrict the successful implementation of a new technology. The ‘size’ of these barriers is influenced by a lot of factors such as country or industry and could vary greatly. The ‘size’ of these barriers has a great influence on the amount of investment a company must make to implement a new piece of technology (Parente & Prescott, 1994).

The rate at which the technology is adopted represents a major part in technological advancements. It is dependent on the industry and setting of which the technology is introduced to (Hanman & McDowell, 1984). It is commonly accepted that new technologies are complimentary to skills and knowledge of the company, however, the effects of a newly introduced technology are not commonly felt immediately (Boothby et al., 2010). Through past research, it has been proven that it is common for performance to drop immediately after the introduction of process changing technology. But after a few months, performance improves dramatically. This suggests that there is a learning curve involved. It is dependent on the company’s willingness to invest in time and resources to ‘learn’ the new technology (McAfee, 2009). It is important that SBD sets up measurement processes for technological systems to

determine their effectiveness and keep track of progress. This will also act as a motivational element for managerial staff when progress can be visually seen.

Much research has gone into the acceptance of information systems and factors that influence the diffusion process. The implementation of information systems by companies in urban areas have been heavily studied around the world particularly in the business setting. For example Wang et al. (2010) conducted extensive research into the adoption of computer based information systems in the business to business sector in Taiwan. Moving away from the much investigated business to business sector, Ahearne and Rapp (2010) looked at the role and adoption of technology between salespeople and consumers. Research by Wymer and Regan (2011) looked at the adoption of e-technology and e-commerce by small to medium businesses in the United States.

But the utilization of IT systems in rural areas has lacked insightful analysis, particularly in China (Muniafu et al., 2005). Educational levels of rural Chinese areas are significantly lower than urban educational levels, and a main cause to this is the lack of access to information and technology (Brock, 2009). Due to the nature of the industry; demand for readily available feed, transportation, air quality and space, swine farming facilities tend to be in rural areas. This causes the majority of employees, farmers and other human-labour to be local rural inhabitants, thus generally of lower education levels. This is of particular interest as the GIS implemented in Minnesota was designed for the use by Veterinarians whereas the implementation of GIS in China would be designed to be used by farm employees (generally educated at a lower level) who have daily contact with the swine population.

Factors such as a person’s personal innovativeness have long been recognised as an influencing factor in the use of new technology. Mort and Drennan (2007) found in their research that self-efficacy is another major contributor to the use of information

technologies. Self-efficacy is the “belief in one’s capabilities to mobilize the motivation, cognitive resources and courses of action needed to meet given situational demands” (Mort & Drennan, 2007). The level of self-efficacy will affect the commitment of individuals. Those that have a low self-efficacy tend to focus on personal shortcomings and expect failure. In contrast, those that have high self-efficacy will tend to set higher goals and added commitment (Mort & Drennan, 2007). Zolait (2010) confirmed this through his research into the use of Yemini Bank internet banking services. For SBD Qingdao, the self-efficacy and personal innovativeness of managerial personnel will affect their commitment, in turn affecting their subordinates. Managerial views on the introduction of new information systems within their company directly affect the success of the implementation. Often it is difficult to change personal views and habits especially if self interests are involved. Hierarchal changes may occur and previous tasks may be made redundant with new technology. This would bring even more resistance to the utilisation of new information systems such as the GIS system. This makes managerial support and dedication even more critical.

Over the past two decades cultural aspects of technological diffusion have been under extensive study (Venkatesh & Zhang, 2010). Each individual has an internal pattern for thinking, feelings and potential movements formed from lifelong learning and experience. The social environment acts as the ‘overall boundaries’ of this formation of internal patterns. Great variances can occur across different cultural backgrounds which can affect individual reactions to the diffusion of technology. One of the main dimensions of cultural variances that affect the diffusion of technology is the avoidance of uncertainty. As mentioned before, it is common for company personnel to feel a sense of uncertainty during large scale changes. Uncertainty avoidance is the extent of which individuals among a society attempt to cope with unease by reducing uncertainty. Different cultures tend to have different levels of uncertainty avoidance, where those that have high levels tend to be reluctant to take risks and prefer structured environments (Lean et al., 2009). It should be noted that ‘culture’ can vary

not just across nations but also between urban and rural borders as well as specific company cultures. Much of previous research has been conducted in Western setting and urban areas. Research by Zhang (2010) into cultural characteristics has shown that the Chinese culture and society in general are more conservative than Western nations, particularly in the rural areas where residents still hold onto traditional practices, thus high on the uncertainty avoidance index. The Chinese society is also extremely conservative about 'imported culture', making it often extremely difficult for foreign procedures and methods to enter the rural societies (AA, 2010). The conservative nature of the Chinese society may affect employee willingness to 'experiment' with the GIS system at SBD, creating difficulties in its uptake.

Peansupap and Walker (2005) highlighted the importance of a proper work place environment to improve the technology diffusion process. Personnel must be communicated with and be provided with an environment where they can safely discuss difficulties with using the newly introduced technology. Also management must be open to suggestions for changes or alterations. In addition, an environment with strong peer support is extremely important. It is critical that SBD sets up the proper environment for employees for positive acceptance and learning of the GIS system.

It should be noted that the gender composition of individual departments will have a direct effect on teamwork, communication and cooperation. Studies done on teamwork and performance shows those groups with relatively higher female composition tend to have better team work and team problem solving abilities (Hirschfeld et al., 2005). Currently SBD farming facilities are predominantly male with a total of 6 female farm employees currently employed throughout the 11 farms compared to over 300 male employees. This is a factor which company management needs to take into consideration.

2.4.2 Research Model

Many different models have been proposed trying to explain the acceptance process of new technologies. Widely accepted and popular models like the Technology Acceptance Model and the Theory of Reasoned Action work well in explaining the influencing factors behind technology acceptance. Each different model has its own set of determinants to explain the process with their individual strength and weaknesses (Venkatesh et al., 2003).

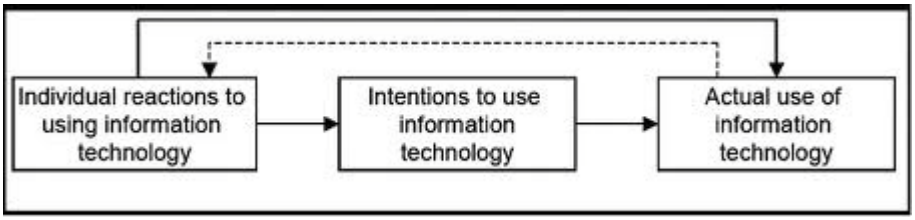


Fig 5: Basic Concept Underlying User Acceptance Models (from Venkatesh et al., 2003)

The basic framework is to assess intention and/or usage as the dependent variable. Following on from this concept, Venkatesh et al. (2003) proposed a Unified Theory of Acceptance and Use of Technology (UTAUT) by combining elements of eight popular frameworks. By combining similarities of previous adoption models, the UTAUT not only covers the individual level factors, but also identifies elements which could amplify or constrain these factors (Venkatesh & Zhang, 2010). By combining the Theory of Reasoned Action, Technology Acceptance Model, Motivational Model, Model of PC Utilisation, Theory of Planned Behaviour, Innovation Diffusion Theory, Social Cognitive Theory and the Combined Technology Acceptance Model and Theory of Planned Behaviour, UTAUT was found to explain 70% of the variance in usage intention of new technologies (Venkatesh et al., 2003).

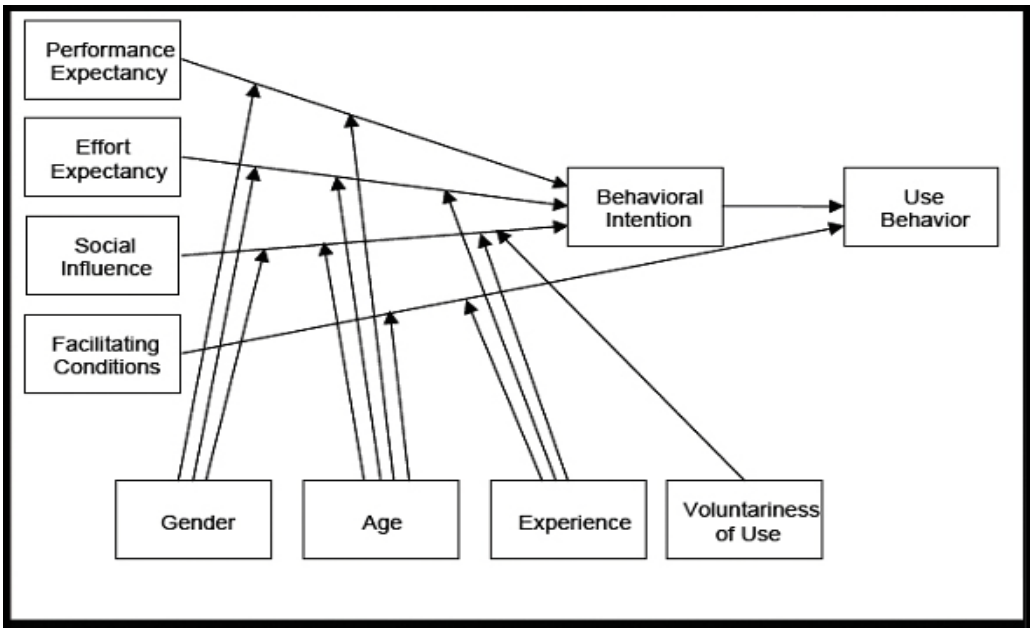


Fig 6: UTAUT Model (from Venkatesh et al., 2003)

Table 1: UTAUT Definitions

Key Construct	Definition
Performance Expectancy	"the degree of which an individual believes that using the system will help him or her to attain gains in job performance"
Effort Expectancy	"the degree of ease associated with the use of the system"
Social Influence	"the degree to which an individual perceives that important others believe he/she should us the new system
Facilitating Conditions	"the degree to which an individual believes that an organisational and technical infrastructure exists to support use of the system"

(Venkatesh et al., 2003)

The UTAUT highlighted four determinants which affect the usage of new technology. Performance Expectancy (PE), Effort Expectance (EE) and Social Influence (SI) directly influence the personal intention of use, where higher PE and SI and lower EE will lead to higher intention of use. The model also identified two determinants of usage; Facilitating Conditions (FC) and Behavioural Intension (BI) which directly affect the usage from personnel, where higher FC and BI will lead to higher level of

usage. The model also acknowledged four contingencies which can alter the determinants by either amplifying or diminishing their effects; Gender, Age, Experience and Voluntariness.

The UTAUT was developed and tested predominantly in the United States. Research conducted in Saudi Arabia however, suggested that although UTAUT accounted for most of the variances in technology use, tests outside of the USA found less variance explained. This indicated the importance of incorporating cultural differences into the acceptance model (Al-Gahtani et al., 2007).

Venaktesh and Zhang (2010) tested the UTAUT model to compare the differences between USA and China and results highlighted the effects of cultural differences with the most noticeable effect being the collective nature of the Chinese society. Research conducted by Hofstede (1983, 1983) confirmed this and his results showed that China and USA were significantly different in their levels of individualism/collectivism. Americans were found to be extremely individualistic (where they take care of themselves) while the Chinese society were high in collectivism (where individuals expect the group to take care of them in exchange for loyalty). He stated that many Eastern Asian countries have a deep root in Confucius teaching and it affects every aspect of life in these nations.

The research conducted by Venaktesh and Zhang (2010) in using the UTAUT model to understand technology adoption in China show aspects that were different to that of the American settings. The results show that the relationships relating to Performance Expectancy, Effort Expectancy and Facilitating Conditions on behaviour intention/usage remained consistent while the relationships relating to Social Influence varied between China and USA. The model was amended to suite the Chinese business environment for understanding technology adoption. The following diagram indicates their new proposed UTAUT for China.

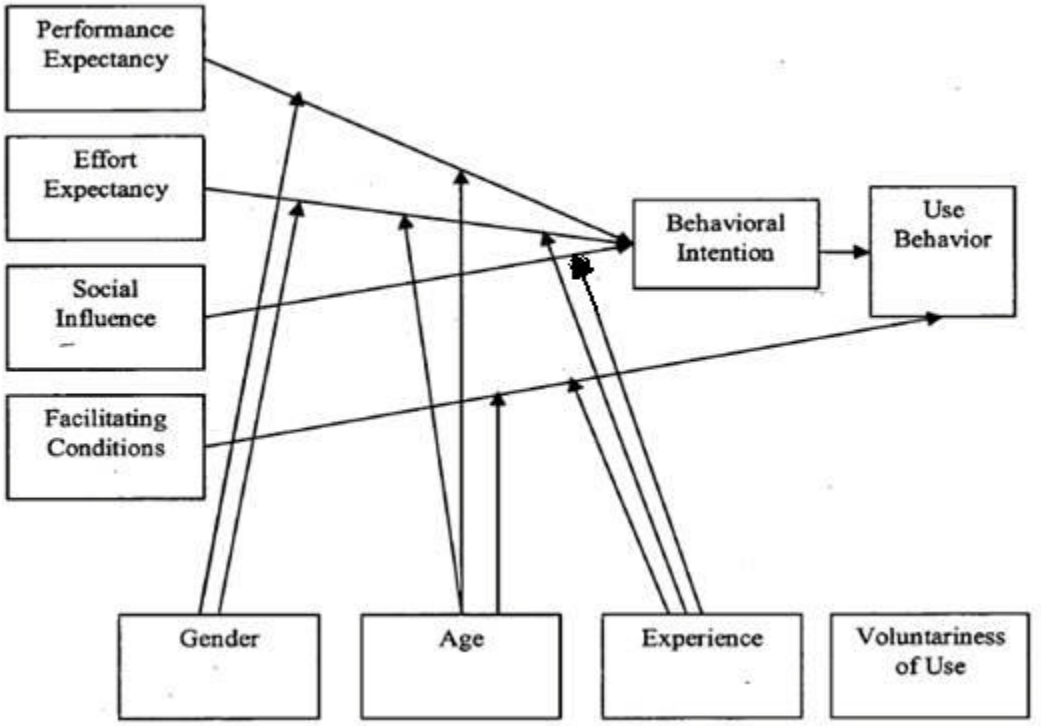


Fig 7: Updated UTAUT for China (from Venaktesh and Zhang, 2010)

As seen in the diagram above, certain changes were made from the original UTAUT. The effect of Performance Expectancy on intention remain constant, its effects vary across gender and age; strongest for younger men. Relationship relating to Effort Expectancy also remained constant varying over gender, age and experience; strongest for older women in early stage of experience. Facilitating Conditions also remained the same in that it varies across age and experience; strongest for older workers in later points of experience (Venaktesh and Zhang, 2010).

Due to the cultural differences and social structure, the effect of Social Influence in China was different from that of the USA. The effects of Gender, Age and Voluntariness on Social Influence were irrelevant in China. Social Influence effects were only moderated by Experience in a way that it was stronger for employees/personnel with less experience as they tend to be uncertain about the jobs at hand, thus leading to being more influenced by others (Venaktesh and Zhang, 2010).

It should be noted that voluntariness does not play a significant role in China. This is due to the collective nature of the Chinese society as mentioned before. Individuals have a tendency to work towards 'harmony' and compromise. Conflicts are avoided through agreement and people tend to defer to other's opinions. This is to maintain relationships and collaborations (Venaktesh and Zhang, 2010).

According to Dr Alan Sun of SBD Qingdao, Chinese employees in general stress the philosophy of 'guan-xi'. The Bloomsbury Business Library – Business and Management Dictionary (2007) translates it to 'connections' referring to the trust and relationship between business partners. This was confirmed through McKenna's (2001) article regarding business in China, which stated that 'guan-xi' is an essential element to business operations in China. Lin (2011) stated that 'guan-xi' is the Chinese understanding of relationship in English. It is both the basis of how people and businesses interact and a potential source of competitive advantage. Individuals tend not want to be 'unique' and strive for 'common' among groups to avoid destroying existing 'guan-xi' or potential future 'guan-xi'. This element of 'guan-xi' builds on the collective nature of the Chinese society leading to the irrelevance of voluntariness which is an individual's own willingness to use the system on a non mandatory situation (Venaktesh and Zhang, 2010).

Through the tests conducted in China, it showed that the UTAUT accounts for 64% of variances in behavioural intention compared to 70% in the United States. But the new amended version of UTAUT with fewer interaction terms accounted for 68% of the variance in behavioural intentions regarding the use of technology (Venaktesh and Zhang, 2010).

One aspect of the research by Venaktesh and Zhang (2010) that should not be overlooked is that the research was based on a sample of employees from an organisation that operated in both the United States and China. To ensure that the research was controlled and only cultural differences were measured, participants

chosen operated in the same business unit conducting the same work; business analysis. Also they were knowledgeable employees with a high average education level. But this is not the case for SBD as the employees that are going to use the GIS system vary greatly particularly in education levels and job functions. As mentioned before, the education level in rural areas in China are significantly lower than Western nations. According to Dr Alan Sun, unfortunately for SBD Qingdao, the majority of employees are of relatively low education levels. This will have a significant effect on the diffusion of the GIS technology by SBD Qingdao.

It is widely accepted that the differences between educated and uneducated personnel is tremendous, especially in terms of income, promotions and favourable treatments (Morgan 1929). Education levels also have a significant influence on diffusion of technology in corporate environments. In Porter and Donthu's (2006) research into the effects of attitudes towards the usage of internet, they found that the level of education affects an individual's attitudes towards the use of technology. In the research, they stated that the level of education affects the perceived usefulness (PU) (Performance Expectancy) in that it is stronger for higher educated individuals and perceived ease of use (Effort Expectancy) in that the effect is stronger in those who have lower education. Research in Indonesia also shows that it is common for early adopters of new information technology to be highly educated (Wahid et al., 2004).

As stated before, work experience moderates the Social Influence of acceptance of technology. Employees with relatively lower experience tend to defer and are more likely to be affected by the more experienced individuals (Venaktesh and Zhang, 2010). Like experience, education is believed to have similar effect on Social Influence, that it is stronger for lower educated people.

Bergeron et al. (1990) highlighted the importance of a substantial education program as part of the diffusion process of technology. As experienced personnel tend to find it easier to located different mediums of support and help, less experienced employees

require additional help and support. Through education programs, less educated personnel can gain the information and training required to utilise new technology. Yet the same program may not be sufficient for educated people (Venkatesh et al., 2003). Research by van Ours and Ridder (2000) indicated that organisations are more likely to invest in the training of higher educated individuals as they are harder to replace in comparison to easily replaced lower educated personnel. Thus the influence of education on the Facilitating Conditions in that it is stronger for higher educated individuals.

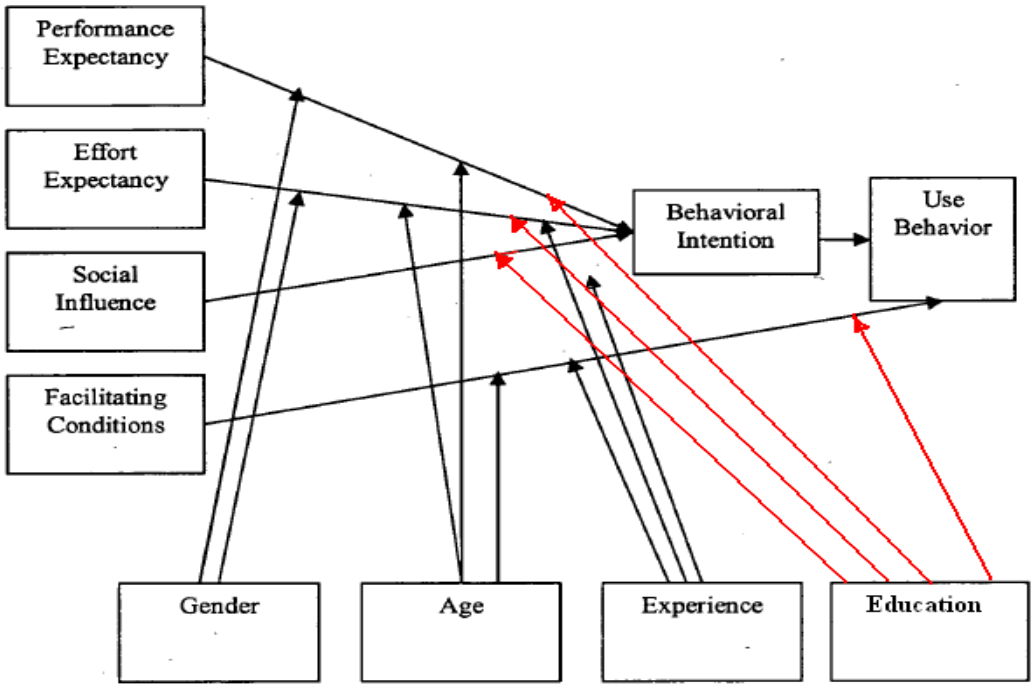


Fig 8: UTAUT for SBD Qingdao

The above model is proposed to represent the influences on the diffusion of the GIS system by SBD Qingdao. Using the amended UTAUT for China and adapting it to the context of the organisation it frames this research. A moderating factor of Education is added to suit the circumstances of SBD Qingdao where the effects of Performance Expectancy and Facilitating Conditions will be stronger for higher educated individuals. While the level of Effort Expectancy and Social influence will be stronger for lower educated employees leading to lower Behaviour Intention.

3.0 Methods and Limitations

3.1 Overview of Research Approach

The purpose of this study was to determine the major barriers in the acceptance and usage of the GIS technology by SBD Qingdao. Using a positivist approach, this research attempts to test the Unified Theory of Acceptance and Use of Technology (UTAUT) proposed by Venkatesh et al. (2003) on the Chinese swine industry. By using a positivist approach, we attempt to establish results that could be replicated for other swine farms in China through a highly structured methodology (Saunders et al. 2007). This research uses a qualitative approach seeking exploratory information regarding the potential barriers and promoters of implementing the GIS system in SBD Qingdao. It is hoping to seek out the factors which are most influential to the introduction of the GIS system to SBD and in the wider perspective of the Chinese pig farming industry in its natural setting, rather than testing the introduction in a control environment (Denzin & Lincoln 2000). By using a deductive approach by building on the modified UTAUT model for China proposed by Venkatesh and Zhang (2010), an updated version of the UTAUT for the specific situation of Chinese swine industry, we are hoping to build a model which can be generalised throughout the Chinese swine industry.

This research uses a case study approach to study the needs, barriers and capabilities of SBD Qingdao to implement the GIS system into its corporate farming strategies. A case study involves the ‘empirical investigation of a particular contemporary phenomenon within its real-life context, using multiple sources of evidence’ (Saunders et al., 2007 page 592).

This research relates to systems relating to the tracking and traceability of the swine

population to ensure animal health and assist in breeding schemes both within the company and with external pig breeds. With over fifty thousand pigs spread through its various farming facilities, the traceability of each individual animal becomes a potential problem. Also with the number of employees coming into contact with the animals, infections and diseases are easily transmitted, putting the company in immense risk of financial losses. Note that enterprise focused information systems which are systems implemented to improve management strategy and styles are not examined as they are beyond the scope of this research paper.

The reasoning for choosing a case study approach is that it allows for research into a particular phenomenon within its real life context. It also allows for in-depth understanding to the needs of SBD Qingdao and its managerial team. The case study approach allows for exploratory research to understand the 'why' behind phenomenon while other strategies tends to only provide 'how' and 'what' results (Saunders et al., 2007).

A single case strategy is utilised in an attempt to seek conclusions regarding SBD Qingdao's needs, capabilities and readiness to use the GIS system to act as a foundation for the implementation process. While an embedded case study focuses on a specific sub-unit of the company, we are more concerned with the company as a whole, thus a holistic approach is taken. That is, this research looks at the company as a whole unit rather than concentrating on a specific farm or sector of the company (Saunders et al., 2007).

As mentioned previously, corporate pig breeding and farming in China has a relatively short history compared with that of developed Western nations. Individual suppliers of pigs and pork meat dominate over 95% of the Chinese pork industry. According to Dr Alan Sun, individual pig farmers range from family bases farms consists of 10-20 meat pigs to village based farms consisting of 200-500 animals. Their need for a system like the GIS system is limited due to the small number of

animals considered. Also their average production, resources and capabilities are limited to implement a system like the GIS technology. Small individual farms tend to only supply surrounding areas making traceability irrelevant. Thus this research uses a case study approach as there is a limited number of large commercial pig farming companies in China. Also by purposefully choosing a company looking to upgrade its information technologies, we are able to assess a participant who has the desire, resources and capabilities to implement a system like the GIS. It is noted that the results would be more generalised with additional swine companies, but with the limited number of corporate pig farming companies in China and geographical restraints of the research, a focus on SBD is chosen.

SBD Qingdao is chosen as it fulfils the requirements of the research aims. Their need for an upgrade in information systems to manage the spread of infectious diseases played a major factor in the decision process. The large financial loss suffered by SBD in 2009 prompted the company to upgrade its company facilities to ensure that this type of disease transfer is contained in the future. Also SBD Qingdao being one of the largest swine breeding and farming companies in China has the resources to implement and utilise a system like the GIS technology. Furthermore, after the introduction of the GIS system to the Managing Director, he was interested in the potential that the system had for the organisation and was willing to grant access. They were interested in the result as it could be part of the basis of action for future technology introduction.

Using the modified UTAUT, we hope to identify the potential problems, company preparation and needs for each of the constructs that affect Behavioural Intention and or Usage. Each of the moderating elements will be considered to determine if the company is ready to implement the GIS system.

We seek exploratory information regarding the potential barriers and supporters of implementing the GIS system in SBD Qingdao. It is hoping to seek out the factors

which are most influential to the introduction of the GIS system to SBD and in the wider perspective of the Chinese pig farming industry in its natural setting, rather than testing the introduction in a control environment (Denzin & Lincoln, 2000). By using a deductive approach, the amended UTAUT is tested against the Chinese swine industry.

3.2 Sampling Techniques

The sampling frame was the total population of senior managers and farm managers of SBD Qingdao which is a total of 38 personnel. A purposeful sample selection strategy was applied to the managers to ensure that all SBD farms and sub companies were represented. This strategy was chosen because of the limited numbers of SBD corporate managers that have direct influence on the implementation process of the GIS system. The reasoning behind choosing purposeful sampling in comparison to other sampling techniques was to ensure that the most appropriate samples were chosen to answer and meet the research aims. This is used as there is a small sample to choose from and we are hoping to choose participants who are most informative (Saunders et al., 2007). It is understood that probability sampling tends to bear results which are more easily generalised (Saunders et al., 2007), but due to the limited number of managers who have direct control over the implementation of the GIS system and their availability, participants were chosen with a non probability sampling approach.

A total of six corporate managers were chosen from SBD including two senior managers, two farm managers, one chief veterinarian, and one information managers. Managers were chosen as they have direct authority on the implementation of the GIS system and will be directly using the system to ensure that the information collected was appropriate to reaching the research aims.

3.3 Data Collection

Qualitative interviews are often associated with semi structured interviews, this is the technique that was utilised. It allows for both exploratory and explanatory information. The interview medium was 1-on-1 and conducted either face to face or via telephone/skype technologies. In comparison to group interviews, 1-on-1 structured interviews does not allow for in-depth discussions among participants. Although discussion among participant can bring insightful information, but due to the availability and geographical constants, 1-on-1 structured interview format is chosen.

The details and order of the questions being asked was determined by the flow of the interview. The conversation was recorded and assisted by note taking (Saunders et al., 2007). Interviews were centred on the amended UTAUT model keeping in mind the influencing factors that would likely to give rise to problems for SBD. All interviews were audio recorded for later references assisted by notes taken during the process. Each interviewee was sent an information pack regarding the GIS system and its functions along with an interview schedule. Collection of employee demographic information was done through the company database. Only age, experience, gender and education levels were collected during the interviews.

3.4 Access and Translation

Saunders et al. (2007) mentioned that access into organisations can be a potential problem with organisation staff concerned regarding the privacy of company information and processes. They defined access as “the process involved in gaining entry into an organisation to undertake research or the situation where a research participant is willing to share data with a researcher” (Saunders et al., 2007, pg. 591). Access for this research into SBD Qingdao was pre-arranged with its managing director and participants were contacted prior to the arrangement of the interview. Information regarding the research was sent through to the managing director via email and once permission was given, individual participants were contacted. Information regarding the research contents and aims were sent to the participants along with an interview schedule and an introduction to the GIS system. The introduction of the GIS system included photos, information on its uses and operation, requirements and benefits.

With the potential for bias and loss of information during translation, three translators including myself were used to ensure that the best possible processes were followed. Simon Shao (Canterbury University Economics Masters Graduate), Leo Li (Canterbury University Economics Masters Student) and myself worked together to translate the information sheet, introduction to GIS and the interview schedule before sending it to participants.

3.5 Interview Schedule

An interview schedule was sent to all participants prior to the actual interview. Please refer to Appendix 3 for the full schedule. The interview schedule includes an introduction to the GIS system, ethics statement from the Ethics Committee of Massey University, an outline of the questions involved and includes a diagram of the type of maps a GIS system would produce.

The initial schedule was constructed in English. With the help of Simon and Leo, it was translated into Chinese. It is designed to allow participants to have a brief idea of the contents of the interviews and have some preparation beforehand.

The interview starts by asking simple background questions regarding the participants such as position, age, and education level and so on. The main body questions of the interview revolve around the UTAUT model. It first focuses on the four main determinants of usage intention and usage behaviour; Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions. It then moves onto the four moderators; Gender, Age, Experience and Education. The questions revolve around the perceived relationships between the various determinants and moderators. At the end of the interview, participants are asked to comment or highlight any other potential aspects which could inhibit or promote the adoption of the GIS system by SBD. Please refer to appendix 3 for full questions asked in the interviews.

3.6 Qualitative Data Analysis Techniques

Interview results were first transcribed from the audio recording including notes regarding tones, time spent on questions and other non-verbal signals. All transcripts were typed out and emailed to respondents in order to ensure that they were accurate. Once gaining their approval on accuracy and meaning, it was then translated into English by Simon, Leo and myself for analysis.

Pattern matching was applied to determine the most influential factors which might inhibit or promote the diffusion of the technology by SBD. Simple analysis was applied to the results of the interview on the importance of each factor to determine the most common factors that the managers feel that are the most important for the introduction of the GIS system.

A new UTAUT model was drawn for each participant. From these individual models; an overall model for SBD Qingdao was developed to determine the most appropriate model for the situation. The overall model is drawn to cover the most participants. Relationships from two or less participants are ignored.

3.7 Triangulation of Data

To ensure the accuracy of the information collected and the meaning behind it, triangulation is used in this research. Triangulation is the use of varies different data collection techniques with in one piece of research to ensure that “the data are telling you what you think they are telling you” (Saunders et al., 2007, pg. 139).

Aside from the information collected from the interview participants, data was collected from the company website, side interview with Dr Alan Sun and some company staff records.

The participants were deliberately chosen from different departments of the company to gain insight into the views on the various factors from different perspectives. Top management, including human resource department was to gain insight from an overall company perspective. The information manager was chosen because he has had past experience in dealing with the implementation of new technologies in the Chinese farming industry. The two farm managers were chosen because they have direct management and contact with the front line staff members that would be using the GIS system. The veterinarian from SBD provided data from a perspective of an end user who would benefit from the information that the system produces.

3.8 Ethical Issues

Prior to collecting data from the interview participants, I applied for and was granted approval for the research from the Massey University Human Ethics Committee. A copy of the approval letter is included in Appendix 1. It was deemed low risk by the Committee and was recorded on the Low Risk Database. Participation in this piece of research was to be totally voluntary, informed and consent was to be sought and the Human Ethics Committee approved the study as not being harmful to the participants.

The ethics statement (please refer to information sheet, appendix 2) was translated into Chinese and was incorporated into the structured interview schedule along with the English version to ensure that all participants had a good understanding of the ethical elements of this research.

The central idea of ethical issues in this research was to prevent harm and stress for the participants and others involved (Saunders et al., 2007). Not only ethical issues of participants were considered; the rights of the practitioner or client are not neglected. Both sides of the research; the participants and researcher rights were put into consideration for this research. It needs to be noted that the cultural and gender differences will cause different views on research ethics (Svensson et al., 2009). Akaah's (1989) research into the difference in views on research ethics by females and males indicated that the demand for ethical behaviour was different between males and females, in that female participants tend to show a higher emphasis on ethical behaviour. This aspect was taken into consideration when formulating questions for different genders. Sensitive information such as age for female participants was avoided.

It is widely accepted that cultural differences will have an effect on views on ethical behaviour. Different cultures tend to have different levels of acceptance in what is ethical and what is not (Ma, 2010; Cohen et al., 2002). Whipple (1992) indicated in

his research that there are even variances in the teaching of research ethics caused by cultural differences. As part of this research, ethical issues concerning the Chinese environment were also considered; politeness factors and wordings were incorporated into the interview to ensure that all participants were treated in an ethical manner.

Aside from the research formulation, each stage of the research process was carefully conducted to ensure that it meets the standard of the Massey University Ethics Committee. Starting from research access; full permission was obtained from SBD Qingdao before any contact was made with its employees. No information obtained regarding the company or its operations were without the full permission from the Managing Director.

During the data collection stages, all participants were assured of the voluntary nature of the research. They were notified in the interview schedule that they were welcome to withdraw from the research at any time and again reminded at the beginning of the interview that if they have the right to refuse to answer any questions if they feel they were uncomfortable with the content of the research. All interview audio recordings were deleted after transcription and translation was completed. During this time, the recordings were kept securely on a computer hard-drive requiring password access. Participants' anonymity were assured through pseudonym relating to Japanese automotive brands such as Honda, Toyota or Mazda.

Data analysis and presentation of results and findings were conducted in a manner so that it ensures the accuracy of information and quality of presentation. All findings were ensured that it was not misleading or misrepresenting. Participants were clearly informed of the use of the findings and results. All information from the research were stored and handled in an appropriate manner.

4.0 Findings, Results and Data Analysis

4.1 SBD Qingdao and Its Need for IS Technology Upgrades

4.1.1 Company Overview

Super Breed Driving (SBD) Qingdao was established in 2007 and quickly developed into one of the largest swine breeding and farming companies in China. Currently it has four subsidiaries; Weihai SBD Breeding Company Limited, Yantai SBD Farming Company Limited, Qingdao Yinnan SBD Breeding and Yingnan County Agricultural Garden Growth Company Limited. SBD's emphasis on technology and expertise in its breeding schemes has helped them to becoming one of the most modern swine breeding and farming companies in Asia.

Currently SBD has 11 farming facilities of which there is one central core farm in Qingdao, three breed expansion farms, seven growth farms and one agricultural growth facility which produce and supplies feed and other vegetation supplies for the other farms. SBD supplies over 5000 first generation pure bred pigs and 15,000 second generation pigs onto the market every year.

American Duroc Line (1st Generation) 1st Generation large x long white female

In 2008, SBD became the first commercial company in China to import top quality breeding pigs into China. The company introduced 600 top of the line first generation pigs including the Long White, Large White and Duroc Pigs from Genetiporc Incorporated in Canada. These species of swine possess desirable traits like larger litters, high immune systems against influenzas like H1N1 (swine flu), shorter pregnancy periods and faster growth rates (Dr Alan Sun).

4.1.2 Company Management Structure

SBD managing director, Dr Alan Sun graduated from Sydney University in 1989 with a Ph.D. degree in agriculture and was a Postdoctoral Lecturer at Massey University Palmerston North. He also graduated from Wisconsin University with a MBA degree in 2006. He has held various roles in internationally renowned swine companies like the chief technical manager at Taiwan Xiang Pu Agricultural Company, Asia General Manager for ADM America and Asian General Manager of Topigs International (http://www.sbdpigs.com).

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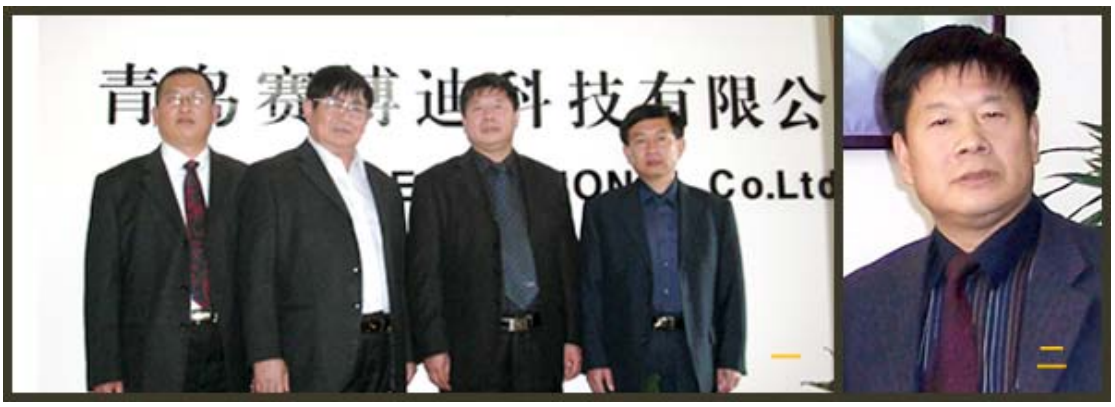
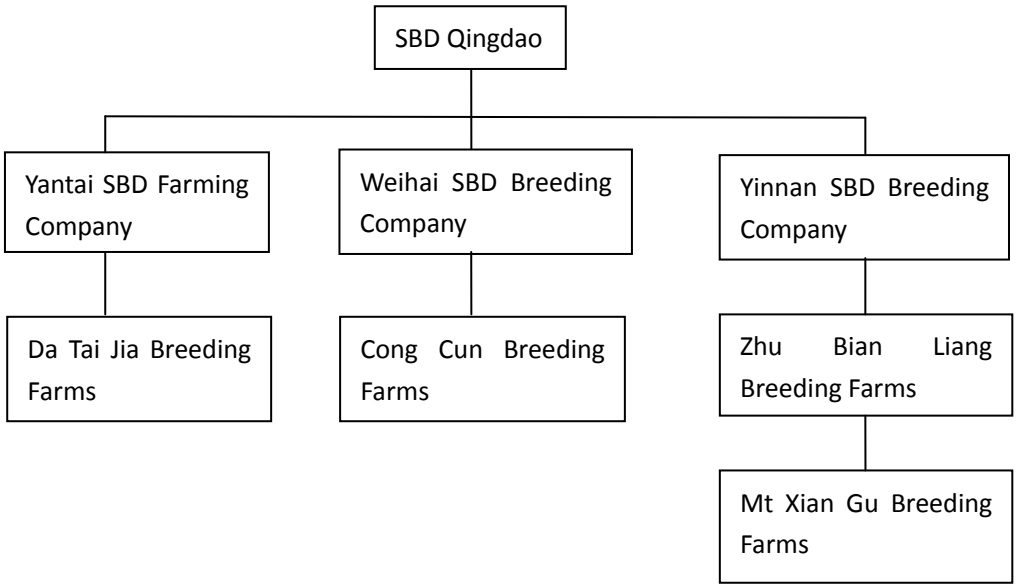


From left to right: Dr Li Yu-Cai (Deputy General Manager), Mr Zhou Yu-Xiao (General Manager), Dr (Alan) Sun Yu-Xian (Managing Director), Mr Yin Pei-Zhen (CFO). Insert: Dr Alan Sun

The company is operated from its central control office in Qingdao under the supervision of Dr Alan Sun. Each subsidiary company has its own general manager that report to SBD general manager, Mr Zhou Yu-Xiao. Each farm has a farm manager and chief technical consultant that report directly to the relevant subsidiary company manager. The only exception is Yingnan County Agricultural Garden Growth Company Limited which works in cooperation with other companies and farms in order to grow and produce relevant feed for specific breeds and animals.



The company holds bi-annual meetings for all farm managers and technical personnel in Qingdao, normally once in July and again in December. An annual meeting for all senior managing personnel is held in July. These meetings are directed by Mr Zhou Yu Xiao to summarise work from different departments and to work together in developing strategies for future improvements (http://www.sbdpigs.com).

4.1.3 Breeding and Veterinary Procedures

Each farm under SBD has its specialty in breeding, whether it is for the large litter size of the Large Whites, the growth rates of the Landerace or the superior meat

quality of the Duroc. The specific traits required are determined by the demand of the market. The company conducts inbreeding between breeds and crossing breeding (hybreeding).

For breeding within breeds, the population of a specific breed are divided into various herds and are kept in different farms. So breeding is actually inter-herds to prevent excessive inbreeding causing the deterioration of desirable traits. Second generation male offspring are slaughtered for meat and only females are kept. Crossing breeding is dependent on required traits desired by the company customers. Like all animal breeding, interbreeding is based on the theory that $1 + 1 > 2$; the combination of the 2 desirable traits has a bigger sum than 2 separate traits.

There are between 1-2 veterinarians at each of the farming facilities to make initial analysis of animal conditions and for daily checkups. The results are then entered into a spread sheet and sent through to the central office via email. Office personnel analyses this information and then arrange appropriate actions as required. If needed, central veterinarian personnel will be dispatched to the appropriate farming facility.

4.1.4 Current Information Systems and Needs

Currently the company is using two forms of information technology to help in managing the farms; data monitoring and behavioural monitoring, both of which are designed to assist in the breeding stages of swine farming. Information regarding individual animal and herds are entered into a spread sheet by farm veterinarians and other relevant employees. These are then reported to the central office once every week for monitoring. Data monitoring include analysis and updating of information including birth-date, age, weight, size, parents, ancestors (3 generations), pedigree and

reproduction cycles. The most important information recorded is the BVI value; a breeding index used to determine the best future breeding patterns. Normally, the higher the BVI value, the better the pig quality. But because each year the demand of specific traits varies, the BVI are maintained within a certain range, normally 110-150.

The other information system the company uses is animal behavioural monitoring. Individual pigs are taped and analysed. This is particularly useful during breeding periods where female pigs are taped to monitor its behaviours to hogs and its movements during pregnancy. Also to ensure proper care is made to new piglets by both the mother and employees. Individual animal feeding and drinking patterns can also be monitored using this technique. The company invested heavy resources into the set up of this technology. LCD screens in the central control office offers full view of each individual pig in breeding facilities. Top management are able to have visual of in-heat and pregnant females round the clock.

According to Dr Alan Sun, the company is in the initial stages of purchasing and implementing a specific information system that would assist the company in monitoring and contending the spread of infectious diseases. Like any swine farms, SBD haves troubles with the spread swine infectious diseases like trichinella infection.

According to Dr Alan Sun, SBD Qingdao suffered significant losses due to swine diseases in 2009 accumulating up to 5 million Yuan (RMB), equivalent to around 1.2 million NZ Dollars. Nearly 10,000 pigs were slaughtered as a result of infection from diseases, causing significant financial impact on the company as well as pork production and supply in Shandong China. Among the 10,000 animals slaughtered, a majority were first generation breeding pigs. This caused a ripple effect on pork

quality as Shandong experienced a shortage in top quality breeding animals; leading to reduced quality is meat pigs.

It is vital for SBD to monitor infected animals and control the spread of these diseases. Because of the breeding schemes and activities by the company, individual animals are moved on a constant basis, which can encourage the spread of diseases. Real time updates must be available allowing for central control offices to have the most up to date information. The spread sheet system is deemed insufficient for the control of diseases and a new system is required according to Dr Alan Sun.

4.1.5 GIS Justification for Disease Control in SBD

The GIS system has been heavily used in the swine industry around the world to ensure proper prevention of illness and diseases. The systems effectiveness has allowed it to be introduced and used in the veterinarian field in the locating of surveillance and monitoring of infected farms and facilities. Norstrøm (2001) outlined in her research that the GIS systems has helped the National Institute of Norway in the “recording and reporting of information, epidemic emergency, cluster analysis, modeling diseases spread and planning control strategies”.

From past researches, it can be concluded that the GIS system will be beneficial to SBD in their efforts to monitor and control of swine diseases. It satisfies the requirements made by Dr Alan Sun to find a system which will help the prevention of large scale spread of diseases, particularly across different farms and facilities.

4.2 Interview Results Summary

Interviews were conducted on six influential individuals within the SBD company who have direct input on technology upgrades; Toyota (Senior Manager), Isuzu (Farm Manager), Honda (Data and Information Manager), Mazda (Human Resource Manager), Subaru (Farm Manager) and Suzuki (Chief Vet).

All interviews were conducted in Mandarin. It is transcribed and translated by three individuals; Simon Shao (Canterbury University Economics Masters Graduate), Leo Li (Canterbury University Economics Masters Student) and myself. It is then assessed and combined into one final transcription to ensure its accuracy. Full interview transcribes are available in appendix 1.

The interviewees ranged from ranged from 32 years old to 52 years old with 4 people in their thirties. Only one female was interviewed due to the disparity between males and female employees in the company as mentioned before. Their education level were relatively high compared to the rest of the company with four having bachelor's degrees and two with Ph.D. degrees. The following tables are a summary of the interview results.

Please note that abbreviations are used in the tables below during the results summary:

PE = Performance Expectancy
EE = Effort Expectancy
SI = Social Influence
FC = Facilitating Conditions
BI = Behaviour Intention

Toyota

Name	➢ Toyota
Age	➢ 52
Position	➢ Senior Manager
Education	➢ Post Doctorate ➢ MBA
Effects of PE on BI	➢ Yes. ➢ Rural inhabitants most likely to view technology as upgrade to living standards. ➢ Modern ways to work procedures ➢ Improvement to current situation ➢ Management personnel more stubborn and may view PE as lower ➢ Management may view switching to new technology as added work rather than more efficient ways
EE on BI	➢ Yes. ➢ Front Line staff mostly uneducated so hard for them to learn and use the system. ➢ Not a factor for Management staff as most of them is highly educated and has competent computer skills.
SI on BI	➢ Strong Effect on the acceptance of the GIS system. ➢ Chinese people tend not to want to become exceptions so tend to follow others (Collectivism) ➢ Important to convince most influential; Area managers and those who have direct power over promotions ➢ Farm managers rotate on bi-annual basis, so hard for them to gain trust from employees ➢ Could be potential barrier to GIS adoption.
FC	➢ Essential to success of technology adoption

	➢ Training Programs ➢ Regulations to enforce use ➢ Display GIS results and benefits ➢ Monitory rewards for use ➢ Long term management strategies
Gender	➢ **Gender affects SI** ➢ Females more likely to follow others; obey orders and respect elders ➢ SI influence higher for females
Age	➢ **Age affect PE, EE and SI** ➢ PE Lower for older personnel (older individuals tend to view it as less useful) ➢ SI effects higher for younger employees (younger follow older) ➢ EE higher for older generations
Experience	➢ **Experience affects PE, SI and FC** ➢ PE lower for more experienced ➢ SI higher for lower experienced (less experience follow others) ➢ FC higher for more experienced (more experienced personnel tend to have access to more company support)
Education	➢ **Education affects PE, EE, SI, FC** ➢ Higher PE for lower educated ➢ Higher EE for lower educated ➢ Stronger SI for lower educated ➢ Higher FC for lower educated
Emphasis	➢ Display of results and benefits that the GIS system will bring to the daily work of the employees will benefit technology adoption. ➢ Vital to convince them that the use of GIS is not added work, but an improvement to existing procedures.

Isuzu

Name	Isuzu
Age	32
Position	Farm Manager (Farming Facilities A)
Education	Bachelor
PE on BI	➢ Yes ➢ Most will view the GIS system as beneficial to the company ➢ Currently uses databases to store pig information ➢ Employees understand the importance of technology to modern businesses
EE on BI	➢ Yes ➢ Should be no problem to teach and train. Repetitive tasks such as the use of GIS system should be easy to learn.
SI on BI	➢ No. ➢ No social effects. ➢ More individual work by front lines staff.
FC	➢ Training Programs ➢ Company procedures to ensure no extra work for employees to use the GIS system ➢ Payment incentives not important ➢ Two stages in GIS adoption: first using regulations to enforce the use of the system. Secondly using positive results to convince employees on the benefits of using the GIS system.
Gender	➢ **No effect at all** (mostly males so did not feel that gender would be an moderating factor)
Age	➢ **Age has an effect on PE and EE** ➢ PE lower for older personnel ➢ EE higher for older personnel

Experience	➢ **Experience has an effect on PE and FC** ➢ PE lower for more experienced staff ➢ FC higher for more experienced staff
Education	➢ **Education affects PE, EE and FC** ➢ PE lower for lower educated ➢ EE higher for lower educated ➢ FC higher for lower educated
Emphasis	➢ Two stages for the adoption of the GIS system in facilitating conditions; initially using regulations to ensure use and later using beneficial results to convince personnel.

Honda

Name	➢ Honda
Age	➢ 35
Position	➢ Data/Information Manager
Education	➢ Bachelor
PE on BI	➢ Yes ➢ Most will view the GIS system as beneficial to the company ➢ Pig farming in China as a whole requires technology upgrades
EE on BI	➢ Yes ➢ 2 types of employees, educated and uneducated. ➢ Uneducated going to find it hard to use the GIS system.
SI on BI	➢ No effect
FC	➢ Important to show results of past uses of the GIS by other farms and the benefits it has bought ➢ Regulations to ensure use ➢ Training programs ➢ Reward programs (monitory and promotions).
Gender	➢ **No effect**
Age	➢ **No Effect** ➢ More to do with education than age.
Experience	➢ **No Effect**
Education	➢ **Education affects EE and FC** ➢ EE higher for lower educated ➢ FC higher for lower educated
Emphasis	➢ Telecommunication infrastructure and hardware of rural areas where the farms are located. Whether it can facilitate the GIS system. Particularly internet speeds and connection stability.

Mazda

Name	➢ Mazda
Age	➢ 33
Position	➢ HR Manager
Education	➢ Bachelor
PE on BI	➢ Yes ➢ Most personnel in the company will view technology as a means to make daily life easier
EE on BI	➢ Yes ➢ Direct effect on use intention
SI on BI	➢ Yes ➢ Important to train/convince those who are educated and experienced.
FC	➢ Training Programs ➢ Form a company culture that is open to change ➢ Establish hiring strategies with the use of technology in mind ➢ Regulations as a short term solution
Gender	➢ **No effect**
Age	➢ **No effect**
Experience	➢ **Experience Affects PE and SI** ➢ Higher PE for more experienced staff ➢ Lower SI for more experienced (lower experience follow others)
Education	➢ **Education affects EE and SI** ➢ EE higher for lower educated individuals ➢ SI stronger for lower educated individuals
Emphasis	➢ The availability and stability of the telecommunications in rural areas.

Subaru

Name	➢ Subaru
Age	➢ 38
Position	➢ Farm Manger (Farming Facilities B)
Education	➢ PHD
PE on BI	➢ Yes ➢ Most will feel it as beneficial to the company and daily work ➢ Particularly rural areas where they feel technology is an upgrade to life.
EE on BI	➢ Yes ➢ EE VERY high for frontline staff. ➢ Easier for management staff.
SI on BI	➢ **No effect**
FC	➢ Training Programs ➢ Regulations to enforce use ➢ Usage Incentives; Promotions and make using the GIS system a part of the criteria for company paid training and overseas work experiences.
Gender	➢ **No Effect** ➢ Close to 100% of front line staff is male.
Age	➢ **No Effect**
Experience	➢ **No Effect**
Education	➢ **Education has an effect on EE and FC** ➢ EE higher for lower educated ➢ FC lower for lower educated
Emphasis	➢ Make GIS technology use a part of the choosing criteria for company paid training and overseas experiences to promote use.

Suzuki

Name	➢ Suzuki
Age	➢ 46
Position	➢ Chief Vet
Education	➢ Bachelor
PE on BI	➢ Yes ➢ People will only use if viewed as useful. ➢ Particularly management staff.
EE on BI	➢ Yes ➢ Harder for some but should be achievable to teach and train all.
SI on BI	➢ Yes ➢ Few follow majority (Collectivism) ➢ Important to have strong emphasis from top management staff to affect the majority
FC	➢ Training Programs ➢ Conferences ➢ Monthly Bonus possibilities for use
Gender	➢ **No Effect**
Age	➢ **No Effect**
Experience	➢ **Experience has an effect on EE** ➢ More experience higher EE
Education	➢ **Education has an effect on EE, SI and FC** ➢ EE higher for lower educated ➢ SI stronger for lower educated ➢ FC higher for lower educated
Emphasis	➢ Make the use of GIS system into the assessment criteria for employee monthly bonuses.

4.3 Analysis

This research is framed by the Universal Theory of Acceptance and Use of Technology (UTAUT) proposed by Venkatesh et al. (2003). The model was amended to suit the SBD environment by adding in the moderating factor of Education as shown in figure 9.

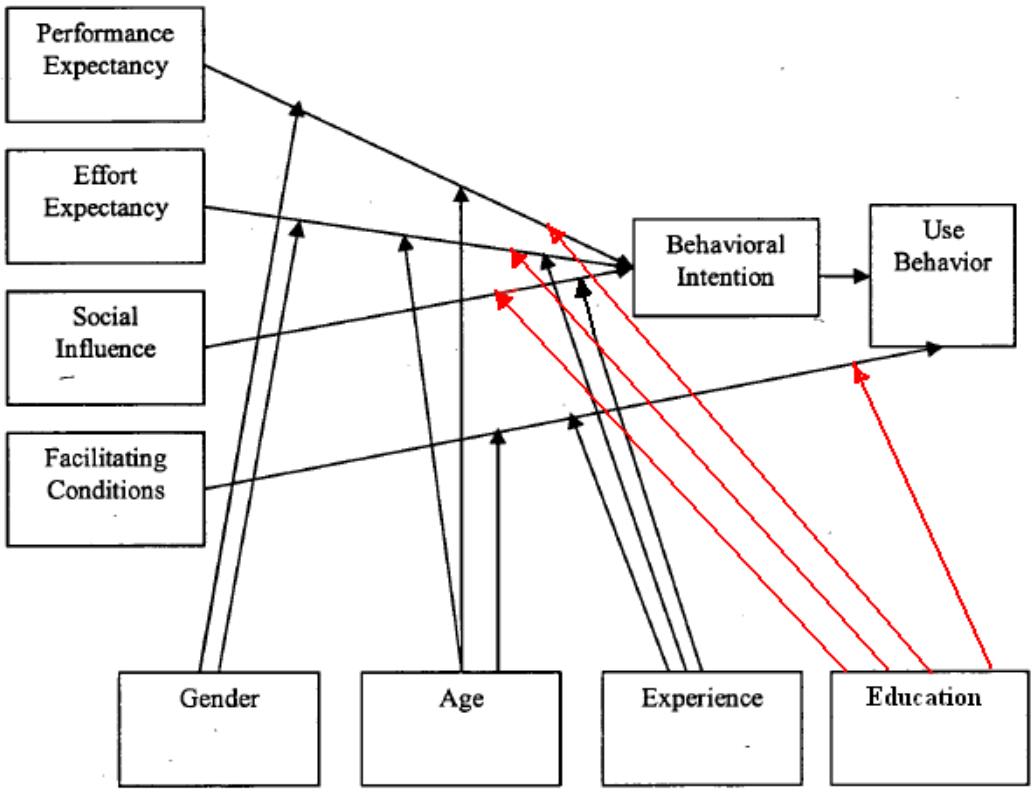


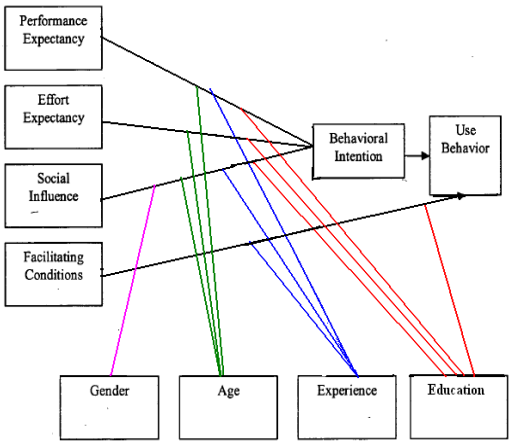
Fig: 9 Modified UTAUT for SBD

In the proposed Modified UTAUT for SBD, it expects that the effect of Performance Expectancy on Behavioural Intention varies across gender and age; strongest for younger males (higher Behaviour Intention). The relationship relating to Effort Expectancy varies over gender, age and experience; strongest for older women in early stage of experience. Social Influence varies across experience; stronger for personnel in early stages of experience. Facilitating Conditions varies across age and experience; strongest for older workers in later points of experience. Effects of the

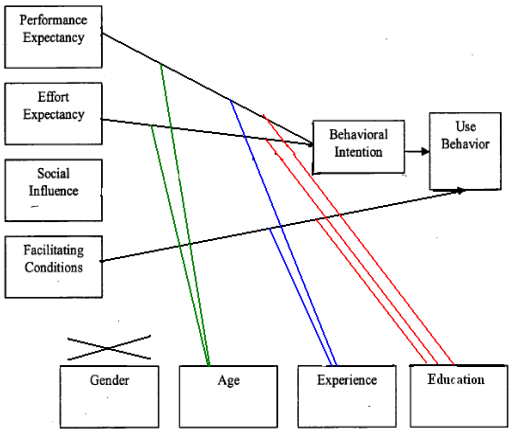
newly introduced moderating factor of education is that lower education will lead to stronger Performance Expectancy, Effort Expectancy and Social Influence, while lower Facilitating Conditions.

Previous research conducted by Venkatesh and Zhang (2010) tested the validity of the UTAUT in China using a quantitative approach to determine the relationships between the various factors. This research use the UTAUT to test the adoption of GIS by SBD from a qualitative perspective; to determine if the managerial personnel of SBD views to the adoption of the GIS technology are in accordance to the updated UTAUT and their views on the most influential factors.

All six interviewees had different views on the relationships between the factors than proposed. Each had a slightly different view on the model's structure and relationships. The following diagrams show the perceived relationships by all six participants.



Toyota



Isuzu

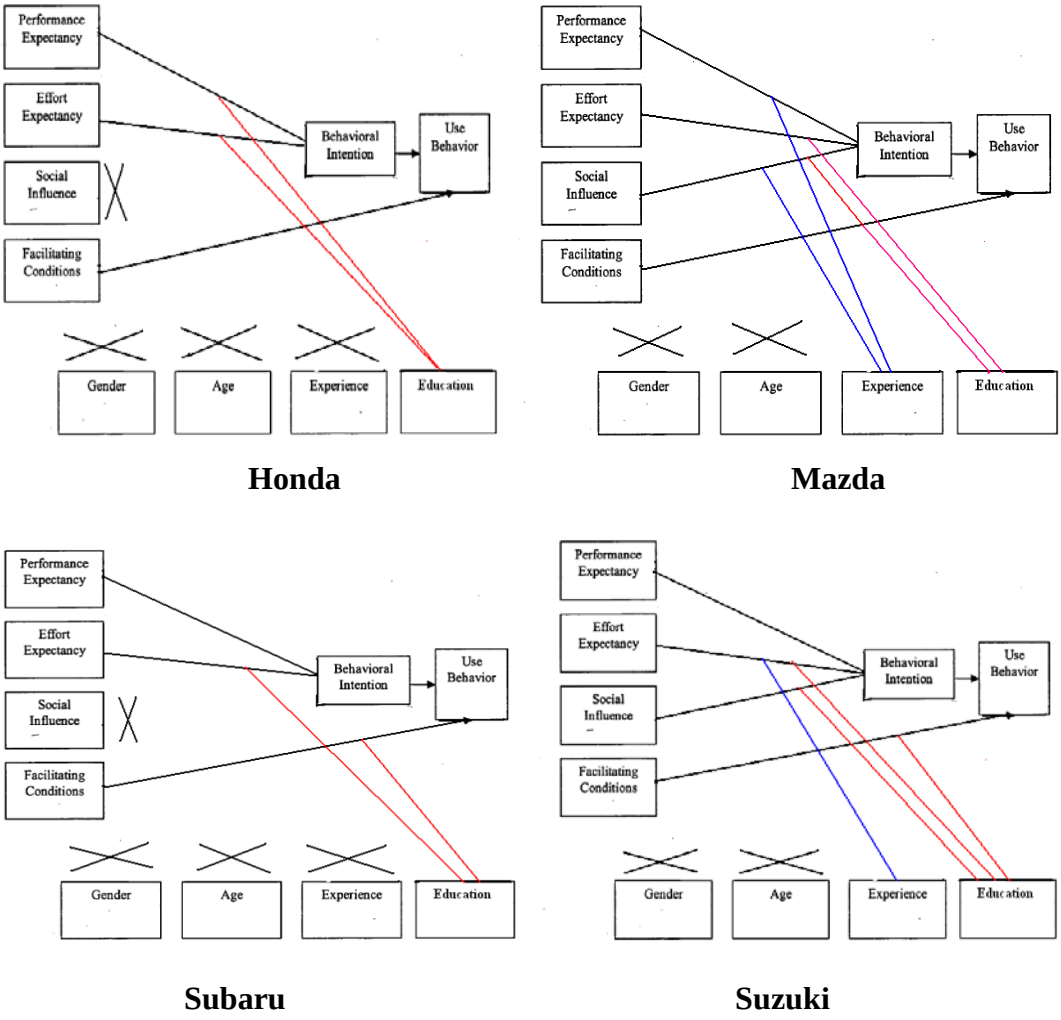


Fig 10: Summary of Responses for each Respondent

From the above diagrams we can see that each person's perspective on the relationships of the UTAUT is slightly different. By combining all six models from different interviewees, the following model for SBD Qingdao is proposed.

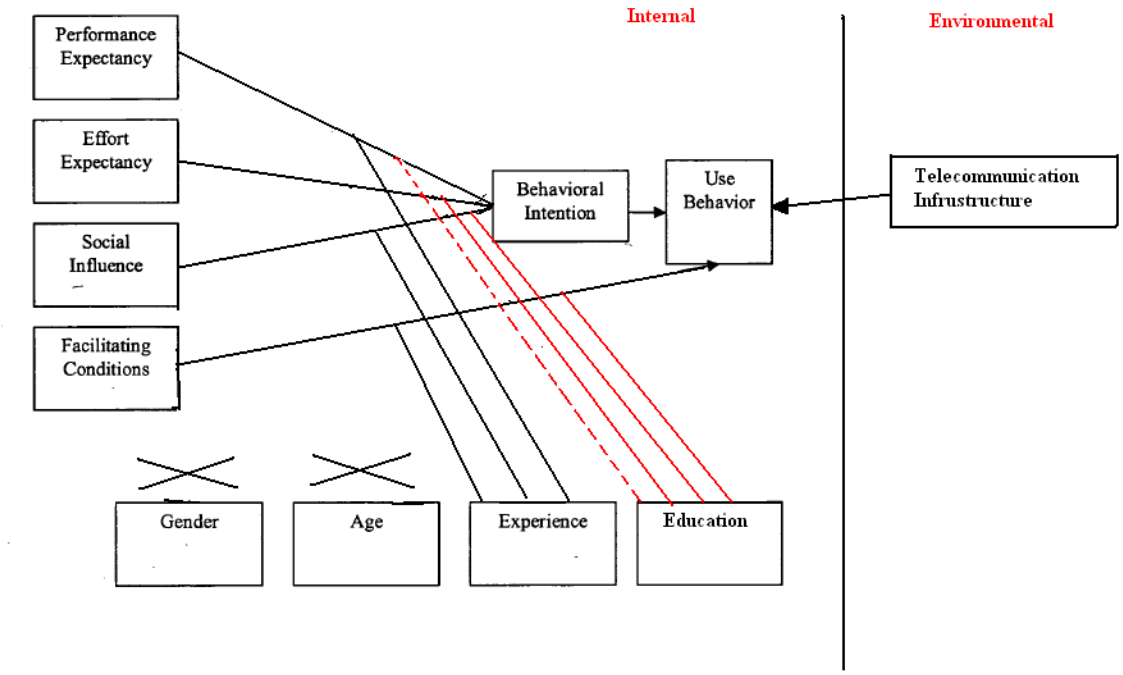


Fig 11: Amended UTAUT for SBD Qingdao

The above model is derived from the six individual interviews. Each relationship satisfies at least half the interviewees. Moderating factors age and gender are excluded as most of the participants felt that they were not a contributing factor. The relationships are as follows:

- Performance Expectancy is moderated by experience where the effects of Performance Expectancy are increases for lower experienced individuals. The effects of education on Performance Expectancy are unclear as there was contradicting information. Toyota felt that because lower educated people tend to be from rural areas, they are more likely to view technology as an upgrade to living standards and life styles by stating:

  "Most will view technology upgrades as an improvement, especially in the rural areas where technology is not part of their daily lives."

Isuzu on the other hand felt that lower educated people tend to not have a full understanding of the potential uses and benefits of a new piece of technology thus their PE would be lower leading to lower Usage Intention, stating:

"Well those with less education will definitely not fully understand the benefits of the technology. So no doubt they will view it as less important."

There is a relationship between the factors, but its form and effect is unclear at this point. Isuzu and Toyota have distinctly different levels of education with bachelors and Ph.D. respectively. Toyota is a farm manager and Toyota is a senior company manager, so Toyota does not have a direct contact with front line staff on a regular basis. This may be a reason why their views contradict as their level of understanding of the frontline staff members vary.

- Effort Expectancy is moderated by education, where its effects are stronger for less educated individuals.
- Social influence is moderated by education and experience, where it is stronger for less experienced with lower educations.
- Facilitating conditions are moderated by experience and education where it is higher for more experienced and lower educated individuals.

From the interviews, each participant put emphasis different factors which could potential promote or inhibit the introduction of the GIS system by SBD. Most were facilitating conditions such as regulations for use, monetary rewards through monthly bonus or making the use of GIS technology part of the criteria for overseas working experience. But two individuals mentioned a factor which is external to the company; telecommunications infrastructure. This introduces an environmental aspect outside of the control of the company. Although this factor may not be a factor in the United States where the UTAUT was originally derived, this may pose as a problem for rural China where telecommunications infrastructure is still relatively under developed.

Thus the model is divided into two parts; internal and environmental. An environmental factor “telecommunication infrastructure” is added into the model that directly affects the Use Behaviour of the technology where the better the infrastructure, the higher the likelihood of use behaviour. Also better and more developed infrastructure would make the use of internet based technologies more efficient and pleasant to use. More detail is paid to this aspect in the Discussion section.

5.0 Discussion

In this chapter, we attempt to explain the results from the respondents with reference to findings of previous researches. The discussion is focussed around the four main determinants of intention of usage and usage behaviour; Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions. Their relationship with the four key moderators; Gender, Age, Experience and Education are discussed. Also the newly introduced environmental factor, Telecommunication Infrastructure is also addressed in this chapter.

5.1 Performance Expectancy

In the Unified Theory of Acceptance and Use of Technology (UTAUT) proposed by Venkatesh et al. (2003), the factor Performance Expectancy (PE) is defined as “the degree of which an individual believes that using the system will help him or her to attain gains in job performance”. The importance of PE in the intention of use of new technologies cannot be overlooked. Previous tests on UTAUT have shown that this factor has remained constant across cultures and geographical borders. Studies conducted by AlAwadhi and Morris (2010) on the adoption of e-Technology in Kuwait have shown that the intention of use by individuals were heavily affected by PE.

Due to the cultural differences between the United States, where the UAUT was initially derived, and China, changes were made to the original UTAUT to suit the local environment. It was initially proposed that PE is moderated by gender, age and education where it is strongest for younger men with lower education. That is, younger men with lower education tend to have higher performance expectancy of the GIS system, thus leading to a positive intention to use the technology.

Throughout the six interviews with SBD managerial personnel, the effect of PE on behaviour intention remained constant and was universally agreed that PE was a significant determinant in the intention to use the GIS system by SBD employees. Suzuki identified usefulness as central to PE, saying “If I don’t feel it is useful, I would not waste my time using it”. Interviewees felt that PE was moderated by Experience and Education in comparison to gender, age and education, thus differing from the initially proposed model. The effects are that performance expectancy of the GIS system would be higher for individuals at earlier stages of experience.

Differentiating from the proposed model, for example Toyota felt experience is a

moderator for PE. He felt that higher experience would lead to lower PE. He mentioned that experienced workers tend to view a technological change is unworthy of the trouble and that their current practices gained through years of experience is the most efficient process; "…they tend to feel that their current practices are the best way to do things". Many will view the use of the GIS system as added work rather than making current company operations more efficient. Farm Manager Isuzu also supports his notion by stating that "In my opinion, those who have higher experience tend to stick with their existing ways. It is hard for them to change. They feel that their way of doing things is the best way. Those with less experience tend to be open to new techniques on improving their ability to perform on their daily tasks". Research conducted by Weinberg (2004) also supports this with his findings that the diffusion of new technologies tends to favour employees in earlier stages of experience.

Mazda, the HR manager of SBD felt differently on the effects of Experience towards Performance Expectancy. Mazda felt that the more experienced employees of SBD would have a better understanding of the importance of the GIS system to the overall management and wellbeing of the company. She felt that experienced staff members tend to have a deeper understanding of the company needs and deficiencies. She mentioned; "From my understanding of the system and its potential uses in the prevention of contagious diseases, I would say that more experienced workers would know the significance of disease control. So yes, I would say that they will be more likely to view it as an important upgrade". Although much research in the technology adoption field have indicated that experience is a potential barrier to the diffusion of new technology, there is research in other fields that suggests experience as a benefit to company changes and upgrades. Research within the management field has argued that an organisation is a learning system where more experienced workers tends to have more knowledge of the company and its requirements to remain competitive with its competitors (Nevis et al., 1995). Mazda tends to support this view and feels that experienced workers in SBD will have a better understanding of the company

operations and the need for the GIS system. Thus their performance expectancy of the technology will be higher than those of less experience.

There were contradicting views on the effects of education on PE. Toyota stressed the importance of PE on the adoption of the GIS system by SBD. Toyota linked education levels and rural upbringing. This was due to the front-line staff being mostly from rural areas where the education levels are significantly lower as mentioned before. He felt that the lower the education, the higher the PE. Toyota mentioned that due to the average education level of the front line farmers and their rural upbringing, many felt that technological upgrades are a modernisation to their current standard of living by stating that: “a movement towards the ‘Western’ way of life by using technology”. His statements highlight the varying stages of modernisations in China. China has experienced major modernisation throughout the past 30 years, but the process has seen varying results depending on provinces and regions. Areas, particularly in rural areas, are still very under developed, with limited technology and backward thinking, while other major commercial centres are extremely westernised (Redfern & Crawford, 2010). Research conducted by Akodo et al. (2010) in Uganda regarding the usage of telecommunications technology and living standards supports the views of Toyota. Through their research, they found that there was a positive correlation between the use of telecommunications technology and standard of living. Much of the participants viewed the use of technology is a sign of improved living standards and modernisation. Researchers have associated modernisation of lifestyles to the use of the telecommunication systems and other information technology (Sitaram, 1974).

Isuzu on the other hand had an opposing view of the effects of education on PE. He felt that those with lower education levels will not have a full understanding of the system, thus not being able to realise its full potential and benefits to the company. He mentioned; “those with less education will definitely not fully understand the benefits of the technology. So no doubt they will view it as less important”. From the various interviewees, it is noted that the education level of front line staff is extremely low, to

a point where some of them are illiterate. Thus their understanding of description manuals and information pack would be limited. Kitchener and King (2002) supported this fact through their research which found that there was a distinct relationship between reflective judgement and education levels on knowledge and information.

All six interviewees did not view gender as a moderating factor on PE, but two people, Toyota and Isuzu, identified age as a moderating factor for PE. They both mentioned that age had similar properties to experience, where older individuals had a lower PE for the GIS system. This is not unexpected as much research has gone into age as a barrier for the adoption of new technology. Eley et al. (2009) noted age as a barrier for the use of information and computer technologies by Australian nurses. Pedlow et al.'s (2010) research into barriers in cell phone usage for the older generation in the USA has shown that the older a person is, the less likely they are going to use cell phone technologies and services.

The reason for the exclusion of age and gender by the majority of interviewees is likely to the makeup of the company. With regard to the GIS introduction into SBD, in the interview schedule that was given to the participants before the interviews, it was stated that the main users of the GIS system considered for this research would be the front line staff that enter the information on a daily basis. Due to the nature of the company and its operations, the front line farm staffs are predominantly young males in their 20s and 30s. Thus it was likely that age and gender is not viewed as having much of an effect because this generation is more accustomed to technology than the older generation.

5.2 Effort Expectancy

Effort Expectancy (EE) is defined by Venkatesh et al. (2003) as “the degree of ease associated with the use of the system”. EE particularly significant during the first time use of technology by staff members and loses its significance over extended periods of usage. This is due to use barriers that exist during the early stages of new behaviours and later will be overcome with experience and new skills (Venkatesh et al., 2003).

It is proposed that the EE has a negative effect on Behaviour Intention. That is, the higher the EE, the lower the intention to use the GIS system by SBD employees. In the proposed model, EE is moderated by gender, age, experience and education. As with PE, all six participants of this research agreed there is a relationship between EE and Behavioural intention. But moderating factors differed from the expected model. The interviews revealed that EE is moderated by education only where EE is higher for lower educated individuals. That is, lower educated individuals will tend to perceive the GIS system as being more difficult to use, in turn reducing their Behaviour Intention. This was in agreement with the expected relationship between education and EE.

As mentioned before, due to the fact that a majority of front line staff are males, the gender of an individual is most likely overlooked by the participants. Also it was mentioned during the interviews that as SBD still uses relatively simple information technologies to store and manage data, very few, if any have experience with a GIS system, thus this moderating factor is likely to be overlooked as well.

It was a surprise that age is overlooked during the interviews. A common stereotype is that elderly individuals are reluctant or unwilling to use technology have been floating around for decades. This is particularly true for higher EE among elder personnel where concerns of inconveniences, unhelpful features and security/reliability worries

exist (Mitzner et al., 2010). Other concerns involve the learning speed and memory of older people which can pose a barrier for technology training such as the use of the GIS system. Past research shows that older individuals tend to have slower learning speeds and information retention abilities. This is associated with the decreasing of processing speeds in older individuals that lead to lower encoding efficiency (Salthouse, 1993). But recent research conducted by Mitzner et al. (2010) on the use of home and work related technology among elderly people challenged the belief that older generations tend to view technology as difficult to use. His research of 113 elderly individuals showed that positive attitudes towards technology far outweighed negative attitudes among older adults, particularly in technology supported activities, improved convenience and ease of use.

5.3 Social Influence

Social Influence (SI) proposed by Venkatesh et al. (2003) was defined as “the degree to which an individual perceives that important others believe he/she should us the new system” (Venkatesh et al., 2003, pg. 451). SI has a positive relationship with Behaviour Intention where strong SI will increase the intention to use of GIS system by SBD employees.

In the model originally proposed, SI is moderated by experience and education where the effects of SI are stronger for personnel in early stages of experience and lower education. That is those with less experience and lower education tends to be more influenced by the perceptions of others. The results from the interviews supported the proposed model that SI had a positive relationship on Behavioural Intention and is moderated by experience and education where SI is stronger for less experienced and lower educated individuals.

Toyota, Suzuki and Mazda all mentioned the importance of Guan-xi in the business environment of Chinese companies. Guan-xi which is literally translated as connections is the Chinese version of relationships. They mentioned that a feature of Chinese culture is people tending to work towards a collective unit rather than exhibiting individualistic behaviour whilst striving to maintain a group. Through the interviews we saw that experience and education levels are directly correlated with the position that an individual holds within the company. As expected, both Suzuki and Mazda mentioned that those with more experience tend to be leaders among groups in the company and higher educated individuals tend to hold higher positions in the company. In turn lower educated and less experience personnel tend to hold lower positions and thus would tend to follow others.

It is interesting to note that Toyota mentioned age and gender as moderating factors

for SI. He said that female employees are commonly more obedient and was more likely to follow the actions of others, “female employees tend to show more respect to superiors and follow their leadership”. Research into gender disparities in employment and income in China by Zhang et al. (2008) showed that although Chinese women have experienced improvements in feminine rights, they are still subject to many disadvantages in employment status and earnings. This is largely due to the female gender in the Chinese society still pay significantly more attention to family care and household chores than males. This factor plays a major role in determining the relationships between female employees and their colleagues, particularly male colleagues. Research into the Chinese society on parental care also showed that women are viewed as the prominent role in care of elderly parents than males, spending more time on home care, in turn affecting their employment status and income. All these combine social factors have lead to a majority of Chinese women holding lower position in companies (Zhan & Montgomery, 2003).

Toyota also mentioned age being a moderating factor on SI. He said that younger personnel tend to follow the instructions of elders and respect their opinion; “Younger generations tend to show their respect to elders and not ‘force’ anything onto them “thus creating a chained effect on others which will lead to more people not willing to use the new system.” The use of a GIS system therefore would be significantly affected by the effects of age on SI, not because of age per se but the cultural expectations that the young respect their elders. This expectation is associated with the culture of China and dates back to the teachings of Confucius, which has a strong effect on most East Asian societies where respect for elders and ancestor respect are vital aspects to life. To date, this way of life still plays a strong role in the operations and interactions within corporations (Sung, 2001). Toyota indicated that the older a person is, the weaker the effect of SI. Older personnel tend to view new technology like the GIS system as a nuisance.

5.4 Facilitating Conditions

Facilitating conditions (FC) is defined as “the degree to which an individual believes that an organisational and technical infrastructure exists to support use of the system” by Venkatesh et al. (2003) when they first proposed the UTAUT. It is expected that FC has a positive effect on Use Behaviour; that is when a SBD employee believes that the organisation strongly supports the use of the GIS system; he/she is more likely to use that it in their daily tasks. In the proposed model, it was believed that FC is moderated by age, experience and education, where it is strongest for older workers in later points of experience with higher education. This is because those who are older, more experienced and higher educated tend to have more access to company facilities and resources, thus gaining more support from the company.

From the interviews, we can see that all respondents had a strong emphasis on the importance of FC on Use Behaviour. They all believed that the success of the implementation of the GIS system in SBD is heavily dependent on the facilities and support the company can provide to individuals, particularly those who require special assistance. All six participants believed in the importance of training programs of the GIS system. Toyota mentioned “…training program has to be set up to ‘teach’ the employees on the steps in using the GIS in their daily work…”. Isuzu commented “Training to reduce the ‘fear’ in experimenting with new procedures. It will make it more likely that they will accept the new technology once they understand how it works and how to use it”. Honda mentioned that training programs is an obvious action by the company to ensure the success of the GIS system. Mazda stressed that it is vital to “…structured training programmes where both teaching the functions of the system along with the benefits (long term and short term) that the system will bring to the company and themselves as individuals”. Subaru viewed training programs is a “must” in the introduction process of the GIS system while Suzuki also supported this view by stating “training programs and conferences. It is important for company

employees to fully understand the system, both in its functions and use. It is not enough to just know how to use the system, but also need to understand its implications to the company. Full information need to be shown to the employees".

Past research in the adoption of new technologies by organisations supports the views of the participants and stresses the importance of a good training programme during the introductory stages of new processes. Research conducted by Andreu and Jauregui (2005) into the adoption of new technology based facilities in the Spanish Bank showed the importance of training programs to the successful adoption of the technologies by employees. They found key components such as course content, teaching modes, course evaluation systems and course development processes. Research into technology upgrades in the health provider industry also shows the importance of training programs and supports the views of the participants of this research. The research examined the views of several executives to determine the biggest factor to the introduction of new technologies, with most of them indicating it was training facilities. John Sheridan, president of eHealth Data Solutions views staff training as the biggest obstacle to technology upgrades (Coping with Progress, 2007).

Another common theme among the participants was the need for regulations as part of the initial introductory process. Much research has gone into the effects of company enforced technology acceptance. Riordan (1992) highlighted how company regulations can slow down the process of technology diffusion. But he also stated that in certain circumstances, particularly when opposition is high, slower technology adoption is beneficial. A case study by Mark and Poltrock (2003) into the adoption of groupware in a distributed organisation showed that the adoption process of the new technology is slowed by variations in the technology standards between company departments. They mentioned that company departments must face new technology adoption uniformly, which can be achieved through companywide regulations and standards.

Isuzu mentioned that the introduction of the GIS system by SBD should be divided into two stages, the first of which should be strict regulations to enforce usage. This will guarantee employee acceptance in the initial stages. This notion is also supported by Subaru, Toyota, Honda and Suzuki.

Each individual during the interviewees had other suggestions for company facilities which could help promote FC among employees and support the adoption of the GIS system. It should be noted that suggestions for FC ranged from monetary rewards for usage and hiring strategies to promotional requirements and bonus criteria. Two unique suggestions proved to be the most intriguing. The first is from Toyota, he mentioned the importance of displaying the results that the GIS system would bring to the company. He mentioned that this is an important procedure in convincing employees that new technologies are beneficial to their daily tasks and is not added workload. Isuzu also mentioned the importance of displaying plausible results that the GIS system brings to the company as part the second stage of his proposed two stage introductory process. He mentioned that this is particularly important in convincing personnel of the benefits of the technology to the company and could only be achieved with concrete results.

Another interesting suggestion was proposed by Subaru to include the use of the GIS system into the selection criteria of overseas training programs. Subaru mentioned that SBD has established annual overseas work experience and training programs for high performers and motivated staff in the company. These programs work with internationally renowned swine farming companies in Holland, United States and Canada to improve farm management skills, sales and breeding technologies. He said that this experience is extremely valuable for company personnel as overseas paid training is rare and highly competitive. Thus by incorporating the use and understanding of the GIS system into the selection criteria for the annual participants list would inform the employees firstly of the emphasis that the company puts on the system and secondly make it more easily accepted by personnel.

In comparison to the initial proposed model that FC is moderated by age, experience and education, the results from the interviews resulted in excluding the age factor. The effects of experience were the same as expected. But the effects of education on FC were the exact opposite; FC is higher for lower educated. As explained by the participants, this is due to the fact that lower educated individual requires additional help when being trained to use the GIS system in comparison to higher educated individuals. It was highlighted through the interviews that those with lower education tend to be from rural areas where the use of technology is still fairly rare. Added into the problem are their literacy levels, in some circumstances, even writing their own name is a troublesome task. This will make any formal instruction manuals, information pack and any other documentation insignificant. This group of lowly educated individuals would require additional assistance, including face to face training. Thus it is believed that the expected company support for lower educated personnel would be higher.

5.5 Telecommunication Infrastructure

An addition was made to the initial proposed model is the effects of environmental factors. Honda and Mazda stressed the importance of the telecommunications infrastructure of rural China. This will have a direct impact on the connection and stability of internet based information systems such as the GIS system. Thus Telecommunication Infrastructure (TI) is proposed as a moderating factor on Use Behaviour, where the higher the level of local IT will increase Use Behaviour.

Research by Shih et al. (2008) into the implementation of IT technologies in developing countries indicates the importance of telecommunications infrastructure of poorer areas. Over the past two decades, China has invested heavily on its telecommunications services into rural areas which include the use of mobile phones, cable net works and internet access. It ranks first in the world in terms of mobile phone and fixed line telephone users and second in terms of the number of internet users. But this development has separated the country among those with access and those who do not. Division is most noticeable along economic and regional lines. Poorer areas, particularly rural China is still low in terms of telecommunications infrastructure which can be seen by the lower numbers of telecommunications technology users (Harwit, 2004).

Due to the nature of SBD and its operations, a majority of the company is situated in rural areas in the Shandong province. The quality of the IT in these areas and its ability to sustain the requirements of the GIS system is in question.

6.0 Implications, Future Research and Research Limitations

6.1 Practical Implications

The increased in focus on computer and information technology usage in modern businesses represents new challenges for organisations. Surveys conducted have shown that most business have plans to increase their investments in information technology hardware. This phenomenon has helped make the acceptance of technology a major activity for most organisations (Raymond & Bergeron 1992). This coupled with the effects of globalisation in full swing; companies are required to recognise the differences and similarities of technology adoption between cultures.

With the stressed importance of technology acceptance, numerous models have been proposed by experts from around the world to describe and understand the drives behind individuals' decision to accept or reject new technologies. The significance of the UTAUT proposed by Venkatesh et al. (2003) lies in the fact that it incorporates all the major models into one unified theory. Further testing by Venkatesh and Zhang (2010) on the UTAUT indicated that in China, the effects of social influences differ from that of the United States of America in that the Chinese society is more collective in nature. This changed the relationships of the moderating factors and neglected the factor of voluntariness.

This research at hand further tested UTAUT in the Chinese setting, in the specific context of the swine farming industry. It found that the moderating factor of education level is expected to have a significant impact on the adoption of technology. The implication of this research is that it highlights the difference in the general abilities to use information technology between developed and developing nations, particularly in the rural areas. This particular research indicates that currently the agricultural industry which is heavily located in rural areas in China still faces potential barriers in

the ability to use computer based IT technologies by staff members. Their level of education, experience with technology and general literacy is a major barrier to the introduction of new technologies. It is also found that in the Chinese swine farming industry, the factors of gender and age are not expected to be a significant factor in the adoption process because of the homogeneous nature of the workforce.

The results from this research would help future companies with their training programs and implementation strategies. Companies operating in the Chinese swine industry need to take into consideration of the education levels of their employees and adjust training and adoption process accordingly to accommodate in the lack of experience and literacy of staff members. By accommodating with individual difficulties in using new technology, companies can increases its rate of adoption and the success of technology implementation.

Another major finding in this research is the concern of external factors, in particularly the telecommunications infrastructure of rural China. Compared to developed nations, areas of rural China lack sufficient infrastructure to allow and maintain the use of the GIS system.

6.2 Future Research

Considering the significant role that level of education in rural China plays in the adoption of technology, specific areas of future research are identified to better understand the relationship in the Chinese setting. By conducting similar research in other industries which operate in rural areas such as mining, horticulture and road works, we can further understand the relationship between education and the adoption of information technology. Research into other corporate swine breeding companies in China would allow reap results which can be more generalised within the industry. Future research should attempt to empirically validate the relationship between education and information technology adoption through quantitative research.

Venkatesh and Zhang (2010) highlighted the importance of the effects of cultural differences on the adoption of information technology. Detailed research into the collective nature and Confucius teaching in China could potential reveal a better understanding of how Chinese organisations react to the introduction of new technologies.

One interesting aspect from this research arose in the effects of education on Performance Expectancy. Contradicting information was obtained from the interviews with some respondents supporting the notion that lower education will lead to higher Performance Expectancy while others argued that lower education will lead to not having a full understanding of the uses of the GIS system. Further research should be conducted in this area to determine the effects of Education on Performance Expectancy. Research into additional participants in SBD or managerial positions of other Chinese swine companies will help to determine the relationship.

6.3 Research Limitations

Qualitative research have been often criticised for not being scientifically sound. It is argued that qualitative research is difficult to replicate. Qualitative research, particularly in-depth interviews are criticised for its inability to be replicated by a different researcher due to the personal interactions between the researcher and participant (Mays & Pope, 1995). Procedures were taken in this research to avoid researcher bias. Although probing was done to gain insight into information gained through the interviews, participants were not lead into answering in a particular way. It should be noted that all participants were not shown the proposed model beforehand to prevent the distortion of their real feelings.

Another major criticism of qualitative research is its lack of generalisability. Due to the nature of the research approach, qualitative research methods, particularly in data collection, tend to generate large amounts of information regarding a small number of settings. Thus leading to its results being less generalisable than quantitative research where large numbers of participants are used. It is argued that due to the large number of participants, the sample is more representative of the population under study (Mays & Pope 1995). This particular research only uses six participants. This put doubts into whether the results can be generalised for the Chinese swine industry or even the entire SBD Company. Although the aim of this research is to identify the potential factors using the UTAUT model that influence the introduction of the GIS system, additional participants would have yielded more accurate results. Also this research uses a single case study method. By looking into additional companies, additional contributing factors may arise. Lastly, this research uses purposeful sampling techniques. Although participants were chosen on the basis that they have direct input in the implementation and management of the GIS system for SBD, they were largely affected by availability. It should be noted that a more random sampling technique would likely to yield more generalisable results.

Another major limitation to this piece of research is through its data collection methods. Focus groups or group interviews would give rise to better discussions that could potentially yield additional insight into certain factors.

7.0 Conclusions and Recommendations

This research builds on the UTAUT proposed by Venkatesh et al. (2003) and evaluates it in the context of SBD Qingdao in their proposed implementation of the GIS system. Through the literature review and research done prior to the interviews, it was found that the Chinese society as a whole is extremely collective in nature and that voluntariness was not a moderating factor in the Chinese business environment. It is proposed that due to the nature of SBD operations, their front line staff would be of lower education and would have difficulties using the GIS system. Thus education is introduced as a moderating factor.

From the research, it was found that the proposed relationships between Performance Expectancy, Effort Expectancy, Social Influence and Behaviour Intention were supported by the respondents. Support was also found for the relationship between Facilitating Conditions and Use Behaviour.

But the perceived effects of the moderating factors were not the same as expected. The opinion of the majority of the participants was that Age and Gender would not have any effect on the adoption of the GIS system by employees of SBD Qingdao. Experience is expected to moderate Performance Expectancy in a way that the effects of Performance Expectancy is stronger for less experienced individuals; that is those with less experience are expected to view the GIS system as being more useful, thus increasing the intention of use. Also Experience is expected to moderate social influence in a way that less experienced individuals tend to be more influenced by others. Experience is expected to have effects on Facilitating Conditions in a way that those with higher experience levels will experience will likely have access to more company resources. As mention in Chapter 2, employees with higher experience tend to have higher knowledge on how to obtain company assistance during the adoption of new information systems.

It is perceived by the participants that Education moderates Effort Expectancy in a way that it is higher for lower educated individuals thus leading to a lower intention of use. It is also expected to moderate Social Influence in a way that lower educated staff members tend to follow the actions of others. Those with lower education will likely to received additional help, thus resulting to higher facilitating conditions.

The effects of education on Performance Expectancy are unclear. Contradicting results were obtained from the interviews with some participants feeling lower educated individuals will have higher Performance Expectancy and some feeling that due to lower education, they are unable to fully understand the usefulness of the system. This particular aspect of the amended UTAUT requires further research to determine the relationship.

Through the research, participants highlighted the importance of environmental factors outside of the company control; Telecommunications Infrastructure. It was mentioned that in rural areas of China, the telecommunications technology is still underdeveloped with slow or unstable internet connections. This is expected to have a direct effect on the use of the system.

7.1 Recommendations

The following is recommendations to SBD Qingdao to increases the success of adoption of the GIS system.

- Develop training programs from all staff members focussed on improving computer literacy.
- Future hiring strategies should have a minimum literacy level for employees.
- Set up education programs for front line staff to improve general literacy.
- All promotions, pay rises, overseas training opportunities should incorporate computer and information technology skills as part of the criteria.
- Include the need for information technology upgrades and the benefits of the GIS system into annual and biannual company meeting. Be specific on the benefits of the system.

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Appendix 1: Interview Transcriptions

Toyota

Q: Good Morning, as a start to this interview, can you please state your name, age, highest education and the position you hold in the company.

A: My name is Toyota. I am 52 years old and am the managing director of this company. My highest education is post-doctorate done at Massey University.

Q How long have you been with the company?

A: I started the company from zero in 2007, so basically from day 1.

Q As you have seen in the email the overview of the GIS system and its potential uses and impacts on SBD do you have any questions you would like to ask regarding the system before we start?

A: No, I think I have an understanding of the system.

Q As mentioned in the email, if you feel that any question you do not feel like asking or feel that the question is too invasive, feel free to tell me and we can go onto the next question.

Q: No problem.

Q: To kick things off, do you feel that the employees' views on the potential usefulness will affect the intention of use?

A: Off course.

Q: Specific to SBD, what do you feel are the employee's reactions to the usefulness of this specific system?

A: I feel in the most part, the frontline SBD team would accept the GIS system. Most will view technology upgrades as an improvement, especially in the rural areas where technology is not part of their daily lives. But their ability to use it is in doubt.

Q: When you mentioned especially in rural areas, what did you mean by that?

A: Because their life styles are still relatively backward, technology is not something

they use as part of their daily lives. So with technological improvements, many will feel that it is an upgrade to existing methods.

Q: So they will feel that it is useful to the company?

A: It's more of a curiosity than usefulness. Many will view it as something new and exciting. Whether or not it is useful in actual fact is not important to them. Their underlying feelings are that it is useful. Viewing it as an improvement to life is probably a better way to explain it, a movement towards the 'Western' way of life by using technology.

Q: Understood. You mentioned frontline staff, what about management staff?

A: Management staff is a different story. Most of them are slightly older and have set habits. For them to view something as an upgrade to their habits is extremely hard. Openness is the key here .They must be able to see concert evidence that the GIS system will bring benefits to their work. Not just the company, but their work. Many will view it as an added workload which will create a resistance among them. Also they are extremely close (relationship wise). So if one resists, all will resist. Hard to get through to them in that sense.

Q: You mentioned their ability is in doubt. Did you mean perceived difficulty of use that affects their willingness to use the GIS system?

A: No. As mentioned before, for most of the frontline staff, they will welcome new technologies and view it as a general upgrade. So their views on the difficulty of usage are not a factor in terms of their willingness to use the system. But their ability to use it.

Q: Could you please explain what you mean by their ability to use the GIS system?

A: It's just general education. Most of the frontline staff is extremely uneducated, with the average education level at about primary school. In fact some of them are illiterate to a point where writing their own names is a challenge. So even if you set up the computer/technology systems up in their working environments, how are they going to type the information in?

Q: Understood. What about the management staff?

A: Education is not a problem for them. Most of them are highly educated and their computer skills are not too bad either. But it's their views on the usefulness of the systems that will affect their willingness to usage. For the GIS system, which does not demand a high degree of computer skills will not pose a problem for them.

Q: So overall, would say the perceived effort level of using the system be a determinant on the intention of use?

A: Yes.

Q: You mentioned that the managing team has close relationships which makes them tend for follow other's actions. How would this affect their acceptance of the GIS system?

A: The effects of relationships have tremendous effects on the acceptance process. Chinese people tend not to be willing to be exceptions, but rather how the group operates. Thus it's a total success of total failure.

Q: What about the effects of 'Guan-xi'?

A: Obviously it's very important. To maintain relationships, often people will support others' decisions. So it's important to affect those that are the most important in the group. For the introduction of the GIS system, it is important to convince the most influential people.

Q: Do you see this as a barrier to the introduction of the GIS system?

A: Yes, all our farm managers rotate on a biannual basis. Sometimes it is hard for them to gain the trust of their employees, particularly for large scale changes. It is hard to them to build up the 'guan-xi' with employees.

Q: Why does the company rotate the farm managers so regularly?

A: I can't tell you the details, but basically to prevent the corruption.

Q: What type of people are the most influential?

A: Managers, in particular the area managers and those that have direct power in promotions and raises.

Q: With the introduction of new systems, the company will need to set up facilitating conditions to help support and train the employees to use the GIS system. What type of these schemes would SBD set up?

A: Obviously a training program has to be set up to 'teach' the employees on the steps in using the GIS in their daily work. But I don't feel this is the most important facility the company sets up.

Q: What would then be the most important facility?

A: As mentioned before, those that are capable of using the system would most likely show the highest resistance. Thus, the company would have to make it into a regulation for the use of the GIS. Also the display of results the GIS brings, monitory awards for usage and long term management strategies are essential. Training programs are not the most important aspect.

Q: I understand that your company are predominantly male, but past research show that gender does have an effect on the acceptance of new technologies. Do you think that gender plays a role in your company's adoption of GIS?

A: Personally I don't think so. The only aspect I would think that it does have an effect is that female employees tend to be more obedient and follow instructions.

Q: You mean like social influence as mentioned before?

A: Yes. Female employees tend to show more respect to superiors and follow their leadership.

Q: Would age have an influence on the acceptance of GIS?

A: Yes definitely. They tend to view technology as a nuisance which does not improve their daily tasks. They are stubborn and unwilling to accept changes. Their influence on others are particularly great. Younger generations tend to show their respect to elders and not 'force' anything onto them. Thus creating a chained effect on others which will lead to more people not willing to use the new system.

Q: What about their ability to use the technology?

A: Definitely it would take them longer to learn. Obviously computer skills is the main problem.

Q: So their effort expectancy is higher?

A: Yes.

Q: Obviously among your employees, they would vary in experience, particular working with pig farming. How does this difference in experience affect their willingness to accept the GIS technology?

A: The experience of employees greatly affects their views on the GIS system. Most the employees with a lot of experience, particularly within the company tend to be very reluctant on change. They tend to feel that their current practices are the best way to do things. So they feel that enhancement in technology is unnecessary.

Q: What about their influence on others?

A: Others tend to follow those with more experience, simply because the more experienced employees generally hold higher positions in the company.

Q: Would experienced works benefit more from the facilities provided by the company?

A: I would say yes. They would have easier access to resources and help.

Q: I understand that the education levels vary greatly, and the front line staff tends to be of very low education levels. How would you see that affecting the adoption of the GIS technology?

A: As mentioned before, the lower educated people are more than willing to use the system as they view it as an improvement to currently situations.

Q: What about the effects of education on the kind of help the company can provide them?

A: Due to the fact that they some of them are illiterate, any working manuals, training guides etc. are useless to them. Thus their only form of help would be face to face, hands on help.

Q: Since they require face to face help, then would social influence be a factor?

A: Definitely. The views, perceptions of others would have a higher impact on lower educated people because of a less degree of understanding.

Q: That is great, before we finish, are there any other factors you feel that would affect the adoption of the GIS technology?

A: As I said before, it is vital for the company to display results that the new system brings. Let everyone know the benefits and monetary rewards to the extra work.

Q: Perfect, thank you for your time.

A: No Problem.

Isuzu

Q: Hi there, to start the interview, can you please state your name, age, highest education and the position you hold in the company.

A: My name is Isuzu, 32 years old. I graduated from Qingdao University with a Bachelors Degree in Animal Nutrition. I am currently the farm manager at the farm facilities A.

Q: How long have you worked at SBD?

A: For about 3 years now. But I have been working with Dr Sun for about 7 years now.

Q: I believe that you have seen the overview of the GIS system from the email I have sent you. Do you have any questions regarding the system or its uses before we start?

A: No, I have used something similar before when I was working in Wuhan when I was working with wild chickens. Just on a smaller scale. We tagged each animal with a tracking device to track its movement and behaviour. The results showed up on a computer screen that simulated the geographical area of the farm.

Q: Was it like a map?

A: Yes. Well actually like a 3D map of the mountain range that these chickens were farmed on.

Q: Understood. As stated in the email, if you feel any question is too invasive please feel free to refuse to answer.

A: Ok

Q: To start things off, do you feel employee's views on the potential usefulness of the system will affect their intentions of use?

A: Yes.

Q: Specifically to SBD and the farm you manage, what do you feel are the employee's reactions to the potential usefulness of the GIS?

A: The company currently is already using other information systems to manage information and our staff members are asked to input and store data on computer

databases. So an enhancement of technology would be welcomed. Most will feel that a new system would improve currently ways of doing things.

Q: What kind of systems are being used now? What kind of procedures are required of your staff members?

A: Currently front line staff is required to record feed amounts, water, health and other information regarding individual animals. This information is then entered into the computer to store in our database for future use. Although our front line staff are not required to use computer based technologies first hand, they do have a chance to actually understand how it benefits the company.

Q: Do they have any problems do that for the company at the moment?

A: No, no problem at all.

Q: The GIS system would require your staff members to actively enter and update information into the computer. Would that pose a problem for your staff members?

A: I don't think so. Something that is repetitive can be easily taught.

Q: So you feel that it is important for the company to establish training programs?

A: Definitely. Training to reduce the 'fear' in experimenting with new procedures. It will make it more likely that they will accept the new technology once they understand how it works and how to use it.

Q: What other facilities should the company implement to improve the acceptance process?

A: It is important for the company with to set up procedures to ensure that the new technology does not bring forth extra work for the employees.

Q: What about things like payment and results?

A: Payment is not important. Sometimes even added pay does not justify extra work. Particularly for those who do not have family to support, for them easier work is preferred. But results are important. From my experience, to introduce a dramatic change like new technology, it is better to divide the process into 2 stages. The initial introductory stage should be made by company regulation. Rather than awarding usage, punish refusal. This will force everyone to use it. The second stage is showing results. Once after a period of use, desirable results, particularly if it improves company efficiency will help convincing people to accept the technology. By then company regulation is no longer important as people will understand the benefits it

brings and will incorporate it into their daily tasks.

Q: To my understanding, social influence have a major impact in the Chinese society, especially in Chinese companies. In your views, how does the idea of ‘guan-xi’ affect the acceptance of the GIS technology at SBD?

A: Guan-xi plays an important part in commercial operations in China, particularly in Northern China, due to the local cultures and habits. But in terms of accepting the GIS system, I don’t feel that social factors play a role.

Q: You mean that there will be no incidences where individuals tend to be more willing to accept the GIS if others all accept it?

A: Yes. You have to understand the in the pig farming industry there are limited cooperation between front line staff. Each staff member is responsible for a certain number of pigs or pig sheds. They have their roles and do not actually work together with others. So they tend to stick with the process they are used to or know well. Rather than following the examples of others.

Q: But wouldn’t the actions of front line staff members affect others in the company like those that are managing them? If they use the system, wouldn’t it benefit others?

A: Well you have to see things in their eyes. They are paid to look after the pigs, nothing else. I understand how they keep record of information will affect others, but for them, they just want to do the bare minimum. As long as the pigs are alright. They don’t really see the company from the big picture. So for me, social influence is not a factor.

Q: Understood. I know that the company is mostly male employees, but past research show that gender does have an effect on the acceptance of new technologies. Do you think that gender have effects on the company’s adoption of GIS?

A: No I don’t think gender plays any role in the introduction of a new piece of technology.

Q: What about age?

A: Age does have an effect. Those above 50 tend to be unwilling to change. While those who are under 40 tend to have a better understanding of the benefits of technology will be more likely to accept the GIS.

Q: Why would those over 50 not willing to accept?

A: Well first of all they are stuck in their way and would be less likely to view change

as a good thing. Secondly they tend to have less computer skills. Those who are under 40 tend to use the computer on a much regular basis.

Q: What about age on the support the company is able to provide? Like would older people get more assistance?

A: No I don't feel that age would have an effect.
Q: Experience tends to be another major factor. What do you feel about how experience will affect the acceptance of the GIS system?

A: In my opinion, those who have higher experience tend to stick with their existing ways. It is hard for them to change. They feel that their way of doing things is the best way. Those with less experience tend to be open to new techniques on improving their ability to perform on their daily tasks.

Q: What about the effect of experience on the perceived effort involved?

A: Well I personally don't think it will affect the effort level. Their experience is not what will affect their ability to use the system.

Q: What about company support?

A: Those with more experience, particularly if they have been with the company longer will definitely have access to more resources, thus will probably receive more assistance one way or another. Newer employees tend to know less people and will definitely not have the ability obtain help as much.

Q: The last factor I was wondering is education. How do education levels affect the acceptance of the GIS system?

A: Education is a major factor. Those with lower education will find it difficult to use the system.

Q: What about the performance aspect of the GIS technology?

A: Well those with less education will definitely not fully understand the benefits of the technology. So no doubt they will view it as less important.

Q: What about company support? Or facilitating conditions?

A: Well, I would assume the company would pay special attention to those with lower education as it would take longer to train them. So to me, I would assume that those that are lower educated will receive and be able to access more resources and help.

Q: Understood. To finish things off, are there any other factors that you feel would affect the acceptance of the technology?

A: No, I think we cover everything.

Q: Thank you for you time.

A: No problem.

Honda (very strong dialect)

Q: Good day, as a start to this interview, can you please state your name, age, highest education and the position you hold in the company.

A: My name is Honda, I am 35 years old and is the data/information manager at SBD. I have a bachelor degree from Qingdao University and have a MBA degree from Qingdao Ocean University.

Q: When did you start working for SBD?

A: I started in the first half of 2009.

Q: I sent you an email with an overview of the GIS system. Before we start, is there any questions you would like to ask about this particular piece of technology and its uses?

A: I think I have a fair understanding of the system. If I have any questions along the line, I will ask you.

Q: If there are any questions you don’t feel is appropriate, please feel free to not answer it and we can go on to the next question.

A: Ok

Q: Specific to SBD, do you feel that the GIS system would be beneficial to the operations of the company?

A: Definitely. I feel that swine farming in China needs an upgrade in the technologies it utilises. A majority of Chinese pig farming still uses very primitive processes which are not very efficient and can cause problems in the modern commercial environment.

Q: What types of problems are caused?

A: The major problem is the source. Many of the pork meat on the market are sourced from small individual farms, making standardizing of quality and price very difficult. That is one of the reasons why pork prices fluctuate between provinces. Like the prices in Beijing is about 1.5 times higher than Shandong. Prices of feed, transportation and other factors vary causing market prices to vary as well.

Q: Understood. What do you feel about SBD's employees' views on the usefulness and performance of the GIS technology?

A: I feel that if the company can provide information on past uses of the system, employees should have a positive view on the technology. It is important for the company to provide information on past practical implementations of the system to ensure that employees have a fair understanding on the uses.

Q: You mean by providing detailed information on the use of GIS systems by other pig farms?

A: Yes, including results and performance levels would be beneficial.

Q: We will call the views of the employees on the usefulness of the information system as performance expectancy. Do you feel it has an effect on the adoption of the system?

A: Definitely. Like in any other situations, if the change is beneficial to the person, he/she will be much more likely to accept it.

Q: Would the use of a computer based information system such as the GIS prove to be a problem for the employees of SBD?

A: Yes. The effort that the company employees will put into learning the system will be high. Right now, the company has 2 types of employees. First is the well educated middle aged to 50 year old managers which is about only 13 percent of the company. This group uses information systems, computer softwares and other technologies on a regular basis, so it would not be a problem for them. Then we have the group who are very lowly educated people, the front line farmers. This group has very low computer skills and literacy levels which will pose a much higher level of difficulty.

Q: Would the level of computer skills or effort put into using/learning the system be a barrier to the intention of use of the GIS technologies?

A: Yes. If something is easy to use, wouldn't you be more likely to use it?

Q: Obviously. Another factor that has come to my attention is social influences, particularly ‘guan-xi’ in the Chinese society. Do you think it will play a factor on the introduction of the GIS system?

A: Personally I don’t think so. For this type of change, the company regulation is more important. The company needs to implement a structure, culture and rules that will guide the introduction of the GIS technology.

Q: So to you employees will not follow the actions of others, even if they are more influential?

A: From my experience no. Not in this type of situations.

Q: So there will not be any peer teaching or peer support during the introduction of the GIS system?

A: Peer support, peer teaching and team work is an idealistic way of thinking. It is a theory that would maximise the efficiency of the company. But how often does it happen in real life?

Q: What do you mean?

A: For example the company implements the GIS system and it is incorporated into the daily tasks of the company. Obviously it will be an aspect of company assessment for performance right?

Q: Yes.

A: So if you know how the use the system, would you encourage your peers to use it or teach it to your co-workers? Wouldn’t them not knowing or not using the system be more beneficial to you in a competitive working environment? You have to understand the China is a very populated country. Every job position is a fight between literally hundreds of people.

Q: Understood. So social influence will not affect the use of the GIS by employees?

A: No. People will tend to only consider how it will affect their current jobs, rather than how others accept the system.

Q: So would the conditions that the company set up be a direct effect on the use of the technology?

A: Off course. How the company sets up its structure will determine the success of the introduction.

Q: You mentioned the company needs to set up structures and regulations to implement the system. What other facilitating conditions would the company need to set up?

A: Obviously training programs, reward programs and strict regulations. No one wants extra work, thus only regulations and structure can ensure successful implementation.

Q: SBD consisting of both male and female employees, would gender affect the implementation of the system?

A: No, I don't feel gender will have any effect in this kind of situation.

Q: What about age?

A: No I don't think so.

Q: Even if older employees tend to be more stubborn and lower computer skills?

A: Well when you consider most of the company is lowly educated; computer skills tend to be low regardless of age. Also everyone is stubborn to a point, it will only depend on the benefits for change.

Q: Understood. What about experience?

A: From my experience no.

Q: Obviously you feel education is a major factor. You mentioned it will affect the effort level of using the system. Would it affect the perceived usefulness?

A: I don't think so. I feel that whether you are educated or not, most people prefer not to change. Under that kind of thinking, you would have a distorted view on things, thus creating a false view of your current processes being sufficient. If not, employees would be actively looking to change, making the whole introduction of technology redundant.

Q: Would education have an effect on the facilitating conditions the company provides?

A: Yes most definitely. The company will have to invest higher resources into those who have lower education levels because it will take longer for them to learn.

Q: From your experience, are there any other factors that will affect the introduction

of the GIS system?

A: When I was working in Nanchang, we tried to implement a new computer based database for Zhengbang Agricultural Group. Although you can train lower educated personnel, but they are more prone to mistakes, making the accuracy of the data questionable. Other than the education level being too low to successfully adopt the technology, the infrastructure and hardware of the company also proved to be a problem.

Q: Can you please go into more detail about that?

A: Most the farms were located in extremely rural areas where internet connects, 4G networks and other telecommunication infrastructures were not available or insufficient, making the introduction that much more difficult.

Q: Would this pose a problem for SBD?

A: Well Shandong province is a lot more developed and the internet connections are a lot better. But there are still concerns in rural areas where even cell phones have problems with connection. So if there are no 4G or broadband networks available, delays are going to occur. Otherwise the company will have to invest a large amount of resources into setting up these facilities. In this case, the benefits will not justify the costs.

Q: Understood. Is there anything else that you want to mention that will affect the adoption of the GIS system by SBD?

A: I think we covered everything.

Q: Excellent. Thank you very much for you time.

A: It is my pleasure to help.

Mazda

W: Good Morning Ms Mazda, good to catch up with you again.

F: Yes, it has been a long time since we have talked.

W: Yes. Well to start things off, can you please state you name, position and highest education please. (Did not ask age because Mazda is a female, but from records, she is

33 years old).

F: My name is Mazda, I am the HR manager for SBD Qingdao and have a bachelors in Human Resource Management from Qingdao Ocean University.

W: How long have you been with SBD?

F: Since the beginning in 2007. But I have work with Dr Sun for nearly 10 years now since he was the General Manager at Topigs International.

W: I have sent you an email with an overview of the GIS system. Before we start, is there any other questions you would like to ask about the system?

F: I think I have a fair understanding of the system. If I have questions, I will ask along the way.

W: In your views, do you feel that performance expectancy of a system like this will affect the success of adoption?

F: Definitely. It has to be beneficial for it to be accepted.

W: For SBD, what do you feel are the employee's reactions going to be on the usefulness of this specific system?

F: I think they will feel positive about the system. There is a common view that technology will make life easier. So the performance and result of the system is not important, as long as it can make life easier.

W: You mentioned make life easier, what about the effects their views on the effort involved in using a system like this?

F: Well the effort will be different for different people. But whether it is high or not, it will have a direct effect on the likelihood of adoption of the GIS.

W: Do you feel that the influence of social factors will directly affect the success of the adoption of the GIS by SBD?
F: Social influences are very important in the Chinese society. It is important that the company train and convince the experienced and educated first and let them lead the others in the company.

W: How would the company train and convince the experienced and educated?

F: Obviously with structured training programmes where both teaching the functions of the system along and the benefits (long term and short term) the system will bring

to the company and themselves as individuals.

W: So you believe that the facilitating conditions of the company has a direct effect on the use of the system?

F: Yes

W: Other than training and teaching programs, what other facilities should the company set up?

F: It is important that the company establishes a culture for changes and upgrades to currently processes. This comes from the company values and hiring strategies.

W: What do you mean by hiring strategies?

F: Well, currently as part of the company regulations, for all employees other than front line farmers, they are required to take IQ tests and learning tests to determine their ability to learn new skills and knowledge. This includes foreign languages. We have a strong focus and preference for people who are capable of being trained and learning. We have established special training classes and programmes at local Universities and facilities.

W: What type of programmes or classes are these?

F: SBD has set up training courses for a range of skills and professions. It includes accountancy, finance, agricultural classes, vet classes and so on.

W: Do you have any computer courses?

F: Yes we do.

W: What does that teach?

F: It focuses on office use, typing and data entry. For more specific positions, we have software and hardware maintenance courses. But mostly entry level and general computer usage.

W: Ok understood. What about company regulations to use new system?

F: Personally I feel that it is an essential to guarantee the success of new process. But that is just a short term solution.

W: The company employees range from age and gender. How do you feel these two aspects will affect the adoption of the GIS system?

F: I don’t feel that age and gender will be a factor. You will find similar results. But education will be more of a factor.

W: Can you please expand on that?

F: SBD has two types of employees. First are those who have no education at all. Then you have the highly educated. For the lower educated personnel, they are going to struggle to learn and use the system. It is harder for them to adopt new processes and technology.

W: So their effort expectancy for the use of the system will be higher?

F: Off course.

W: Would education have an effect on the performance expectancy?

F: Not so much I feel. I would assume that the various level of education will not affect their views on the usefulness of the system. But rather their individual situations and the type of work they are doing.

W: What about education and the social factors?

F: Those with lower education will definitely tend to follow those that are higher educated.

W: What about the facilities the company can offer?

F: I don’t feel that would have an effect. The courses and training programmes set up from previous upgrades in technology have been quite universal. All employees other than professionals are required to participate, regardless of education levels. Also the benefits and rewards were equal.

W: Understood. Would experience be a factor?

F: Well experience would probably affect the perceived usefulness of the system. Experienced workers tend to have a higher sense of responsibility. They would more likely to adopt something that is useful. They have a better understanding of the company and its needs.

W: So would more experienced works view the system as more useful?

F: From my understanding of the system and its potential uses in the prevention of contagious diseases, I would say that more experienced workers would know the

significance of disease control. So yes, I would say that they will be more likely to view it as an important upgrade.

W: What about their views on the effort level required to use the system?

F: I would assume that experience is not a factor.

W: Social influences?

F: Definitely. More experienced workers tend to be the leaders among groups in the company. So they are more likely to influence others and less experienced tend to follow.

W: The company facilities?

F: Same with education, all employees are treated the same in terms of upgrades. So I would say that experience would not affect how the company treats them.

W: So more experienced employees will not be more likely to access additional resources?

F: SBD is quite strict on the allocation of resources. So no I don't feel that experience will affect that.

W: Excellent. Before we finish, do you have any other comments you would like to ad regarding SBD's ability to adopt the GIS system?

F: The only other factor that you did not mention that comes to mind would be the technology infrastructure of the location.

W: What do you mean by that?

F: Considering it is live updates and data entry, the speed of the internet and the stableness of the connection would be a major factor. In rural areas, particularly in mountainous environments would that be a problem?

W: Yes that would pose a potential difficulty.

F: Is there anything else you would like to ask? I have to go now.

W: No that is all. Thank you very much for your time.

F: You are welcome. Bye William.

Subaru

W: Good Morning Subaru

C: Good morning, what you do you need from me today?

W: Don’t worry I won’t take up too much of your time. Before we start, you had a look at the email I sent you regarding the overview of the GIS system?

C: Yes I have.

W: Are there any questions you would like to ask before we start?

C: I should be fine.

W: Can you please state your full name, age, position, highest education and length of time with SBD please.

C: Subaru, 38 years old, doctorate degree with Shandong Agricultural University and I have been with the company for about 1 and half years. I am the farm manager at farm facilities B.

W: Excellent. To start things off, do you feel that the performance expectancy of the system would affect the adoption of the system?

C: What do you mean by performance expectancy?

W: Basically how useful the system would be in the eyes of the employees.

C: Yes definitely.

W: Do you feel the company employees would view the system as useful to their daily work?

C: I would say so, if appropriate information is available. Particularly those from the rural areas, most will view technology as a benefit to the work.

W: Why would you say rural areas in particular?

C: Most of them are quite primitive in their ways. So their views of technology as a sign of modern upgrades.

W: Understood. In your perceptions, would you say the effort level expected to use the system be a factor in the adoption process?

C: Yes. I would say so. The easier something is, the more likely it would be used.

W: How would SBD employees view the difficulty of the GIS system? Basically data entry and computer usage.

C: That depends on who is using it. The company ranges from highly computer literate people to extremely low. From your email, it stated that mainly frontline staff will be entering the information and office management will be using the information, am I right?

W: Yes.

C: The front line staffs are extremely lowly educated. The effort for them would be very high (through the sky? Metaphor?). I would say it is close to impossible for them to use a computer to enter information.

W: So education is a factor on the effort level expected to use the system?

C: Yes.

W: Would social influences affect the intention of use by the company employees?

C: No

W: So no effects of ‘guan-xi’?

C: ‘Guan-xi’ has more to do with the way people act when it comes to events affecting the group as a whole. In the event of introducing the GIS system, it would be a change in daily tasks. To me, it is more about the individual rather than the group.

W: Do you agree that the facilitating conditions of the company has a direct effect in the use of the system?

C: Offcourse.

W: What type of facilities should the company set up?

C: Training programs is a must. Regulations and usage incentives.

W: What type of usage incentives? You mean monitory rewards?

C: No, I mean advancing opportunities and training programs. The company right now has training programs in local universities available for personnel who show potential. The usage of GIS technology can be listed as part of these criteria to participate in these training programs.

W: Do employees show a high level of interest in these programs?

C: Yes. You have to understand that the competition in China is extremely high. In Shandong along, there are around 3 million bachelor graduates every year. Jobs are hard to find if you only have a university degree. On job training is more important. Last year, SBD sent around 30 employees to Holland and 56 employees to USA for 3 months to train swine farm management and vet care. This type of opportunities is not available just for anyone. There is a high level of internal competition to participate in these programs. Even at local universities, they are receiving free training with pay. If the use of GIS system is incorporated into the choosing schemes of these programs, it would greatly increase the use of the technology.

W: Understood. What about the effects of Gender and Age?

C: I would say close to 100% of the frontline staff are male. So gender is not an issue. Age to me is not a problem either.

W: What about experience?

C: I don’t think it has any effect either?

W: Obviously you mentioned that education has an effect on the effort level of use. What about the effects of education on the perceived usefulness?

C: I don’t think it will have a direct effect on that.

W: How about the effects of education on the company facilitating conditions.

C: That will have an effect. For those of lower education, the training programs are out of consideration.

W: So those with lower education has lower access to company resources?

C: Yes. Cause their only incentive is money. They don’t care about anything else and they won’t qualify for anything else either.

W: Why does the company hire so much lower educated people?

C: That is a useless question.

W: Just out of curiosity.

C: It is simple. Lower costs and easy access in rural areas. Cost to much to transfer a higher educated urban employee to rural areas.

W: Excellent. Before we finish, are there anything else you would like to add?

C: No.

W: Thank you very much for your time.

C: No problem.

Suzuki

W: Thank you for meeting with me.

S: No problem.

W: Can you please state your name, age position, highest education and length of time you have been with the company please.

S: My name is Suzuki. I am 46 years old. I graduated from Shandong Agricultural University in Tai-An with a bachelors in veterinary. I am currently the chief vet at SBD.

W: Excellent, from the email, did you have any more questions regarding the GIS system?

S: So it is a map where you can locate individual animals and its information right?

W: Yes, in its simplest terms. Basically front line staff can enter the information regarding each animal into a computer. Then management can access this information in a form of a geographical map. Allowing to easily locate and track each animal.

S: Ok.

W: From a vet's perspective, do you feel that the GIS system is useful to contain and prevent contagious diseases?

S: Yes. If we were able to track the movement of each pig and its history, it would allow us to more accurately determine the quarantine zone.

W: Obviously you will be the type of people within the company that would actually use the information from the system. Do you feel that the perceived usefulness of this piece of technology will influence your decision to use it or not?

S: Offcourse. If I don't feel it is useful, I would not waste my time using it.

W: What do you think the views of your co-workers would be on the usefulness of the system?

S: No doubt they would like it was well. I think everyone in the company, particularly anyone in the management levels would benefit from this system. It will definitely be an upgrade to current procedures.

W: Would perceived effort in using the system be a factor in the adoption process?

S: Offcourse, the easier it is, the easier it will be adopted.

W: What are your thoughts on the ability of SBD employees in using this system?

S: I feel it is doable. Although some of the employees don't use computers on a regular basis, I don't think it is that hard to learn.

W: Do you feel social influence is a factor in determining the intention of use?

S: Yes. Obviously people are more willing to use it if their peers are using it. It a matter of the few following the majority.

W: How do you propose to convince the majority into using the system?

S: It is all about how the company views the system. Starting from the CEO and board of directors. If they truly believe in the system, others will be more likely to follow.

W: So would company conditions be a direct factor in the use of the system?

S: Offcourse.

W: What type of facilities should the company set up?

S: Training programs and conferences. It is important for company employees to fully understand the system, both in its functions and use. It is not enough to just know how to use the system, but also need to understand its implications to the company. Full

information need to be shown to the employees.

W: Are there any other facilities the company should set up?

S: That would be the main one. I would say bonus opportunities offered to those that are first to use these would also be beneficial.

W: What do you mean by that?

S: SBD has a monthly bonus scheme to all employees ranging from cleaners to top level management. Each person will be assessed it his/her performance to determine the amount of monthly bonus. So if the use of the GIS system is included into this bonus scheme, it would be beneficial.

W: If you don't mind me asking, how much are these bonuses? Is it enough to warrant the extra work?

S: Well the bonus to range greatly. Last month, the lowest bonus I heard was around 100 yuan and the max was nearly 500 thousand yuan. So it will all be determined on the level of interest by top management.

W: Ok. So the potential of the bonus are quite high.

S: Yes.

W: Do you feel age is a factor?

S: No. I don't think it will be of any influence.

W: What about gender?

S: No.

W: Experience?

S: I would say the more experience a person has, the harder it is for him/her to change their ways.

W: So their effort expectancy is higher?

S: Yes.

W: Would experience have an effect on performance expectancy?

S: If we are assuming the technology is new to everyone, then no. Obviously if some have a higher level of understanding of the technology, then it would be a different story.

W: Understood. What about social influence?

S: I would say no. Social influence is more to do with position rather than experience.

W: What about facilitating conditions?

S: I would say no too. The company conditions should be equal for all in theory.

W: Education would be a major factor right?

S: Yes.

W: Would education have an effect on performance expectancy?

S: No. But will affect effort.

W: How would it affect effort?

S: Simple. Its hard for lower educated people to learn to use the system.

W: You mentioned that social influence is about position, would education have an effect on social influences?

S: Yes. Because lower educated people tend to hold lower positions in the company. So they are more likely to follow other.

W: So the lower the education is for someone, the stronger the influence of social factors?

S: Yes.

W: What about company facilities?

S: Well same with experience, in theory it should be equal to all. But I would assume lower educated people will get extra assistance.

W: Why would that be?

S: Well they tend to be the front line staff members who are going to be entering the information as you have stated. So it is more vital for them to have a good

understanding of the system. As well as they tend to take longer learning.

W: Perfect. Are there anything else to want to mention that could affect the adoption of the GIS system?

S: Well, there should be extra focus on education as the education levels within the company vary greatly. Another factor is the origin of the employee. People from different locations tend to vary greatly in terms of their ability to learn as areas in extreme mountainous areas tend to be more backward thinking in comparison to coastal areas. Not sure if that will affect what you are proposing, but just a thought.

W: Yes that could be a factor. Is there anything else you want to add?

S: I think that is all.

W: Thank you very much for your help.

S: No problem.

Appendix 2: Ethics Committee Letter

MASSEY UNIVERSITY

15 February 2011

Yan (William) Sun
3 Greenhurst Street
Sockburn
CHRISTCHURCH 8042

Dear William

Re: Acceptance of GIS Technology by SBD Qingdao

Thank you for your Low Risk Notification which was received on 4 February 2011.

Your project has been recorded on the Low Risk Database which is reported in the Annual Report of the Massey University Human Ethics Committees.

The low risk notification for this project is valid for a maximum of three years.

Please notify me if situations subsequently occur which cause you to reconsider your initial ethical analysis that it is safe to proceed without approval by one of the University's Human Ethics Committees.

Please note that travel undertaken by students must be approved by the supervisor and the relevant Pro Vice-Chancellor and be in accordance with the Policy and Procedures for Course-Related Student Travel Overseas. In addition, the supervisor must advise the University's Insurance Officer.

A reminder to include the following statement on all public documents:

> *"This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named above are responsible for the ethical conduct of this research.*
>
> *If you have any concerns about the conduct of this research that you wish to raise with someone other than the researcher(s), please contact Professor John O'Neill, Director (Research Ethics), telephone 06 350 5249, e-mail humanethics@massey.ac.nz".*

Please note that if a sponsoring organisation, funding authority or a journal in which you wish to publish requires evidence of committee approval (with an approval number), you will have to provide a full application to one of the University's Human Ethics Committees. You should also note that such an approval can only be provided prior to the commencement of the research.

Yours sincerely

J. O'Neill

John G O'Neill (Professor)
Chair, Human Ethics Chairs' Committee and
Director (Research Ethics)

cc Dr Dick Whiddett
School of Management
PN214

Prof Claire Massey, HoS
School of Management
PN214

Massey University Human Ethics Committee
Accredited by the Health Research Council

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Appendix 3: Interview Schedule

The following interview schedule was sent to all participants of the research and the company Managing Director as reference prior to the data collection:

First of all, I would like to thank you for your time and troubles to participate in this research. As mentioned in the information sheet that was sent to you earlier, this research is regarding the introduction and implementation of the GIS system into the operations of SBD Qingdao. The interview will take around 10-15 minutes of your time regarding SBD's capabilities to successfully implement the system.

Following on from the information I have sent you via email, I have attached the following brief information regarding the GIS system as a reminder. GIS stands for Geographic Information System and it is an information system which captures, stores, analyses, manages and presents data which are linked to geographic locations. Information stored in a web based GIS system can be altered and updated globally via the internet.

Current uses for GIS system include crime control, conservation, population surveillance and assisting in emergency services.

In Minnesota, USA, the GIS system has been implemented in local swine farms. It is used to store information on diseased swine locations. It is to assist veterinary departments and farm management to control and prevent the spreading of infectious swine diseases. The web based GIS systems allow veterinarians to update information via the web without geographical barriers, creating a real time surveillance of swine diseases by central managerial offices.

Images such as this allow the company to quarantine areas which are in danger of infection and stop all movement of animals to and from the area. The company can predetermine the quarantine area size and arrange counters to diseases. A similar system is proposed to be implemented by SBD Qingdao cooperation. A web based GIS system will allow for the central office to have a complete data base of infected pigs' information and location as well as movement of animals. The application of the GIS system can also be used to manage breeding traits of the swine population. It can be utilised for storing and managing of swine attributes used for future mating programmes, feeding programmes and the movement of the swine population.

Information is inputted into the database by front line staff regarding individual pigs on a daily or weekly basis through a computer. This will update the database for the central control office to view. Basic computer and data entry skills are required of the front line staff.

Permission was obtained from Massey University Human Ethics Committee for this research and the following statement was issued:

This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named above are responsible for the ethical conduct of

this research.

If you have an concerns about the conduct of this research that you wish to raise with someone other than the researcher(s), please contact Professor John O'Neill, Director (Research Ethics), telephone 06 350 5249, email humanethics@massey.ac.nz.

Again, during any part of the research, if you do not wish to answer any particular question, please feel free to ask me to skip it or stop the interview.

Interviewer: William Sun
Date:
Topic: Adoption of GIS technology by SBD Qingdao
Interviewee:

1.) Interviewee Name
2.) Interviewee Age
3.) Interviewee Position with SBD
4.) Interviewee Highest Education Level and Major
5.) Interviewee Length of time with the company
6.) Do you feel that perceived performance of the GIS system will have a direct effect on the intention of use by SBD employees?
7.) Your perception of SBD employees' views on the usefulness of the GIS system.
8.) Do you feel that perceived effort of use of the GIS system will have a direct effect on the intention of use by SBD employees?
9.) Your perception of the expected effort of SBD employees using the GIS system.
10.) Do you feel that social influence will have an effect on the intention of using the GIS by SBD employees?
11.) What types of social influences are present? Guanxi?
12.) Do company facilities have direct influence on the use of the GIS system?

13.) What types of company facilities would SBD set up to promote the use of the system?

14.) What are the effects of Age on Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions?

15.) What are the effects of Gender on Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions?

16.) What are the effects of company experience on Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions?

17.) What are the effects of education on Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions?

The above is the outline of the interview contents. During the interview, you are more than welcome to introduce new factors which may contribute to the promotion or restriction of the GIS technology.